

Full Length Research Paper

The use of effective communication in enhancing the teaching and learning of school Mathematics

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The study examined the use of effective communication in enhancing the teaching and learning of school mathematics. Forty Senior Secondary two (SS2) mathematics teachers and 800 SS2 mathematics students from Enugu State and Private Secondary Schools in Enugu, Nigeria were included in the investigation. A descriptive survey instrument was constructed for the study based on the factors of effective communication which incorporated 24 items. Analysis of the results showed that a. mathematics teachers were effective in 66.7% of the factors identified from their opinion but from the students' response, the teachers were effective in 55.2% of the factors of effective communication. b. there is no significant relationship between the teachers' and students' responses on the effectiveness of teachers' communication in the mathematics classroom. The results of this study suggest that mathematics teachers should be sensitized by education authorities and students- mathematics teachers also prepared in their methodology class using those identified factors of effective communication.

Keywords: Mathematics classroom, descriptive survey, Nigeria, secondary school students, mathematics teachers.

INTRODUCTION

For science and technology to successfully achieve the goals of sustainable development in any country, there is need to engage creatively in science and mathematics. Bajah (2000) noted that no nation can make any meaningful progress in the information technology age, particularly in economic development without technology whose foundations are science and mathematics. This is because the level of Science, Technology and Mathematics Education (STME) of any nation has been widely accepted to be index of measuring any nation's socio-economic and geo-political development.

Mathematics is widely regarded as the language of science and technology. According to Baryelo (1987), mathematics has been borrowed to science its structure, syntax, grammar and logic while science has borrowed to mathematics its physicality and dynamics which supply its relationships between mathematics and science. Grank (2002) noted that mathematics is a legal study of shape, arrangement and quality and it deals with abstract

quantities such as number, form and symbols. Children were first taught numbers, addition and subtraction. Mathematical sentences were drawn without context to written vocabulary or meaning. Stressing on the importance of mathematics, Harbor-Peters (2001) highlighted her view pointing to the fact that mathematics remains the pivot on which any true science can rest and no true science can succeed without going through mathematical demonstration.

Notwithstanding the indispensable role of mathematics in nation's development, researches (Ezezoba, 1997; Luka and Mohammed, 2005; Ugama and Akpama, 2005; Maduabum and Odili, 2006; Okereke, 2006; Okonkwo, 2006) had shown that students' performance in the subject at both internal and external examinations has remained consistently poor. Many variables have been blamed as responsible for the poor performance which include; government, curriculum, teachers, students, home, school environment, examination bodies, and textbook variables. Ugama and Akpama (2005) stated that self-concept of students in senior secondary classroom influences their academic achievement because students feel shy to ask questions in class for

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further clarification by the teacher or to enter the class when the lesson has already begun. They concluded that positive self-concept enhances good academic achievement.

Communication is the activity and process of expressing ideas and feelings or giving people information. Okunna (2002) defined communication as the process by which we understand others and in turn endeavor to be understood by them. Effective communication is a fundamental part of the career of any mathematician. For effective teaching and learning of mathematics at the secondary school level, there is need for mathematics teachers to convey their teaching in a language that will meet the ability level of the class in question in order to establish a learning environment in which students are able to broaden and deepen their response to the beauty of ideas, methods, tools, and structures of mathematics. With effective communication, the vocabulary and syntax aspects of mathematics will be cleared since the teaching will be presented in a language the learners are conversant with.

Communication involves a process. Information and understanding are passed to the receiver and the knowledge of its effect is passed back to the sender in the form of feedback. Barry & Rhonda (1996) noted that effective communication is composed of three basic elements: a sender, a receiver, and an understood message. The binding link between the students and the teachers in the achievement of the stated goals of education is communication. Thus, the teacher (sender) must communicate his thoughts to the students (receiver) in such a way that the students, based on their experiences are able to understand the message transmitted to them.

Factors of effective classroom communication are; language, attitude of the sender(teacher), material, channels, feedback, students abilities, attitude of students, class size and school environment (Dynamic, 2007). Lindquist and Elliot (1996) noted that we all need to communicate mathematically to fulfill the societal goals of a mathematically literate workforce, lifelong learning, opportunities for all, and an informed electorate. Besides, communication is also central to students learning of mathematics and to the solving of mathematical problems. Through effective communication students would be able to organize, consolidate and explain their mathematical thinking coherently and clearly to peers, teachers and others.

In particular, Barrody (1993) proposes two more reasons for focusing on mathematical communication. First, he noted that mathematics is essentially a language of itself. It is not only a thinking tool that helps us to discover patterns, solve problems and draw conclusions, but also a tool for communicating clearly, precisely and succinctly our ideas and thoughts. Secondly, mathematics teaching and learning are social activities

that involve at least two parties, teachers and students. Gurnam (2005) also pointed out that when students are giving their opinions and solving problems orally and in writing, they are guided to use correct language and the accurate mathematics register. Students are also trained to select information presented either in mathematical language or non-mathematical language; interpret and represent this information in tables, graphs, diagrams, equations or inequalities; and subsequently present this information without changing the original meaning in other forms that are clearer and easily understood. Based on the roles of effective communication of mathematical concepts and skills, this study set to find out the extent of use of effective communication skills by mathematics teachers in their classrooms.

Statement of the problem

Mathematical Communication is one way to share ideas and clarify the understanding of mathematics concept and skills (Federal Ministry of Education, Malaysia (2003). Through talking and questioning, mathematical ideas can be reflected upon, discussed and modified. The problem of this study is on ineffective use of communication skills by mathematics teachers which may have resulted to lack of interest and underachievement of mathematics students. Therefore, the study is designed to determine the extent of use of effective communication by mathematics teachers in enhancing teaching and learning of mathematics in secondary school.

Purpose of the study

This study is to investigate the extent of use of effective communication by mathematics teachers to enhance teaching and learning of mathematics in school. Specifically, the study sought the following:

- Investigate the extent to which the teachers communicate effectively in mathematics classroom.
- Determine the relationship between the teachers' and students' responses on the effectiveness of the mathematics teachers' communication in the classroom.

Research questions

1. To what extent do mathematics teachers communicate effectively in mathematics classroom?
2. Is there any significant relationship between the teachers' and students' responses on the effectiveness of teachers' communication in the mathematics classroom?

Research hypothesis

There is no significant relationship between the teachers' and students' responses on the effectiveness of teachers' communication in the mathematics classroom.

Research design

The study is a survey research.

Population and Sample

The population was made up of all the Senior Secondary two (SS2) mathematics teachers and students found in Enugu Education Zone of Enugu state. A total of 40 SS2 mathematics teachers and 800 SS2 mathematics students were used for the study. Forty private and public secondary schools were selected from the zone by simple random sampling. One SS2 mathematics teacher each was chosen from the 40 schools and from the same selected class 20 students were chosen also by simple random sampling.

Instrument and Validation

The research used two sets of questionnaire tagged Questionnaire for Mathematics Teachers (QMT) and Questionnaire for Mathematics Students (QMS). Both QMT and QMS contain the same information but the former was directed to the teachers while the later was directed to the students.

QMT: The QMT was made up of 24 items constructed by the researchers based on the factors of effective communication (Dynamic, 2007). The questionnaire was in two sections- A and B. Section A was designed to collect relevant preliminary information on the teachers' school, sex qualification and years of teaching experience. Section B was designed to elicit information from the teachers which measured the extent to which teachers communicate effectively in the teaching of mathematics.

QMS: The QMS has only one section- A; made up of the same 24 items as in QMT but this time the language was reframed so as to direct it to the students. It measured the extent to which students communicate effectively with their teachers during the teaching of mathematics.

The QMT and QMS has a four- point scale of Always, Sometimes, Rarely and Never which were assigned to values of 4, 3, 2, and 1 respectively for positive items and vice versa for negative items.

The validity of the items was ascertained by two experts in mathematics education, two in counseling psychology and two experienced mathematics teachers. Also, the two sets of the questionnaire were trial tested with five

mathematics teachers and one hundred mathematics students from the schools not participating in the study but within the same Education Zone. The reliability of the two sets of the questionnaire was established using Cronbach reliability technique in each case which was found to be 0.86 and 0.80 respectively for QMT and QMS.

MATERIALS AND METHODS

Method of data collection

The researchers in addition to two research assistants administered the questionnaire to the respondents in the sample schools. Each administered 210 (10 QMT and 200 QMS) copies of the questionnaire in ten schools. Thus, in each school visited only one SS2 mathematics teacher and 20 SS2 mathematics students filled the questionnaire for the research. To solve the problem of exchange of information, time, improper filling and no return of the questionnaire, the questionnaire was filled and returned on the spot. With this measure, all the 840 copies of the questionnaire distributed were returned.

The questionnaire has a four- point scale of Always, Sometimes, Rarely and Never which were assigned to values of 4, 3, 2, and 1 respectively for positive items and vice versa for negative items. The cut off point for regarding each item as effective was determined by the mean value of 2.50. Any item that has a mean rating above 2.50 is regarded as being positive (effective), mean of 2.50 is regarded as being neutral, and mean rating less than 2.50 is regarded as being negative (ineffective).

Method of data analysis

Data collected were analyzed with Mean, Percentage, Pearson Product Moment Correlation (r) and the Student t-test.

RESULTS

The findings of this study are tabulated in the tables 1, 2, 3 below:

DISCUSSION

Research question one: To what extent do mathematics teachers communicate effectively in mathematics classroom?

Table 1 presents the analysis of research question one. The table revealed that teachers were effective in 66.7% of the factors identified for effective communication and ineffective in 33.3% of the factors. Therefore, to certain extent (66.7%) mathematics teachers communicate effectively in mathematics classroom. To compare the teachers' and students' responses on the effectiveness of mathematics teachers' communication in the classroom, students' opinion was obtained. This was answered in research question two.

Table 1.Teacher's Response on the Effectiveness of their Communication in the Mathematics Classroom

S/N	ITEMS	Always	Sometimes	Rarely	Never	Mean (X)	Remark
1	Mathematics teachers use mother-tongue in teaching	-	24	-	16	2.20	Disagree
2	Mathematics teachers use the dictionary	-	32	8	-	2.80	Agree
3	Students prefer English to the mother-tongue during lessons	24	16	-	-	3.60	Agree
4	Mathematics teachers are provided with the curriculum	40	-	-	-	4.00	Agree
5	The required textbooks are available to mathematics teachers	-	24	8	8	2.40	Disagree
6	Mathematics teachers are provided with teaching aids	8	8	8	16	2.20	Disagree
7	Mathematics teachers improvise unavailable teaching aids	4	4	24	8	2.10	Disagree
8	Mathematics teachers illicit for students opinion during lessons	10	10	15	5	2.63	Agree
9	Mathematics teachers ask students questions during lessons	16	24	-	-	3.40	Agree
10	Students answer their mathematics teachers questions	24	16	-	-	3.60	Agree
11	Mathematics teachers give assignments	40	-	-	-	4.00	Agree
12	Mathematics teachers mark the assignments	16	24	-	-	3.40	Agree
13	Assignment scores form part of the students term grade	16	8	8	8	2.80	Agree
14	Mathematics teachers test students previous knowledge	20	-	10	10	2.75	Agree
15	Mathematics teachers explain the meaning of words/ terms/ symbols used in a topic	32	8	-	-	3.50	Agree
16	Students inform their mathematics teachers that it is time for lessons	-	10	24	6	2.10	Disagree
17	Students gives flimsy excuses to leave the class during lessons	12	24	4	-	3.20	Agree
18	Mathematics teachers have full classes during mathematics lessons	26	14	-	-	3.65	Agree
19	Mathematics teachers can control all the students in their class	6	6	12	16	2.05	Disagree
20	Mathematics teachers can tell the ability of each of the students in their class	10	10	16	4	2.65	Agree
21	Mathematics teachers require the aid of loudspeakers during lesson	-	-	-	40	1.00	Disagree
22	Mathematics teachers are distracted by happenings outside the classroom	24	-	10	6	3.05	Agree
23	Students make noise during lessons	-	26	14	-	2.65	Agree
24	Mathematics teachers are distracted by activities going on in the church/ market/studio during lesson	-	-	-	40	1.00	Disagree

Table 2. Students' Response on the Effectiveness of their Teacher's Communication in the Classroom

S/N	ITEMS	Always	Sometimes	Rarely	Never	Mean (X)	Remark
1	Mathematics teachers use mother-tongue in teaching	84	588	96	32	2.91	Agree
2	Mathematics teachers are fluent in English language	412	324	32	32	3.40	Agree
3	Students prefer English to be used during mathematics lessons	192	444	96	68	2.95	Agree
4	Mathematics scheme of work is made available to students	144	128	96	432	1.98	Disagree
5	Students use the required mathematics textbooks	133	268	399	-	2.67	Agree
6	Mathematics teachers use teaching aids during lessons	-	152	280	368	1.73	Disagree
7	Mathematics teachers ask students to improvise teaching aids	284	100	-	416	2.32	Disagree
8	Mathematics teachers allow students to contribute during lessons	284	100	-	416	2.32	Disagree
9	Mathematics teachers ask students questions during lessons	724	44	32	-	3.87	Agree
10	Mathematics teachers answer students questions	728	36	-	36	3.82	Agree
11	Mathematics teachers give students assignments	416	348	36	-	3.48	Agree
12	Mathematics teachers mark students assignments	160	576	32	32	3.08	Agree
13	Students assignment scores are included in their result booklet	640	160	-	-	3.80	Agree
14	Mathematics teachers ask students of their previous knowledge before teaching a new topic	-	52	176	572	1.35	Disagree
15	Mathematics teachers explain the meaning of words/ terms/ symbols used in a topic	191	36	-	573	1.81	Disagree
16	Students inform their mathematics teachers that it is time for lessons	160	276	44	320	2.35	Disagree
17	Students leave the class during mathematics lessons	64	32	-	704	1.32	Disagree
18	All members of the class are present during mathematics lessons	100	252	68	380	2.09	Disagree
19	Mathematics teachers can control all members of a class	636	96	-	68	3.63	Agree
20	Mathematics teachers can tell the ability of each of the students	364	172	36	228	2.84	Agree
21	Students hear all that their mathematics teacher says during lessons	404	356	40	-	3.46	Agree
22	Students are distracted by happenings outside the classroom during lessons	124	548	-	128	2.82	Agree
23	Students make noise during mathematics lesson	28	356	44	372	2.05	Disagree
24	Students are distracted by activities going on in a church/ market/studio during lessons	28	356	44	372	2.05	Disagree

Table 3. Student t-test for Significant Relationship between Teachers and Students responses

Responses (Subject)	N	Mean	Alpha (α)	df	t-cal	t-crit
Teachers	24	2.78	0.05	22	0.920	2.074
Students	24	2.63				

Research question two: Is there any significant relationship between the teachers' and students' responses on the effectiveness of teachers' communication in the mathematics classroom?

Students' responses on the effectiveness of their teachers' communication in the mathematics classroom was presented in table 2. Table 2 revealed that teachers were effective in 55.2% of the factors identified for effective communication and ineffective in 45.8% of the factors from the students' opinion. Because of the disagreement between the teachers' and the students' opinion on the factors of effective communication, the researchers determined the relationship between the two responses using Pearson Product Moment Correlation (r) which was found to be 0.15. The value of $r=0.15$ showed a very low correlation between the responses of the teachers and students on the effectiveness of communication in the mathematics classroom. The significance of the relationship was determined by testing the null hypothesis.

Hypothesis: There is no significant relationship between the teachers' and students' responses on the effectiveness of teachers' communication in the mathematics classroom ($P<0.05$).

The null hypothesis was tested with Student t-test and the summary table presented in table 3. Table 3 revealed that the calculated value of t (0.920) is less than the t -critical value (2.074) and the research up-held the null hypothesis. Therefore, there was no significant relationship between the teachers' and students' responses on the effectiveness of teachers' communication in the mathematics classroom.

The finding of this study had a support from Ugama and Akpama (2005) who stated that self-concept of students influences their academic achievement because most of the students feel shy to ask their teachers questions for further clarification in the class. Based on the views of Barry and Rhonda (1996) and Okunna, (2002), it seems that mathematics teachers do not communicate effectively in the classroom. Okunna (2002) presented communication as the process by which we understand others and in turn endeavour to be understood by them. According to Okunna, for communication to be effective ideas have to be presented to the learner in a clear and understanding way for effective teaching and learning to take place. Also, Barry and Rhonda (1996) pointed that effective communication is composed of three basic elements- a sender, a receiver, and an understood message.

The binding link between the students and the teachers in the achievement of educational objectives is communication. By implication, the teachers not communicating effectively in the mathematics classroom seems to may have contributed to low interest and underachievement of students in mathematics.

Conclusion

Based on the findings of this study, the following conclusions were drawn:

- Mathematics teachers were effective in 66.7% of the factors identified from their opinion but from the students' response, the teachers were effective in 55.2% of the factors of effective communication.
- There is no significant relationship between the teachers' and students' responses on the effectiveness of teachers' communication in the mathematics classroom.

RECOMMENDATIONS

The following recommendations were made based on the findings of the study:

1. Mathematics teachers should be sensitized by education authorities on the factors of effective communication in the classroom.
2. The students- mathematics teachers should be prepared in their methodology class using those identified factors while receiving training from their various institutions.
3. Orientation on effective communication should be organized for the mathematics teachers together with their students so as to know when communicating mathematics effectively and ineffectively in the classroom.

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