

Distribution of Teachers and Students Discourse in the Teaching of Mathematics in Secondary Schools

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Abstract: Globally, mathematics in school curriculum is essential to communities and the society at large. This is applicable in the African context Kenya in particular. The study also aimed at revealing any difference in classroom discourse patterns in the teaching and learning of mathematics in the three types of schools, boys, girls and mixed schools. The reason could probably be that the classroom discourses used during mathematics lessons discourage students' interaction in the teaching and learning processes. The primary concern of this study was therefore to establish whether or not the problem of poor performance lies in the discourse patterns used during mathematics lessons in secondary schools. The study was a cross-sectional descriptive survey focusing on form 3 students and their mathematics teachers. Disproportionate Stratified sampling technique was used to select 9 secondary schools from 67 public schools of Nakuru District. Form 3 students were selected purposively. Simple random sampling used to select a form 3 stream from each of the sampled school where there is more than one stream; otherwise the stream was purposively selected. Quantitative analysis made use of descriptive statistics such as means percentages, and frequencies and Analysis of Variance (ANOVA) values. The data analyzed revealed that mathematics teachers use different discourse patterns in their classes. The teachers discourse dominated the mathematics classrooms as opposed to students' discourses which were mainly determined by the teacher and were mostly in form of responding to teachers initiated questions. The teachers controlled the classrooms and thus denied the students with the opportunities to express their thinking process verbally.

Keywords: classroom, discourse patterns, teaching, mathematics, Kenya

1. Introduction

Globally, mathematics in school curriculum is essential (Rukangu, 2000) to communities and the society at large. This is applicable in the African context Kenya in particular. Despite the changes being effected in schools, poor results in mathematics continue to prevail (Eshiwani, 1981). Students' poor performance in mathematics can also be aggravated by factors such as pupils' negative attitudes towards the subject, over-enrolment and inappropriate syllabus, (Whitebread, 1996, Eshiwani, 1983, Shiundu 1987).

Secondary school students' continued poor performance (Njuguna, 2000), at KCSE mathematics examinations in Kenya has been an area of concern to all the stakeholders in the field of education. Studies carried out attributes poor performance in mathematics to factors such as poor teaching methods, lack of teaching resources and students' attitudes towards the subjects among others (Thuo, 1985, Shiundu, 1987, Eshiwani, 1983, Kathuri, 1986).

Poor performance in mathematics at KCSE level have been blamed on stakeholders (Kneec 1995 such as, teachers, students, parents, and educational administrators. Teachers are blamed by students, parents, and educational administrators for poor quality teaching and low attitudes towards their work. Such repeated accusations year after year and poor results among others results to low morale and negative attitudes towards the teaching and learning process of mathematics. The teachers may pass on this kind of attitude to the students (NCTM 1990). However there are teachers with good qualities (Cockcroft, 1982) and who use appropriate teaching methods despite poor performance in mathematics. Such teachers are able to build up positive

attitudes towards mathematics (Macnab, and Cummine, 1987). This study intended to establish whether the teachers' teaching methods encourage or inhibit the students' participation in the process of teaching mathematics.

Students are also blamed by the teachers (Kiswili, 1995), parents, and educational administrators for not taking their studies seriously. Yet, there is the probability that some students could be serious with their work even when their performance in mathematics is low. To some students, constant blame may lead to low morale and negative attitude towards the subject and their teachers. Such students are unlikely to actively participate in mathematics teaching and learning process. The study wished to establish the student-related factors that affect the level of the classroom interaction in mathematics teaching-learning environment.

Similarly, the teachers and the students blame the schools administrators and the parents for lack of the needed mathematics teaching and learning resources such as textbooks and classroom facilities among others. Resources and facilities might be important in facilitation of teaching and learning of mathematics. The essence of this study was to find out whether or not resources used during mathematics lessons facilitate learning interactions.

The knowledge of discourse patterns that encourage learner participation will improve effective communication and interaction in secondary schools mathematics lessons. As a result, the findings will add to the increasing knowledge of classroom research hence student's performance will be improved.

2. Study Design

The selected study design was cross-sectional descriptive survey. It was chosen because it describes and interprets what prevails, or conditions and relationships as they are with the intent of employing data to justify current conditions and practices or to improve them. (Koul, 1984). Due to this, it enabled the researcher to obtain discourse patterns that are used in secondary school classrooms in Kenya. The method was also used because it is useful in obtaining quantitative data regarding mathematics learning in the classroom in which various discourse patterns are used.

2.1 Study location

The study was carried out in Nakuru County, Kenya. It has fairly many public secondary schools. It was also chosen since the general students' performance at National level examination and at the district level shows similar analysis.

2.2 Study population

As per the ministry of education records for the year 2002, there are 67 public schools in Nakuru County. This includes 57 mixed, 6 girls' and 4 boys' schools. Thus the study comprised of some stratified randomly selected public secondary school teachers and their students in Nakuru County.

2.3 Sampling technique

The study was restricted to public secondary schools in Kenya. The selection of the sample was done through disproportionate stratified Random sampling technique from a list of public schools. Schools were classified into school types: boys, girls and mixed schools. Three schools from each type were then selected regardless of their proportions

The teachers' discourse as shown in table 4.2 represented 61.8% of the total classroom discourses. Out of these, 53.81% accounted for teachers either asking questions or demonstrating a problem solving strategy. It was also observed that the teachers tended to create an authoritarian classroom environment in which students' were not free to express their thoughts. This is evident from categories 1 (accepts students' feelings) and 3 (accepts and uses students' ideas) in which only 1.22% and 9.88% of the student' feelings and ideas were accepted respectively. Only 10.04% of the 17159 total instances involved teachers praising their students despite the students giving right responses. It was also observed that 17.11% of the total instances were used in directing the students on the direction of discourse. This makes the students to over rely on the teachers thus minimizing their role in the teaching and learning of mathematics. There were even cases of teachers criticizing the students who did not comply with the teachers' direction though it was at a minimum of 0.87%. This kind of teaching behavior restrained the students' freedom to participate freely in the classroom discourse.

The students' discourse within category code 8 to category code 10b gave the students' a passive recipient role with

in the population using "lucky-dip" type of simple random technique. This technique ensured that every individual has the probability of being selected and selection of one did not affect the selection of the other in any way, thus ensuring a representative sample (Gay, 1992:126). Purposive sampling was used to select the sample of mathematics teachers.

A total of 360 students and 60 teachers filled the Mathematics students' questionnaire (MSQ) and Mathematics teachers' questionnaire (MTQ) respectively. Sekaran (1992: 253) rightly observes that, for a population size of 2680 and 67, the sample size will be 339 and 59 respectively. This difference in number of students and teachers did not significantly affect the research findings.

The data thus obtained was analyzed and the raw frequencies calculated to provide descriptive data for further analysis. One-way ANOVA (Analysis of variance) was used to show the variation of teaching discourse patterns of teachers in the three types of schools.

3. Findings

Table 1: Frequency distribution of teachers discourses

Teacher discourse	Category code	Totals	%
1	Accepts feelings	210	1.22
2	Praises students	1733	10.04
3	Accepts ideas	1695	9.88
4a	Convergent questions	3946	23.00
4b	Divergent questions	686	4.00
5a	Lecture	262	1.53
5b	Demonstrations	5280	30.81
5c	Illustrations	266	1.55
6	Directions	2936	17.11
7	Criticisms	146	0.87
	TOTAL	17159	100

only 38.61% control of the classroom discourse. Distribution of students discourses are summarized in table 4.3

Table 4.3: Distribution of students' discourses

Students' discourse No	Category code	Total	Percentage (%)
8	Response	3067	28.97
9a	Initiation	3409	22.75
9b	Student-student initiation	1182	11.16
10a	Silence/confusion	1297	12.25
10b	Working silence	2632	24.86
	Total	10587	100

It was observed that more than half of the students' discourses were in response to the teachers' questions (category 8) or directives that required the student to work silently (category 10b). These two categories represented direct responses from the students' and accounted for 53.93% of the students' discourses. Direct responses are students' responses that are as a result of convergent questions asked by the teacher or directions that inhibits the students to use their own initiative. Consequently, Category 9a representing unpredicted response from the students' where they can use their own initiative accounted for only

22.75%. This is less than a third of the total students discourse.

Comparing the statistics in table 4.3 and those in table 4.1, it can be observed that although 11.04% of category 8 was the highest in the students' discourse, in the real sense 28.97% of that was in response to the teachers' questions during demonstrations and giving directives. Thus 29.60% of both categories 5b and 6 were the actual determinant of discourse patterns. These two categories code the teacher discourses which means that majority of the student's mathematics time was spent being prepared by their teachers for carrying out exercises either from the chalkboard or the textbooks. This is also evident from category 10b (working silence) which took 24.86% of the students discourse. Such a situation makes the students perceive that doing mathematics require knowledge of a trick that have to be revealed to them as they first watch passively and then simply reproduce the teachers approach. Thus, they become reluctant to rely on their thinking and their ideas in process since they take their teachers to be the authority for right answers and algorithms. Teachers need to change from such teacher-centered lecture or demonstrations to cooperative exercise in which the students are involved at all stages of the lesson.

Teachers in boys' and mixed schools used more questions (categories 4a, 4b); Solicites categories (Questioning), than did the teachers in girls' schools. By use of One-way ANOVA method of analysis at $\alpha=0.05$, it is indicated that there is a significant difference in the use of questioning in the three types of school ($F=3.494$, $p=0.039$). Although generally all teachers used more of convergent questions (category 4a) than divergent questions (category 4b), teachers in boys' schools asked questions that were more probing and continued the question with a particular student for longer descriptions and explanations.

4. Conclusion

The study established the fact that the teaching-learning environment in mathematics classes is in most cases teacher-centered. The teaching discourses used are in most cases not sensitive to the students needs and thus do not fully provide for students participation in learning activities. It was noted that there was a marked use of lecture with demonstrations (expository) in all classes observed while student-centered technique were sparingly used.

References

- [1] Cockcroft, W.H. (1982). Mathematics counts. London: HMSO.
- [2] Gay, L. (1992). Educational research. Competence for analysis and application. 4th edition. New York: Macmillan.
- [3] Kiswili, P.D.M. (1995). "Mathematics across the curriculum: A case study of the applications of Mathematics in selected Kenyan secondary school subjects" Unpublished M.Ed Thesis, Kenyatta University.
- [4] Kenya National Examinations Council (1995). 1993 and 1994 KCSE mathematics Report. Nairobi: KNEC.
- [5] Koul, L. (1984). Methodology of educational research, modern printers k-30, Navin Shahdara, Delhi, India.
- [6] Mutunga, P. and Breakell, J. (1992). Mathematics education, Nairobi: ERAP
- [7] National Council of teachers of mathematics (NCTM) (1990). Professional standards for teaching mathematics. Reston, VA: Author.
- [8] Njuguna, J.N. (2000) "Verbal Classroom Interaction Patterns of Home Science teachers and their students in selected secondary schools of Nairobi Province". M.Ed. Thesis, Kenyatta University.
- [9] Rukangu, S.M. (2000). "Pupils development of spatial ability in Mathematics: An issue of learning environment in selected secondary schools in Kenya." Nairobi: Unpublished PhD Thesis, Kenyatta University.
- [10] Sekaran, V. (1992). Research methods for Business: A skill building approaches 2nd edition. New York: John Wiley, and sons, Inc.

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