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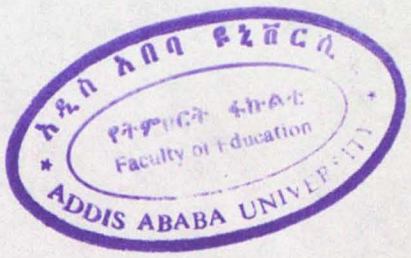

TEACHER - PUPIL INTERACTIONS IN MATHEMATICS' CLASSES : A STUDY OF CURRENT CLASSROOM PRACTICE IN SELECTED SECONDARY SCHOOLS IN ADDIS ABABA

Patrica A. McCaul

June 1994

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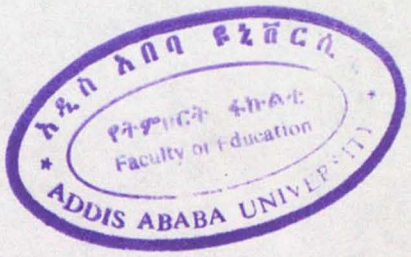

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THESIS SUBMITTED TO ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN EDUCATION

Patricia A. McCaul

Addis Ababa

June 1994

This Thesis has been submitted for examination with my approval as University Advisor

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Date:- 5/6/94

Place:- Addis Ababa

Addis Ababa University

School of Graduate Studies

Teacher - Pupil Interactions in Mathematics' Classes : A Study of Current Classroom Practice in Selected Secondary Schools in Addis Ababa

by

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Sincerest thanks must go to Dr. Tassew Zewdie for his extremely helpful comments and advice in approaching and undertaking this study.

DEDICATION

In fond and loving memory of my late parents William and Julia Smallwoods (RIP).

In honour of my children, Conan, Orlaith, Finnian and Ceire.

In honour of my beloved husband Edmund, without whose love, support, patience and constant inspiration this study would never have materialised.

TABLE OF CONTENTS

PAGE

PAGE

PAGE

LIST OF TABLES

LIST OF FIGURES

Figure

Chapter I

Background and Introduction

1. 1 Introduction

Education is of great importance in the social and economic development of any country. Efforts are being made world-wide to improve the quality of education and make it more effective and efficient. Anderson (1991) quoting Fuller (1986), Avalos and Haddad (1981) and Cohn and Rossmiller (1986) contends that several factors could contribute to raising educational standards. For example, more money could be spent on education. If school expenditure was increased, better instructional materials and facilities could be made available to students and teachers. Teacher-training courses could also be improved with more funding. The teacher- pupil ratio could be lowered. Nevertheless, Anderson (1991) asserts that since the early Eighties there has been a rising awareness among educators that if teaching was made more effective, this could have a far-reaching effect on the quality of education that students experience. Gage (1978) asserts that the classroom teacher plays a central role in education. He also claims that a major aim of education is to increase teacher effectiveness.

1. 2 Research Trends in Effective Teaching

Perrott (1992) maintains that some educators claim that effective teaching cannot be defined because of the complexity of interacting variables. Yet several researchers, such as Dunkin and Biddle (1974), Anderson (1989) and Kyriacou (1992) have determined that an effective teacher is one who brings about the intended change in behaviour in student learning through an educational activity.

Research in teaching effectiveness has been going on for centuries although the focus of most research studies before the Sixties was outside the classroom. Medley and Mitzel (1963) state that what actually happened within the classroom, how the teacher taught and how the pupils learned, was virtually ignored; so inputs and outputs or antecedents and consequences were investigated. The process of education, or as McNamara (1980) metaphorically states, what happened within the 'black-box' was to all intents and purposes overlooked. Wragg(1974) assays that since the Sixties there has been a remarkable increase in studies involving live observation of classrooms.

Bennett and Desforages (1985) describe research within the classroom as flourishing. Tassew (1992) quoting Simpson and Galbo (1986) reports that first-hand observation of teachers and pupils is considered as one of the notable advances in research on teaching. Kyriacou (1992) recounts that the focal point of recent research on teaching has been on life within the classroom and more specifically on the interaction between teacher and pupils.

Many researchers, such as Ryans (1969), Rosenshine and Furst (1973), Ober (1967), Amidon (1967), Medley and Mitzel (1963), have been active in this field. The best known researcher in this arena has been Ned A. Flanders who developed a systematic observation technique for coding patterns of teacher's and pupil's verbal behaviour. Dunkin and Biddle (1974) report that Flanders' system has been the most widely and the most often used system, to observe classrooms. Delamont (1985) contends that in Simon and Boyer's (1971) anthology of classroom observation of the seventy nine systems listed, thirty percent were derived from Flanders Interaction Analysis Categories (FIAC). However, with one or two notable exceptions, it seems that very little research has been conducted, in this field, in Ethiopia.

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1. 3 Research Trends on Teaching in Ethiopia.

Ethiopia is a poor country with a fast increasing population, so disbursement of funds for educational research is extremely limited. Very few studies have been carried out as mentioned above. Tekeste (1990) reveals that the Ministry of Education conducted a nation-wide survey in 1986 to determine the cause of the decline in the quality of education. This was of a general nature and did not study specific school subjects in depth. Derese et al. (1990) studied factors affecting the achievements of lower primary school students in Amharic and Mathematics. Again this study was very broad. Asmamaw (1993) compared the scholastic achievements in mathematics of students taught by two different methods (inductive and deductive).

As regards studies dealing with the interaction of teachers and students in the classroom, only two studies have been identified. Tassew (1992) analysed the interactions of science teacher-trainees in ninth grade science classes using Flanders Interaction Analysis Technique. Abdulkader (1983) inquired into teacher-pupil interaction in four twelfth grade English language classrooms. He utilized a modified version of Flanders Interaction Analysis Technique.

It seems that no researcher has explored teacher- pupil interaction in mathematics' classrooms. Nor has any such inquiry been made into teacher - pupil interaction from the point of view of the gender of pupils.

1. 4 Rationale for the Present Study

Wragg (1985) points out that the work of classroom analysts such as Lewin, Lippet

and White (1939) was strongly based on the tenet that a democratic teacher is more effective than an authoritarian one. Delamont (1985) contends that the systematic study of classrooms took root around the time of the Second World War when a wave of democracy was flooding the United States. Democratic leadership both at the political level and group level was being advocated. Wragg (1985) furthermore assays that Lewin et al. were firmly convinced that if children were exposed to dogmatism both at home and in school then 'blindly obedient citizens' would be produced.

According to Wragg (1985), Flanders (1963, 1965, 1970) and numerous other researchers were strongly influenced by these beliefs and strove to prove that there was a positive relationship between, in Flanders' terms, an indirect rather than direct style of teaching and achievement.

Democracy is a burning issue in Africa today. South Africa has just held it's first multi-racial elections and chosen it's first black President. Malawi which has been under tyrannical rule for several decades has just elected a new President, following the first democratic elections in more than thirty years. In Ethiopia, the Transitional Government has stated that free and fair elections will be held in the near future.

At the present time in Ethiopia, it is imperative to study classrooms from the point of view of the empathy of teachers and the socio-emotional climate of the classroom, as teaching behaviour affects student behaviour.

1. 5 Emergence of the Present Problem

In a third world country such as Ethiopia, where according to the World Development Report (1993), the primary net enrollment in 1990 was just twenty eight percent and only fifteen percent of the population of secondary school-age children were enrolled in education, it is important that schooling be of as high a calibre as possible. In Ethiopia, where economic

resources are very limited, it is important to make teaching more effective and efficient without the burden of extra financial spending. This can be achieved by improving the classroom behaviour of teachers.

Mathematics is a vitally important subject in the school curriculum. Yet it is a subject which many students experience difficulty with. Knowledge of mathematics, to some degree, is a necessity in various aspects of everyday life. So it is crucial that this subject be taught effectively

It cannot be denied that women have a significant role to play in development and in this regard education is of vital importance. At present due to cultural, social and economic pressures, to name but a few, the number of girls participating in the educational system in Ethiopia is considerably less than boys. World Bank (1993) indicators show that in primary education the number of boys enrolled in 1990 outnumbered girls in the ratio of 100 : 64. In secondary education the ratio was 100 : 67 in favour of boys.

In addition to this disparity, girls who are enrolled in the school system demonstrate comparatively low performance. Gennet (1991) reveals that between the years 1978-1987 in the grade six National Examination, only thirty five percent of the total number who passed were female. Gennet's statistics also show that from 1979-1987 an average of only forty percent of all female students who sat the grade eight National Examination passed. In the Ethiopian School Leaving Certificate Examination female students fared even worse. Of all students who earned the required GPA of 2. 3 and above, needed to enter higher education, only 5. 9 percent were female. Teacher performance in the classroom may have had a bearing on this.

Tassew (1992) made the significant discovery that teacher talk in Ethiopian classrooms constituted seventy five percent and above of classroom teaching time. He recommended that further studies in the area of classroom interaction be carried out.

Keeping in mind the growing interests of some educationalists in the systematic study of classroom processes and the spread of innovations at classroom level, the present investigator has ventured to undertake a descriptive research into the current classroom practice in mathematics' classrooms in selected secondary schools in Addis Ababa.

1. 6 The Problem

The purpose of this research is to study the teacher- pupil interactions in mathematics' classes and to highlight the current classroom practices in selected secondary schools in Addis Ababa.

1. 6. 1 Objectives of the Study

The investigation will consider the following general and specific objectives.

1. 6. 1.1 General Objectives

The research project is designed to study the nature of teacher- pupil contacts in the classrooms of some secondary schools in Addis Ababa, considering mathematics' teachers and students as subjects of the investigation. In the process, the interaction of the teacher with male and female students will be taken into consideration.

1. 6. 1. 2 Specific Objectives

a. To find out what proportion of the classroom time is shared between teacher and pupil activities.

b. To find out whether any differences exist in the participation of girls and boys in the classroom.

c. To identify the various approaches to teaching mathematics as utilized by mathematics' teachers in the case study classrooms.

d. To evaluate the current practice of mathematics' teaching in the classrooms observed in the study, against some established teaching principles.

1. 7 Significance of the Study

It is important to study classroom interaction in an effort to identify improved strategies or approaches to teaching. Conclusions drawn from the analysis of the current practices of classroom communication is expected to contribute to the improvement of mathematics' teaching in secondary schools in Ethiopia.

1. 8 Limitations of the Study

The major limitation of the study is the researcher's lack of knowledge of Amharic or any other Ethiopian language. Therefore, the study was of necessity, confined to classes in the senior secondary schools where the language of instruction is deemed to be English. Limitations inherent in the Flanders Interaction Analysis System may be reflected in this study . Lack of

modern resource material in the libraries of Addis Ababa University severely handicapped the study.

1. 9 Brief Conceptual Foundations of Some Terms Used in This Study

1. 9.1 Concept of Teaching

Highet (1954) conceived teaching as a form of art. He compared teaching to painting a picture or composing a piece of music.Gage (1978) on the other hand asserts that art should be based on scientific principles as is the practice of medicine or engineering.

It has long been acknowledged that teaching is a complex task involving a number of variables. Dunkin and Biddle (1974) report that Mitzel (1960) identified a paradigm for studying teaching. He distinguished four variables which had an effect on teaching. They were presage, context, process and product variables. According to Gage (1978) they can be placed in a time sequence with presage and context variables coming first and second respectively, followed by process variables. Product variables bring up the rear.

Presage variables are concerned with teacher characteristics such as sex, age and training. Context variables refer to features of the environment over which the teacher has no control but which can have a bearing on pupil learning. These include such factors as school facilities and pupil characteristics. What occurs in the classroom or on the site where learning takes place is classified under process variables. Finally, product variables pertain to the outcome of instruction i.e. whether objectives have been attained. Almost all research studies over the last few decades have retained this framework.

Since the Sixties most research studies have tried to link classroom behaviour of teachers with pupil learning. So process-product studies have played a dominant role in recent research on teaching behaviour. Ryans (1969), Flanders (1970), Rosenshine (1971), Brophy et al. (1975), Bennett (1976), Brophy (1987) and Anderson et al. (1989) have been active in this field.

1. 9. 2 Definition of Teaching

Gage (1963) defined teaching as an interpersonal activity aimed at changing the behaviour of others. In a later work (1978) he construed teaching as an activity which one person engages in to help another to learn. This activity, he points out, often involves verbal communication.

Amidon (1967) sees teaching as an interactive process between teacher and pupils. This interaction, he contends, chiefly involves talking.

Flanders (1970), Chauhan (1990) and Sharma (1990) define teaching as an interactive process. Teachers and students influence each other in a reciprocal manner.

Anderson and Burns (1989) in forming their own definition of teaching, quote Klauer (1985) who regards teaching as an interpersonal activity in which learning should take place by one or more people. This interpersonal activity or interaction can be two-way in that both teachers and students talk and influence each other.

Anderson and Burns (1989) present their definition of teaching: -

> *"Teaching is an interpersonal, interactive activity, typically involving verbal communication which is undertaken for the purpose of helping one or more students learn or change the ways in which they can or will behave." (p 97).*

So teaching can be regarded as a bi-directional communication, which to a large extent involves talk between teachers and students. Bellack et al. (1966) argues that very few classroom activities can be executed without using language.

1. 9. 3 Teaching Behaviour

Effective teaching is concerned with maximizing pupil-learning. Accordingly, many research efforts have addressed the problem of trying to identify classroom behaviour that have the optimum effect on student learning.

Flanders (1970) sees teaching as occurring within a social context. He conceives teaching behaviour as the acts a teacher performs which guide complementary reactions from the students. He asserts that teachers should encourage children to think creatively. Medley (1982) interprets teaching behaviour in terms of teacher performance or what the teacher does in the classroom. Ryans in (1969) proposed that teaching relates to the activities of the teacher which affect learning. Accordingly teaching behaviour can be defined as the actions of the teacher in the learning situation. Bloom (1972) contends that it is what the teacher 'does' and not

what the teacher is 'like' that determines what students learn and how they perceive learning.

Teaching behaviour can be classified as either verbal or non-verbal.

1. 9. 3.1 Verbal Teaching Behaviour

Verbal teaching behaviour can be defined as 'teacher talk'. Flanders (1970) categorized teacher talk either as direct or indirect.

1. 9. 3.1.1 Direct Teaching Behaviour

Examples of direct teaching behaviour are teacher lecturing, giving directions and criticizing or justifying authority. Direct teaching behaviour restricts student participation.

1. 9. 3.1.2 Indirect Teaching Behaviour

Indirect teaching behaviour is concerned with behaviour such as praising, accepting feelings, using pupils ideas and asking questions. Indirect teacher behaviour allows more student response.

1. 9.3.2 Non - Verbal Teaching Behaviour

All Teaching behaviour not including talk, can be termed as non-verbal. Communication in the classroom can also be non-verbal. A smile, a nod, in fact any sign or gesture which conveys information from the teacher to the pupil can

be classified as non-verbal teaching behaviour. Flanders (1970) assumes that non-verbal teaching behaviour is reflected in verbal behaviour.

1. 10 Patterns of Teaching Behaviour

Walker and Alderman (1990) see the classroom as a place of action, with it's own laws and reasoning. Within this setting many events take place over and over again forming a pattern.

Gage and Berliner (1988) drawing on the work of Bellack et al. (1966) assert that recitation is the dominant teaching behaviour, especially in secondary schools. The prevailing pattern of teaching which they identify is structuring - soliciting - responding - reacting. The teacher first of all provides a framework for the learning task. This is followed by the teacher trying to elicit a response from the student. The student then responds and finally the teacher reacts to the student's reply.

Flanders (1970) conceives teaching as a 'chain of events', one occurrence leading to another. For example: teacher questioning usually leads to pupil's response.

Chapter II

Review of Related Literature

2. 1 Introduction

In this chapter studies relevant to teaching and teacher behaviour in general and to the teaching behaviour of teachers teaching mathematics in particular have been reviewed.

As has been conceptualized in the preceding sections of this paper, the present research venture utilized systematic classroom observation techniques to gather pertinent data. However, the presentation of information in this chapter starts with a brief note on systematic approaches to the study of classroom teaching behaviour. This is intended to assist the reader to firmly grasp the review of related studies without difficulty.

2. 2 Interaction Analysis as a Technique for Studying Teacher Behaviour

Many researchers such as Flanders (1970), Amidon and Hunter (1967), Medley (1982), Bellack et al. (1966) and Boydell (1979) see teaching from the point of view of interaction. For learning to take place, there must be interactions between the teacher and students. These interactions can be verbal or non-verbal.

Recent research efforts have tried to identify classroom interactions which boost learning. These studies were often structured to record the frequency of different teacher behaviour and various student behaviour and these were then correlated with student-learning gains.

Anderson and Burns (1989) point out the advantages of using a structured system when observing classrooms:-

(a) information gained as happenings occur in the classroom can be very specific and exact.

(b) the structure of the system dictates how facts are recorded and interpreted.

(c) qualitative and quantitative data can be analysed effectively.

Nelson (1969) states that one of the first systematic approaches to observing and analysing classroom behaviour, can be traced back to H.H. Anderson. An adaptation of Anderson's categories is shown in Figure 2. 1 below.

Domination	Integration
1. Determines a detail or acts for the child in carrying out a detail.	1. Approval.
2. Direct refusal.	2. Accepts differences.
3. Relocating, repeating, or placing children in different relations to each other or to property.	3. Extends invitations to activity.
4. Postponing, slowing up the child.	4. Question or statement regarding child's expressed interest or activity.
5. Disapproval, blame, or obstruction.	5. Builds up (helps child's definition or to better solution without giving final answer).
6. Warning, threats, or conditional promises.	6. Participates in joint activity with children.
7. Calls to attention or group activity.	7. Gives sympathy.
8. Rations material.	8. Gives permission.
9. Lecture method (defining a problem or anticipating a question.	
10. Questions, lecture method (one-answer questions) recitation.	
11. Perfunctory questions as statements (indifference).	

Figure 2. 1 Anderson's Categories for Coding Domination and Integration. Adapted by Dunkin and Biddle. (1974, p. 98)

He studied the effects of dominative and integrative teachers on child performance and recorded 'contacts' or behaviour patterns in classrooms over a number of years in nursery and elementary schools. He concluded that dominant teacher behaviour is related to dominant behaviour in students while integrative teacher behaviour stimulated integrative behaviour among students.

As is pointed out by Wragg (1979) at about the same time as Anderson's the dominative vs integrative study of teachers. Lippet and White conducted research on the effects of authoritarian, democratic and laissez-faire leadership on pupils in children's clubs. They discovered that morale was highest and there was more integrative behaviour in clubs where leadership was democratic and neither authoritative nor laissez-faire. Medley and Mitzel (1963) contend that Withall in 1949 explored the 'Social-Emotional Climate' in classrooms. His study was based on verbal statements made by the teacher. See Figure 2. 2

1. Learner-Supportive statements that have the intent of reassuring or commending the pupil.
2. Acceptant and clarifying statements having an intent to convey to the pupil the feeling he was understood and help him elucidate his ideas and feelings.
3. Problem-structuring statements or questions which proffer information or raise questions about the problem in an objective manner with intent to facilitate learner's problem-solving.
4. Neutral statements which comprise polite formalities, administrative comments, verbatim repetition of something that has already been said. No intent inferable.
5. Directive or hortative statements with intent to have pupil follow a recommended course of action.
6. Reproving or deprecating remarks intended to deter pupil from continued indulgence in present "unacceptable" behaviour.
7. Teacher self-supporting remarks intended to sustain or justify the teacher's position or course of action.

Figure 2. 2 Withall's Classroom Climate Categories. Adapted by Dunkin and Biddle (1974, p.99).

There were seven categories of statements in all on a continuum extending from 'teacher-centredness to pupil -centredness' . If more teacher talk was recorded in categories one, two and three than in categories five, six and seven then the climate in that classroom was said to be learner-centered. If more teacher talk occurred in categories five, six and seven than in categories one, two and three than the classroom climate was said to be teacher-centered

Withall also developed a 'climate-index' which was the ratio of the number of statements falling into categories one, two and three to the total; hence he was able to assess the 'social climate' of the classroom.

Quoting Nelson (1969), intensive research efforts utilizing Withall's technique by Flanders(1958), Perkins(1951), Mitzel and Rabinowitz (1951) ensued, she avers that Mitzel and Rabinowitz tried to test the reliability of Withall's categories and they concluded that the system could determine distinct differences in teacher behaviour, although teacher behaviour did vary from one time to another.

She attests that Perkins (1951) used Withall's categories when studying in-service teacher training programmes. He investigated the social climate in leader-centered groups and group-centered groups. Perkins concluded that climate was a major factor both in quantitative and qualitative terms of learning with the group-centered group attaining more learning and more positive attitudes.

2. 3 Research on Teaching Behaviour

Kyriacou (1990), reports that the hidden curriculum has the most important bearing on classroom climate. How a teacher acts, even unintentionally, may affect student learning. She contends that teachers' talk dominates in the classroom. When pupils are permitted to speak, their talk is often curbed by the teacher. Bennett et al. (1984), confirms this. Their findings show that even when pupils try to express their own ideas, teachers restrict the

exchanges with talk based on their own ideas.

Flanders (1970) classifies talk as either being direct or indirect. Direct teacher talk limits student participation, whilst indirect talk encourages student involvement in learning. He maintains that a more equal balance of direct to indirect talk in the classroom improves learning.

Gage and Berliner (1989) report that studies by Rosenshine (1971), Dunkin and Biddle (1974) and Soar (1973) all show a low positive relationship between teacher talk and student achievement. Mullinix (1982) argues that there is a higher mean gain in achievement in classes taught by teachers who rank higher in more direct-talk Beaumont (1984) found that students attained higher scores in basic mathematics and reading when student-initiated talk was intense rather than limited.

Pandey (1981) in his research on teaching behaviour in science classrooms concluded that accepting pupils' ideas and giving praise, had a significant positive correlation with concept attainment. He also found that questioning and encouraging pupils' response aided pupils' learning.

Everston and Veldman (1981) report that behaviour in English classes and mathematics' classes differ. Mathematics' teachers more often tended to introduce new topics through lecturing while students sat passively. English classes ranked higher on enthusiasm, clarity and positive teacher behaviour. Students also initiated more statements in English classes.

Brophy et al. (1975) focused attention on two sets of data. One drawn from classrooms in a low socio-economic setting (SES), the other from classrooms deemed to be of high-SES. Data gathered suggested that low-SES students benefited from positive support of the teacher, high-SES students profited if a high level of achievement was expected from them. Passivity had a negative correlation with achievement.

Extra learning time or increased on-task time has been shown by Brophy and Everston (1976) and Stallings and Kaskowitz (1974) to enhance learning. Bennett (1976) in a

controversial study compared formal, informal and mixed teaching styles. He concluded that in mathematics, reading and English a formal style of teaching was generally more effective. Aitkin et al. (1981) on re-analysing Bennett's statistics, challenged these findings and determined that such inferences could not be drawn from the study. Gray and Satterly (1981) contend that as teaching styles vary so much, teachers' can be effective or ineffective within any specific style.

2. 4 Mathematics' Teaching

Pellery (1991) insists that mathematics' instruction has occupied a central position in education from ancient times to the present day.

Travers (1991) states that in most schools between fifteen and twenty percent of instructional time is spent on mathematics. He also points out the importance of mathematics in society. Mathematicians are needed in industry and high technology. On a more fundamental level mathematics is needed in everyday life.

Fey (1969) warrants that results of research into methods of teaching such as discovery, laboratory or lecture are questionable and inconsistent. He proffers that classroom observation techniques could be a strong tool for identifying an effective teaching style.

Since mathematics is a basic subject in school curricula, Fey (1982) contends that the effectiveness of teaching mathematics has been an important concern in educational research. Nevertheless the search for theories to guide instruction has had very little success.

Good et al. (1978) in making an empirical comparison of effective teaching in mathematics between high and low-SES classrooms asserts that no pattern of teaching can be applied consistently. Effective teachers adapt their teaching to certain groups of students. They confirmed the findings of Brophy et al. (1975) that low-SES students need more praise than high-SES students.

Good and Grouws (1977) differentiated between patterns of teaching behaviour that they found to be effective versus ineffective in elementary mathematics' classrooms. The effective teacher concentrated on the task, repeated daily, attended to growth and mastery, oversaw set work and gave homework regularly. Furthermore, they verified that when teachers were trained to behave in this manner student learning gains increased significantly.

Fey (1979) reporting on findings of a study sponsored by the National Science Foundation (N.S.F.) claimed that the pattern of mathematics' teaching which was found prevalent was teacher-controlled explanation, followed by written desk work. Classroom procedures included correction of homework, then a short time was spent introducing a new topic. The next days assignment was then started in class.

Fey (1982) concludes that studies have given a discouraging view of the reality of life in mathematics' classrooms. Students see themselves as being passive recipients of information which they have to memorize.

Anderson (1991) contends that teachers who provide structure for their students, moderately but consistently influence student achievement. He also reveals that teaching behaviour across the world is quite similar. In a world wide study, which concentrated on mathematics' classrooms, he postulates that three basic activities take place: "teachers talk at or with their students.....,students work at assignments in their desks.....,and teachers engage in a general set of management activities."

Flanders (1970) conducted a systematic study in eight grade mathematics' classrooms. He concluded that effective teaching behaviour was more indirect than direct in style.

2. 5 Gender Issues in Mathematics' Classrooms

Maccoby and Jacklin (1974) assert that empirical evidence demonstrates that girls and boys differ in mathematical achievement, verbal ability and spatial ability. Girls surpass boys in

work requiring verbal ability. Boys excel in mathematical performance and on tasks requiring spatial ability.

Rigon (1990) divulges that girls have consistently on average, scored lower in the Scholastic Aptitude Test (SAT) in the United States. She asserts that the same pattern is shown worldwide. Gennet (1991) states that girls have performed very unsatisfactorily in mathematics in the Ethiopian Leaving Certificate Examination (ESLCE).

Mahoney (1985), quoted by Wilson (1991), asserts that mixed-sex schools are catastrophic for girls as they impair their performance and self-esteem. Wilson also quotes Clarricoates (1978) who maintains that boys tend to dominate talk in the classroom. Wernersson (1991), confirming the findings of Brophy (1985) and Kelly (1986), claims that teachers attend to boys more than girls in all grade levels. Kaiser (1991) also contends that teachers devote more time to boys. This is particularly noticeable in traditionally male areas of study such as mathematics and science. She quotes research of Bartz (1985) who reported that even when teachers were asked to give girls more of their time, girls took up only forty-two percent of the teachers' attention.

Chapter III

Method and Procedures

3. 1 Method

In order to identify certain prevailing teaching patterns in mathematics' classrooms, in Addis Ababa, a descriptive research method was employed. The study paid particular attention to the verbal communicative behaviour in classrooms.

3. 2 Procedures

This research was carried out in three phases.

3. 2.1 Phase 1

The first phase of the investigation was concerned with determining the sample and becoming familiar with the Flanders Interaction Analysis System as an instrument of investigation and technique of interaction analysis. Moreover, preparation of secondary data documents was started at this stage.

3.2. 2 Phase 11

The second phase was concentrated on the collection of data through a slight modification of FIAT and compiling this, so that ten by ten matrices for individual teachers and eventually groups of teachers observed could be prepared.

Data was also collected on student involvement in learning from a questionnaire distributed to students.

3. 2. 3 Phase 111

Analysis and interpretation of data was dealt with in the third stage of the investigation. Having organized and analysed the data, tentative conclusions were made on the basis of the findings.

3. 3 Sample

For analysing verbal interactions in the classroom a sample of twelve teachers was deemed to be adequate. It was decided that each teacher would be observed, for approximately twenty minutes on three occaasions. Grade nine mathematics classes were chosen. This researcher would have preferred to study grade eight mathematics classrooms as statistics are available from research conducted by Flanders pertaining to behaviour in grade eight mathematics classrooms. However the researcher was constrained through the lack of knowledge of the indigenous language i.e. Amharic, which in practice is the language of instruction in grade eight (even though the official language of instruction is English at that level). In the circumstances the researcher elected to observe the nearest grade being taught in English, which was grade nine. As pupils' verbal interactions were to be examined by gender, it was necessary to observe classes in mixed-sex schools.

To evaluate whether boys or girls were more involved in learning in mathematics classrooms, a student self-report questionnaire, adapted by Anderson (1991) from Hecht (1978) was prepared (Appendix 1). To make this questionnaire more easily understood by the pupils it was translated into Amharic, a major Ethiopian language (Appendix 11). It was

determined that a sample size of two hundred and forty pupils (one hundred and twenty boys and one hundred and twenty girls) would be adequate. Private and international schools were excluded from the study as it was deemed they would not provide a true reflection of teaching behaviour in the Ethiopian national school system.

There are six zones in Addis Ababa, three zones were selected at random i.e. zones two, three and four. Within these three zones one school was selected at random from each. They were Shimelis Habte Comprehensive Secondary School (Zone 2), Nefas Silk Comprehensive Secondary School (Zone 3) and Menelik 11 Comprehensive Senior Secondary School (Zone 4).

In order to complete classroom observations in as short a time as possible, teachers who could best fit the observation schedule were chosen. Six teachers were observed in Nefas Silk Comprehensive Secondary School, two in Shimelis Habte Comprehensive Secondary School and four in Menilik 11 Comprehensive Senior Secondary School.

3. 4 Using Interaction Analysis as a Technique of Observation

In order that the observer could become conversant with coding verbal behaviour in the classroom, training was necessary. For this to occur, random contact was made with three schools and observation schedules were arranged. A cameraman was employed so that video-sound recordings could be made of classroom events. Following this, classrooms were visited by the observer and the cameraman and video recordings of classroom behaviour were obtained. These recordings were used in the training of the observer.

As one of the objectives of the study was to discover if any dissimilarities existed in the participation of boys and girls in the classroom it was decided to modify Flanders Interaction Analysis Categories (Figure 3. 1) slightly, so that note could be taken of the gender of pupils when they talked.

Teacher Talk	Response	*1. ACCEPTS FEELINGS.* Accepts and clarifies an attitude or the feeling tone of a pupil in a non threatening manner. Feelings may be positive or negative. Predicting and recalling feelings are included. *2. PRAISES OR ENCOURAGES.* Praises or encourages pupil action or behaviour. Jokes that release tension, but not at the expense of another individual; nodding head, or saying "Um hm" or "go on" are included. *3. ACCEPTS OR USES IDEAS OF PUPILS.* Clarifying, building, or developing ideas suggested by a pupil. Teacher extensions of pupil ideas are included but as the teacher brings more of his own ideas into play, shift to category five
		4. ASKS QUESTIONS. Asking a question about content or procedure, based on teacher ideas, with the intent that a pupil will answer.
	Initiation	*5. LECTURING.* Giving facts or opinions about content or procedures; expressing his own ideas, giving his own explanation, or citing an authority other than a pupil. *6. GIVING DIRECTIONS.* Directions, commands, or orders to which a pupil is expected to comply. *7. CRITICIZING OF JUSTIFYING AUTHORITY.* Statements intended to change pupil behaviour from non acceptable to acceptable pattern; bawling someone out; stating why the teacher is doing what he is doing; extreme self-reference.
Pupil Talk	Response	*8. PUPIL-TALK-RESPONSE.* Talk by pupils in response to teacher. Teacher initiates the contact or solicits pupil statement or structures the situation. Freedom to express own ideas is limited.
	Initiation	*9. PUPIL-TALK-INITIATION.* Talk by pupils which they initiate. Expressing own ideas; initiating a new topic; freedom to develop opinions and a line of thought, like asking thoughtful questions; going beyond the existing structure.
Silence		*10. SILENCE OR CONFUSION.* Pauses, short periods of silence and periods of confusion in which communication cannot be understood by the observer.

Figure 3. 1 Flanders Interaction Analysis Categories (1970,p.34).*

* There is no scale implied by these numbers. Each number is classificatory; it designates a particular kind of communication event. To write these numbers down during observation is to enumerate, not to judge a position on a scale.

So when coding in categories relating to pupil talk (eight and nine) the sex of the student is logged. For example, if a boy initiated talk 9b was recorded. If a girl responded to a teacher's question 8g was minuted.

Using this slightly modified version of FIAT the observer was trained in coding by an expert in classroom observation. After several sessions of training, inter-inter reliability was eventually obtained using Scott's phi-coefficient * as suggested by Flanders (1970). A reliability coefficient of 8. 76 was secured. Flanders considers a reliability coefficient of 8. 5 as acceptable

3. 5 Data Collection

Having arranged new observation schedules the cameraman and the observer visited the classrooms and video-recordings were made. Contextual data such as physical description of the classrooms was noted. While viewing and listening to these video-recordings teachers' and pupils' classroom behaviour was coded, using the slightly modified version of FIAT.

With the help of an expert from Addis Ababa University a matrix for each observation was developed. On completion of all three observations and tabulation of a particular teacher, the three matrices were combined to produce a master-matrix for that specific teacher. The master-matrices of the twelve teachers were finally combined to get a Master-Master-Matrix. This enabled the analysis of data on the behaviour of mathematics' teachers as a group, to be carried out.

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* Scotts Reliability coefficient is calculated as follows: $\text{Reliability} = \frac{Pq - Pe}{1.00 - Pe}$

Pq represents the agreement between the two observers and Pe represents the agreement between the two observers which occurs simply by chance.

3. 6 Research Tool

Flanders Interaction Analysis Technique was the primary tool used to collect data on verbal interactions in grade nine mathematics' classrooms.

3. 6. 1 Flanders System of Interaction Analysis

Flanders (1970) developed a ten-category observational system known as Flanders Interaction Analysis Categories (FIAC). Interactions in the classroom can be classified in specific categories. Seven categories are devoted to teacher talk (1-7), two to pupil talk (8-9) and one to silence or confusion (10). The main aim of the Flanders' system is to compare initiation with response. The person who initiates talk generally directs the communication. Response is a reaction to initiation.

Flanders (1970) argued that there should be a balance between initiation and response with initiation less weighted in favour of the teacher.

Flanders' system has been used to examine verbal interaction at all grade levels and in different subject areas. Although Walker and Adelman (1990) assert that it is more likely to yield valid results, if it is used in the traditional formal classroom, where talk takes the form of a public dialogue it would therefore be applicable in mathematics' classrooms in Addis Ababa where whole class teaching is the standard practice.

3. 6.2 Procedures to be followed when using FIAT

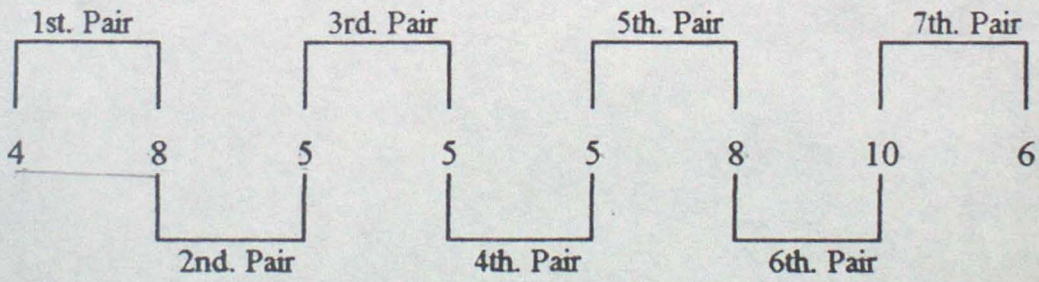
Flanders is primarily a process of encoding and decoding. The encoding process comprises the recording of classroom events. The decoding process entails preparing a 10 x 10 matrix and interpretation of the matrix.

3. 6.2. 1 Encoding Process

FIAT has ten categories. The aim of the observer is to code all classroom communication into these categories. A trained observer sits in the classroom or views a video-sound playback and at approximately every three seconds he records the category which best depicts the classroom behaviour during that period. Keeping recording at an even rate twenty categories are recorded per minute. So in an observation of twenty minutes approximately four hundred tallies of classroom events are recorded.

3. 6. 2.2 Decoding Process

In the decoding process all interactions are sequenced and then paired. Sequencing allows the observer to see the flow of events. A 4-8-4-8-4-8 sequence characterises a quick question-response routine such as a drill pattern. Pairing permits the decoder to put the data into a 10 x10 matrix. From this matrix a multitude of information can be obtained. A 4-8-5-5-5-8-10-6 sequence could be paired as follows:-



The first pair 4-8 i.e. teacher-question followed by pupil answer is recorded in the 4-8 cell by counting four down and eight across. The next pair 8-5 i.e. student answer followed by teacher lecture is tallied in the 8-5 cell. See Table 3. 1 for an example of the matrix tabulation showing the 4-8-5-5-5-8-10-6 sequence.

Table 3. 1 Matrix Showing the Sequence 4-8-5-5-5-8-10-6 Tallied in Cells.

Cat.	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4								/		
5					/ /			/		
6										
7										
8					/					/
9										
10						/				

From a tabulation matrix a number matrix can be constructed. Table 3. 2 is an example of a number matrix based on one classroom observation.

Table 3. 2 Completed Matrix of One Observation

Cat.	1	2	3	4	5	6	7	8	9	10	Total
1					1						1
2					1						1
3											
4				1			1	10		2	14
5				7	291	2		1		5	306
6				1	4	6				3	14
7										1	1
8		1		3	6					1	11
9											
10	1			2	3	6				112	124
Total	1	1		14	306	14	1	11		124	472

To make the course of communication more easily understood, a box-flow diagram was drawn (Figure 4.1 Chapter IV). Space was used in proportion to the interaction pattern. Squares representing the steady state cells were in proportion to the frequency of numbers in the cell. The thickness of the arrows showing transitions was not in proportion to the extent of the transitions.

3. 6.2.3 Computation of Various Behaviour Ratios

From the data compiled on the 10 x10 matrix, several behaviour ratios were obtained using formulae developed by Flanders (1970). Below are the ratios calculated in this study and their formulae.

NB: In the formulae Arabic numbers refer to the total frequency in specific categories.

N = Total frequency of ratios.

Behaviour Ratio		**Formulae**		
Teacher Talk (TT)	=	$\frac{1+2+3+4+5+6+7}{N}$	x	100
Pupil Talk (PT)	=	$\frac{8+9}{N}$	x	100
Silence and Confusion (SC)	=	$\frac{10}{N}$	x	100
Indirect Teacher Talk (ITT)	=	$\frac{1+2+3+4}{N}$	x	100
Direct Teacher Talk (DTT)	=	$\frac{5+6+7}{N}$	x	100

Behaviour Ratio		Formulae		
Indirect to Direct Ratio (I/D)	=	$\frac{1+2+3+4}{5+6+7}$	x	100
Praising (P)	=	$\frac{2}{N}$	x	100
Lecturing (L)	=	$\frac{5}{N}$	x	100
Teacher Response Ratio (TRR)	=	$\frac{1+2+3}{1+2+3+6+7}$	x	100
Teacher Question Ratio (TQR)	=	$\frac{4}{(4+5)}$	x	100
Instantaneous Teacher Responses Ratio (TRR'89)	=	$\frac{(8-1)+(8-2)+(8-3)+(9-1)+(9-2)+(9-3)}{(8-1)+(8-2)+(8-3)+(8-6)+(8-7)+(9-1)+(9-2)+(9-3)+(9-6)+(9-7)}$	x	100
Instantaneous Teacher Question Ratio (TRR '89)	=	$\frac{(8-4)+(9-4)}{(8-4)+(8-5)+(9-4)+(9-5)}$	x	100

Behaviour Ratio		**Formulae**		
Teacher Pupil Ratio (T/P)	=	$\frac{1+2+3+4+5+6+7}{8+9}$	x	100
Content Cross Ratio (CCR)	=	$\frac{(4+5)}{N}$	x	100
Pupil Initiative Ratio (PIR)	=	$\frac{9}{8+9}$	x	100
Steady State Ratio (SSR)	=	$\frac{(1-1)+(2-2+(3-3)+(4-4)+(5-5)+(6-6)+(7-7)+(8-8)+(9-9)+(10-10)}{N}$	x	100

3. 7 Gender Wise Data Analysis

As mentioned previously, note was taken of students' talk by gender. On completion of tabulation of classroom events from the video recordings total response and initiation tallies of pupils by gender was calculated. Behaviour ratios showing the proportion of response and initiation shared by boys and girls were computed. In order that ratios could be adjusted to allow for the number of boys and girls in the classrooms, note was taken of this.

Time which boys separately and girls separately spent working on the blackboard was measured from the video-recording and the ratio showing the portion of time boys spent at the blackboard in relation to girls was calculated. This was also adjusted according to the number of boys to girls.

3. 8 Student Involvement Questionnaire

In order to complement the results obtained from utilizing FIAT it was decided to find out the extent to which boys as a whole and girls as a whole were involved in the learning task and to compare the findings. A set of questionnaires (Appendixes I and II) which Anderson (1991) adapted from Hecht (1978) was used for this purpose.

This was a closed questionnaire containing ten items requiring children to circle YES or NO in response to each statement.

YES responses in the even numbered statements were worth one point; NO responses were worth zero points. For odd numbered statements NO responses were worth one point; YES responses were worth zero points. The total number of points were then tallied. The higher the number of points the more the student is involved in learning.

A sample of 10 boys and 10 girls in each classroom was considered adequate. Questionnaires were distributed randomly immediately after the third observations in each classroom. The third observation was chosen so that students and teachers would have become accustomed to having a cameraman and observer in the classroom. Hence, more reliable results may be obtained.

Following the final observation in the classrooms, the total number of points for each student was computed. Subsequently, the total number of points for all students surveyed, according to gender was totalled. Finally, an average of boys involvement and girls involvement was determined.

3. 9 Mode of Computions

All computations were carried out without the aid of a computer. The statistical computations in this research was carried out by the researcher.

Chapter IV

Analysis of Data, Interpretation and Discussion of Results

This chapter is devoted to the analysis of data obtained from observation of mathematics' classrooms. Before presenting this analysis, it would appear apt to give some background information on the Addis Ababa sample schools and to present a general description of the classrooms where the data was gathered.

4. 1 Time in School

Due to the shortage of school places and the large population of school-age children needing education, students either attend school in the morning or in the afternoon from Monday - Friday. Six classes are held in the morning and another six in the afternoon; the normal length of a period or lesson is forty minutes. In the schools observed, students attended four mathematics' classes per week.

4. 2 Description of Classrooms

The average class size in the classrooms observed, was eighty-seven. The size of the classes ranged from sixty-seven to one hundred and fourteen, across the different classrooms in the sample schools. Due to such large class sizes, in some instances, four or more students were forced to sit in one desk. This resulted, in a number of students not having a clear view of the blackboard and being unable to record the written notes easily. In one of the schools observed,

no desks or chairs were made available to teachers, due to lack of space in the classrooms. In this extremely crowded situation, teachers' movements were restricted.

In most of the classrooms observed, walls were dirty and bare. No visual aids were on display. Windows were often broken. Metal sheeting was used in some classrooms to replace windows. This resulted in poor lighting conditions and inadequate ventilation. Bare electrical wires were seen hanging from the ceilings and protruding from the walls. Sometimes doors were kept closed with the aid of a stone, as fittings were broken. No child was ever addressed by name. On one occasion, a teacher was observed using roll numbers when requesting answers from students.

One feels justified in saying, that the classrooms observed were not conducive to learning or teaching.

4. 3 Approaches to Teaching Mathematics as Utilised by Mathematics' Teachers

In this study it was generally found that all mathematics' teachers were similar in their approach to teaching mathematics as contended by Fey (1974). During observations the investigator noted that the prevalent pattern which existed was correction of homework on the blackboard, followed by the teacher introducing a new topic. Students then copied the work which the teacher had done on the blackboard into their notebooks. Finally homework was given to the students by the teacher; this the students started to do in class.

Students appeared to be very dependent on note taking. In all the classrooms observed, everything done on the blackboard was copied by the students into their exercise books. Of all the teachers observed, only one, actually gave students problems to be worked out in class.

4. 4 A Study of Interactions in Mathematics' Classrooms

As has been indicated elsewhere in the preceding sections, twelve mathematics' teachers were observed in the classroom, each on three occasions. A video-camera was used to record events. Using the playback facility, the verbal behaviour of the teachers was studied using FIAT. At the outset 10 x 10 matrix was developed for each observation. On completion of all observations and tabulations of a particular teacher, the three matrices were combined to produce a master matrix for that particular teacher. The master-matrices of the twelve teachers were finally combined to get a "Master-Master Matrix" (Table 4.1).

Table 4. 1 Master-Master Matrix Showing Classroom Interaction for all Mathematics' Teachers

Catg.	1	2	3	4	5	6	7	8	9	10	Total
1	17	-	-	8	10	3	-	7	5	16	66
2	3	12	26	36	48	9	1	11	5	11	162
3	2	4	64	36	46	5	-	1	3	5	166
4	3	2	4	453	81	29	6	1599	4	122	2303
5	13	6	4	669	5446	78	2	28	9	197	6452
6	3	2	1	44	81	295	4	44	17	176	667
7	-	1	2	38	10	11	84	17	3	19	185
8	5	115	51	854	499	57	59	72	14	90	1816
9	3	12	6	15	17	12	5	4	298	45	417
10	17	8	8	150	214	168	24	33	59	3121	3802
Total	66	162	166	2303	6452	667	185	1816	417	3802	16036
%	0.41	1.01	1.04	14.36	40.24	4.16	1.15	11.33	2.6	23.71	100
%				62.37				13.92		23.71	100

The Master-Master Matrix formed the basis for analysis of classroom interactions in mathematics' classes, since the main objective of this study was to analyse verbal behaviour of mathematics' teachers, as a group. From the Master-Master Matrix, a box - flow diagram (Figure 4.1) was drawn to study the flow of communications in it's general and broad form.

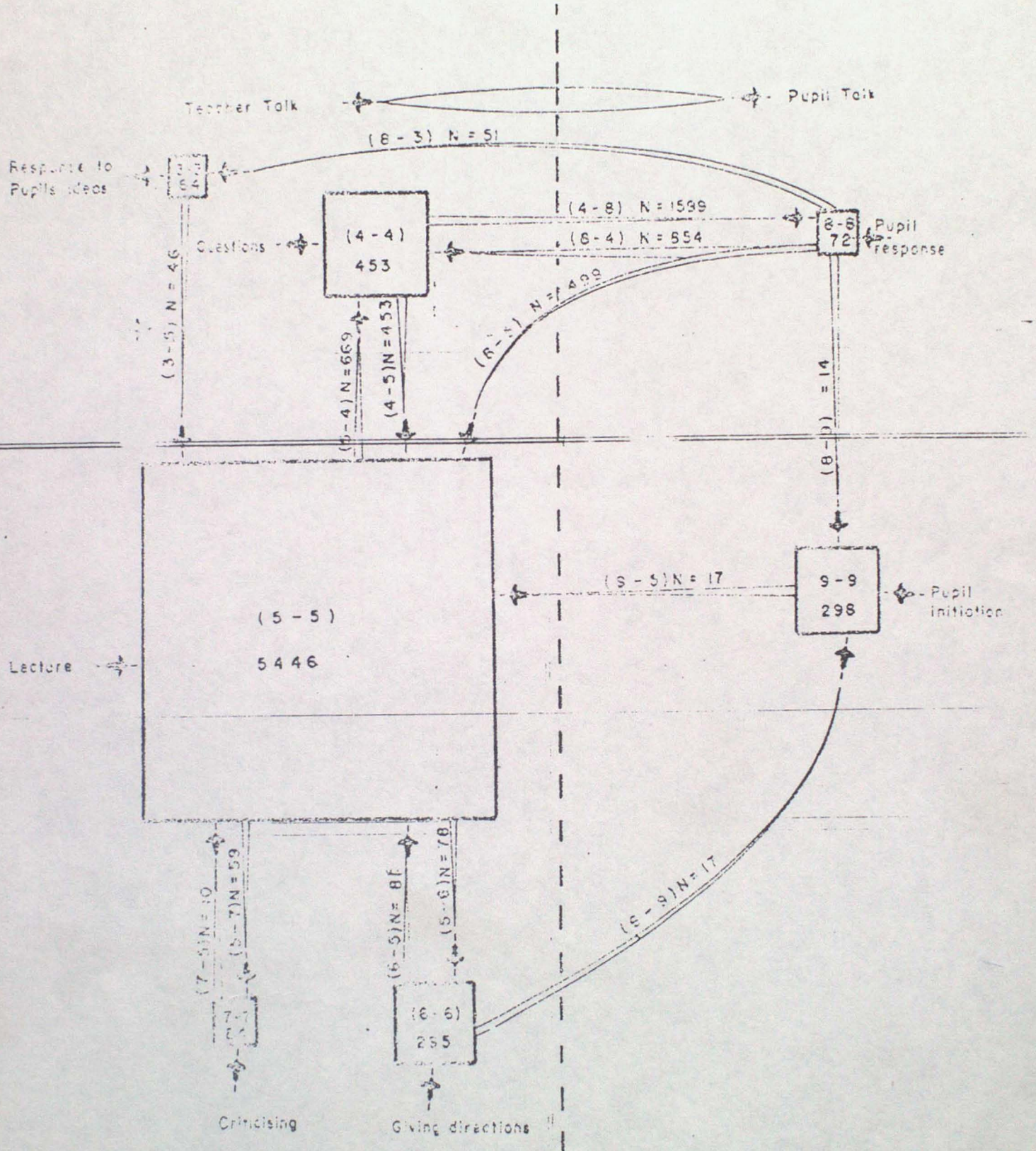


Fig. 4·1 Box - Flow Diagram for Mathematics Teachers

NB. The thickness of the connecting arrows is not in proportion to the traffic pattern

4. 5 Qualitative Analysis of Data

From the Master-Master Matrix and the box - flow diagram, the interactions which took place in the classroom could be interpreted.

A close observation of the Master-Master Matrix indicates that the mathematics' classrooms have been dominated by teacher talk. According to the data obtained, out of the total time devoted to teaching mathematics in classrooms, the total teacher talk amounts to about 62. 34 percent and out of the total teacher talk about 64. 51 percent was spent by teachers giving lectures. Questioning took up 23. 02 percent of the total teacher talk. Praise took up 1. 62 percent of teacher talk, leaving 0. 62 percent for accepting students' feelings. 73. 03 percent of all teacher talk was direct and 26. 97 percent was indirect teaching behaviour. The ratio of indirect teacher talk to direct teacher talk was found to be 36. 92 percent which is much less than Tessew's (1992) findings of 45. 45 percent for science teacher-trainees.

Pupil talk accounted for only 13. 92 percent of elapsed coding time. 81. 92 percent of this was responsive in nature. Most pupil talk was as a result of teachers questions, as the arrow connecting the (4 - 4) and (4 - 8) has a large number of tallies. If one refers to the (4 - 8) and the (8 - 8) cells in Table 4. 1 it can be deduced that responses were usually short. Teacher lecturing was quite often followed by questioning as the (5 - 4) arrow in the box-flow diagram shows.

Almost a quarter of class time, to be exact 23. 71 percent, was spent in silence or confusion which is much higher than the norm (11 percent) developed by Flanders. If one examines the (10 - 10) cell in the Master-Master Matrix one can deduct this was extended.

4. 6 A Study of Teaching Behaviour of Mathematics' Teachers Compared with Expected Norms Developed by Flanders for American Teachers

In order to interpret teaching behaviour ratios, one must compare them to normative expectations. Flanders (1970) proposed behaviour ratios of normative expectations, for different grades and several subjects. In this work, behaviour ratios will be compared with the norms which Flanders established for 8th grade mathematics' classes. Behaviour ratios which Tassew (1992) determined for science teacher-trainees will also be displayed for comparison purposes.

4. 6. 1 Teacher Talk (TT), Pupil Talk (PT), Silence and Confusion (SC)

According to Flanders (1970) three communication states exist in the classroom. Either the teacher is talking, a student is talking or there is silence and confusion. He maintains that teachers normally monopolise classroom time as a way of control and directing teaching. Table 4. 2 shows the proportion of teacher talk, student talk and silence and confusion found in this study. (All numbers are in percentages).

Table 4. 2 Teacher Talk (TT) , Pupil Talk (PT), Silence and Confusion (SC).

Variable	Norm	Mathematics' Teachers	Science Teacher-Trainees
Teacher Talk (TT)	70	62. 37	77. 07
Pupil Talk (PT)	19	13. 92	16.13
Silence and Confusion (SC)	11	23.71	6. 8

Data gathered from this study, as shown above, depicts that teacher talk utilised 62. 37 percent of time; pupil talk 13. 92 percent of the time and silence and confusion shared about 23. 71 percent of the total classroom time. Comparing this with Flanders' normative expectations, it would appear that teacher talk and student talk is less than average but more silence and confusion prevails. These statistics are just rough measures of classroom behaviour and if analysed in a slightly different way a little more information emerges. If one considers only verbal behaviour in the classroom, the normative expectation of Flanders is that teacher talk accounts for 78. 65 percent of all talk. In this study, teacher talk took up 81. 75 percent of verbal behaviour. This is similar to Tassew's (1992) finding i.e. that 82. 83 percent of all talk was carried out by the teacher.

4. 6. 2 Teacher Response Ratio (TRR), Teacher Question Ratio (TQR) and Pupil Initiation (PI)

These ratios were developed to reveal the balance of interaction between iniatition and response. Teacher response ratio is an index which reflects the tendency of the teacher to react to students' opinions and ideas. Teacher question ratio is a variable which indicates the teachers' tendency to ask questions when attending to the content orientation of classroom work. The percentage of pupil talk which was initiated by them is indicated in the pupil initiation ratio. Findings are exhibited in Table 4. 3 (All numbers are in percentages).

Table 4. 3 Teacher Response Ratio (TRR), Teacher Question Ratio (TQR) and Pupil Initiation Ratio (PIR)

Ratios	Norm	Mathematics' Teachers	Science Teacher - Trainees
TRR	35	31.62	64.95
TQR	20	26.30	17.29
PIR	35	18.67	25.49

These figures show that mathematics' teachers observed tend to react less than expected to pupils' opinions. They ask more questions in guiding discussion. Pupil initiation is very much below average whereas the teacher-trainees responed much more to students' ideas and students initiated more talk.

4. 6. 3 Instantaneous Teacher Response Ratio (TRR 89) and Instantaneous Teacher Question Ratio (TQR 89).

The instantaneous teacher response ratio shows the bias of the teacher to praise and use pupils' ideas immediately after the pupil stops talking in class discussion. The instantaneous teacher question ratio reflects the tendency of the teacher to react to pupil talk with questions rooted in his own ideascontrasted with his tendency to lecture. Ratios are given in Table 4. 4 (All numbers are in percentages).

Table 4. 4 Instantaneous Teacher Response Ratio (TRR 89) and Instantaneous Teacher Question Ratio (TQR)

Ratio	Norm	Mathematics Teachers	Science Teacher- Trainees
(TRR 89)	67	59	82. 39
(TQR 89)	39	55. 56	62. 74

Mathematics teachers in this study show less inclination than normal to integrate pupils' ideas or give praise immediately after a student stops talking. They also tend to ask questions based on their own ideas at the end of pupil talk, rather than lecture. These statistics show that the teacher-trainees were much quicker to respond to pupils' ideas than mathematics teachers.

4. 6. 4 Content Cross Ratio (CCR) and Steady State Ratio (SSR)

This ratio indicates the emphasis that teachers put on the subject matter. A high content cross ratio shows that the focal point of classroom conversation was on the content of lessons with the teacher taking a leading part in the discussion. The steady state ratio is a delicate measure which ascertains the rapidity of interchange between teachers and pupils. The higher the ratio the slower the exchange. Table 4. 5 displays the results.(All numbers are in percentages).

Table 4. 5 Content Cross Ratio (CCR) and Steady State Ratio (SSR)

Ratio	Norm	Mathematics' Teachers	Science Teacher-Trainees
Content Cross Ratio	68	67. 73	60. 42
Steady State Ratio	52	61. 50	75. 02

As can be seen from Table 4. 5 emphasis on content was average when compared to Flanders' norm. The reciprocity of interchange between teachers and students is slower than the norm but faster than in the case of science teacher-trainees.

4. 7 Student Response Analysed by Gender

All category eight statements i.e. students' response to teachers were examined by gender. The results are shown in Table 4. 6 (All numbers are in percentages).

Table 4. 6 Response

Response	Percentage
Response by two or more persons in unison	65. 14
Boys (singly)	24. 11
Girls (singly)	10. 75

As observed previously, student response generally followed teacher questioning. Students answered in unison 65. 14 percent of the time. When students responded after being specially identified by a teacher, 24. 11 percent of time was taken up by boys and 10. 75 percent by girls i.e. in the ratio of 2. 24 : 1 in favour of boys. In the classrooms observed, there were a total number of five hundred and thirty seven boys and five hundred and six girls.

Taking this into consideration the ratio was adjusted and the final ratio was found to be 2.11 : 1 in favour of boys. So boys responded more than twice as much as girls.

4. 8 Pupil Initiation by Gender

The elapsed time of student initiation (category 9 statements) were also analysed by gender. The results are presented in Table 4. 7 (All numbers are in percentages).

Table 4.7 Pupil Initiation by Gender

Initiation	Percentage
Initiation by two or more persons	5. 72
Boys (Singly)	77. 86
Girls (Singly)	16. 42

Reflecting on the table it would appear, that boys tended to express their own ideas more than girls in the classroom, in the ratio of 4. 74 : 1. Again, allowing for the number of boys to girls the adjusted ratio would be 4. 44 : 1 in favour of boys.

4. 9 Time Students Spent at the Blackboard analysed by Gender

On several occasions, it was observed that teachers called students to the blackboard to work out some mathematical problems. The proportion of time taken by boys and girls was analysed by gender (Table 4.8).

Table 4. 8 Student Time Spent on Blackboard

Gender	Time
Boys	86 mins. 54 secs.
Girls	32 mins. 50 secs.

Of the total elapsed observation time, 1 hour, 59 minutes and 44 seconds was taken up with students working on the blackboard. Boys worked on the blackboard for 86 minutes and 54 seconds; girls for 32 minutes and 50 seconds. So boys were centre-stage 2. 65 times more than girls. Again adjusting this figure, allowing for the number of boys to girls, a ratio of 2. 49 : 1 was calculated.

4. 10 Student Involvement Checklist

In order to find out the extent to which the children were actually involved in learning, a questionnaire (Appendix 11) was distributed to one hundred and twenty boys and one hundred and twenty girls. The results are given on Table 4. 9. It should be noted that involvement is on a ten point scale. The higher the number the greater the involvement of the student.

Table 4. 9 Student Involvement

Student Involvement	Position on Scale
Boys	2. 87
Girls	3. 01

Results show that girls were more involved in learning than boys, although neither sex would appear to be substantially involved in learning.

4. 11 Discussion and Interpretation of Findings

The main purpose of this study was to highlight patterns of verbal behaviour existing in selected grade nine mathematics' classrooms in Addis Ababa. Before doing this it must be pointed out that the learning environment in which this data was collected would almost certainly be less conducive to teaching and learning than the conditions prevailing in the United States where Flanders collected his data.

4.11. 1 Silence and Confusion

One of the most striking features of the analysis was the high percentage of silence and confusion which often occurred for extended periods. Several factors may account for this. Time was often taken up in cleaning the blackboard at the beginning of the lesson. Teachers frequently wrote problems to be solved during the lesson, on the blackboard, without involving the students. Students also spent a lot of time quietly writing work, which had been written on the blackboard by the teachers, into their exercise books. When students were working at their desks teachers tended not to talk to them. Rather they stood, or walked around the classroom, in a silent manner. Not once during the observations did a student approach a teacher for assistance.

4. 11.2 Teacher Talk

Teacher talk was less than expected. This can probably be explained by the high proportion of classroom time taken up in silence and confusion.

When talk did occur in the classrooms the ratio of teacher talk to pupil talk was higher than average and restrictive. Teachers did not tend to build on or develop students' ideas. Instead they tended to initiate and guide discussion by questions based on their own ideas. Teachers criticized students more than praised them and teachers rarely responded to students feelings.

Teachers may may have felt that they were compelled to exercise control over students due to the large class size they were obliged to deal with.

'Get them in', 'get them out', 'get on with it' and 'get on with them', were four procedures which Lazlett and Smith (1984) identified for good classroom management. The last one was particularly lacking in the classrooms observed. Teachers had no obvious rapport with the students.

4. 11.3 Pupil Talk

Pupil talk was much less than the normative expectations established by Flanders. This was mainly in response to teacher questioning; talk which pupils initiated was very limited. This finding is in accordance with Tassew's (1992). In addition to this, pupils tended to respond to the teacher en masse. It can be deduced from this that the bulk of teachers' questions were directed at the class in general.

Another inference, made from analysing pupils' responses by gender, was that teachers elected to ask boys more questions than girls. It was also noted that boys

virtually monopolised pupil initiation. This confirms the findings discussed in Wilson (1991) and Wernersson (1991).

4. 11.4 Time on Blackboard

Teachers selected pupils to do work on the blackboard. They also decided when pupils should return to their desks. Data shows that again girls were underprivileged as boys spent more time at the blackboard than girls.

4.11. 5 Passivity of Students

This was another interesting finding. Data shows that girls were slightly more involved in learning than boys. This being so, one should expect that girls would perform better in examinations than pointed out by Gennet (1991).

Chapter V

Summary, Conclusions and Recommendations

5. 1 Summary

This research explored the nature of teacher - pupil interactions in twelve grade nine mathematics' classrooms in Addis Ababa. A slight modification of Flanders Interaction Analysis Technique was the major tool used to collect data so that the verbal behaviour of teachers and pupils could be analysed. Particular attention was paid to the verbal behaviour of students by gender. Student involvement in learning, by gender, was also studied.

Results of the study show that direct teacher talk dominated in the classroom. Lecture method followed by drill was the salient pattern of behaviour. Extended periods of silence and confusion were extremely prevalent in classrooms. Pupil talk was limited and this was mainly in response to teacher questioning. Boys dominated in all interactions with the teacher, particularly when initiating talk with the teacher. Boys spent more time at the blackboard than girls. Girls were slightly more involved in learning than boys.

5. 2 Conclusion

From the findings of the study it can be determined that mathematics' teachers played a dominant role in class discussions. Pupil talk was very restrained. It would appear that there is a need to allow pupils more freedom of expression if they are to develop a pattern of creative thinking.

Girls also did not get an equal share of the teachers time as pupil talk was dominated by boys. This may be one of the reasons why girls do not perform well in mathematics in Ethiopia.

Teachers observed in this study were more alike than different in their approach to teaching mathematics. Anderson (1979) found a similar situation in his observations. The basic teaching routine observed was correcting homework on the board, followed by introducing a new topic. This was again followed by students working quietly at their desks.

5. 3 Implications of the Findings

Mathematics' teachers observed, may not be aware of how their patterns of behaviour influences students. If this knowledge was imparted to them, they might tend to be more democratic in the classroom allowing all students and in particular female students, more freedom of expression.

It could also be suggested that teacher-training colleges should include a course on classroom interaction analysis in their curriculum. Not only that trainees would appreciate how teaching behaviour affect students but they could also adjust their own teaching behaviour accordingly.

5. 4 Recommendations

This research was very limited in that only twelve mathematics' teachers were observed, involving only one class i.e.grade nine. It might be prudent to observe a wider sample of mathematics' teachers so that the findings in this study be verified.

It would also be advantageous if similar research was carried out in different subject areas and at different grade levels so that verbal interactions in those classrooms can be compared.

It is strongly recommended that more comprehensive research regarding gender issues be carried out in classrooms in Addis Ababa and elsewhere in Ethiopia

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Appendix I

Student Involvement Checklist

Appendix I

Student Involvement Checklist*

Directions. Read each statement below, thinking back over today's lesson. If you agree that the statement expresses something that you thought or did during the lesson, circle 'YES'. If you believe that the statement does not, circle 'NO'.

1.	I was able to separate the important points from the details.	YES NO
2.	I had trouble understanding what was being talked about in class.	YES NO
3.	I disagreed with something the teacher said or an answer to a question given by another student.	YES NO
4.	I gave up on a question or problem that was just too difficult.	YES NO
5.	I think I could explain what I learned today to other students.	YES NO
6.	I was reluctant to ask for help even though I needed it.	YES NO
7.	I paid attention almost all of the time.	YES NO
8.	During class my mind often wandered and I thought of other things.	YES NO
9.	I thought about how what I was learning was related to things	YES NO
10.	I rarely thought about things I did not understand.	YES NO

* Taken from Anderson (1991).

Appendix II

Amharic Version of

Student Involvement Checklist

Appendix III

Limitations of Flanders Interaction Analysis System

1. It disregards the context in which the data are collected.

2. It only pertains to observable behavior and ignores the purposes and intensity of the behaviour.

3. It does not describe the totality of classroom life; only what can be categorized and measured.

4. Only verbal behavior is observed. Non-verbal behavior is ignored.

5. There is an imbalance in the number of categories devoted to teacher talk and student talk. Little attention is paid to student talk as seven categories are devoted to teacher talk and only two, to student talk

የተማሪዎች ተሳትፎ መረጋገጫ ዝርዝር

መመሪያ፡

የዛሬውን ትምህርት በአእምሮህ/ሽ በማስታወስ ከዚህ የሚከተሉትን - ዐረፍተ ነገሮች አንብብ/ቢ፤ ዐረፍተ ነገሩ የሚገልጸው በትምህርቱ ወቅት አንተ/አንቺ ያደረግከውን /ያደረግሽውን፣ያሰብከውን/ያሰብሽውን ከሆነ "አዎ" የሚለውን ክበብ/ክበቢ፤ ዐረፍተ ነገሩ የሚገልጸው አንተ/አንቺ ያላደረግከውን / ያላደረግሽውን ከሆነ "አይደለም" ክበብ/ክበቢ።

1. ከጠቅላላው ትምህርት ውስጥ ፍሬ ሃሳቦችን ለይቼ
   ማውጣት ችያለሁ .... አዎ አይደለም
2. በክፍሉ ውስጥ ይነገር የነበረውን ለመረዳት ችግር ነበረብኝ አዎ አይደለም
3. አስተማሪው በተናገራቸው አንዳንድ ነገሮች
   ወይም አንድ ተማሪ በመለሰው መልስ ላይ አልተስ
   ማማሁም......................... አዎ አይደለም
4. አንድ ከባድ የሆነ ጥያቄ መሥራት አቅቶኝ
   ትቼዋለሁ......................... አዎ አይደለም
5. እንደሚመስለኝ ዛሬ የተማርኩትን ትምህርት
   ለሌሎች ተማሪዎች ማስረዳት እችላለሁ ...... አዎ አይደለም
6. ጥያቄ ለመጠየቅ ፍላጎቱ ቢኖረኝም እኔ ግን
   አልደፈርኩም .... አዎ አይደለም
7. በጠቅላላው የትምህርት ወቅት በሙሉ ልብ
   አዳምጫለሁ .... አዎ አይደለም
8. በትምህርቱ ወቅት ሃሣቤ ተዘራርቆ ለሌላ
   ነገር አስብ ነበር.................. አዎ አይደለም
9. የተማርኩት ትምህርት ምን እንደሆነና ቀደም
   ብሎም ከማውቀው ነገር ጋር እንዴት እንደሚ
   ዛመድ አስቢታለሁ.................. አዎ አይደለም
10. ስላልገባኝ ነገሮች ያሰብኩት በመጠኑ ነው ... አዎ አይደለም