Durham University

Durham E-Theses

Verbal interaction in mathematics lessons in Anglophone Cameroon.

Felicity Grace Breet

How to cite:

Breet, Felicity Grace (1993) Verbal interaction in mathematics lessons in Anglophone Cameroon. Doctoral thesis, Durham University.

Use policy

The full-text may be used and/or reproduced, and given to third parties in any format or medium, without prior permission or charge, for personal research or study, educational, or not-for-profit purposes provided that:

- a full bibliographic reference is made to the original source
- a https://etheses.durham.ac.uk/id/eprint/1216/ is made to the metadata record in Durham E-Theses
- the full-text is not changed in any way

The full-text must not be sold in any format or medium without the formal permission of the copyright holders.

Please consult the full Durham E-Theses policy for further details.

Academic Support Office, The Palatine Centre, Durham University, Stockton Road, Durham, DH1 3LE
e-mail: e-theses.admin@durham.ac.uk Tel: +44 0191 334 6107
https://etheses.durham.ac.uk

VERBAL INTERACTION IN MATHEMATICS LESSONS IN ANGLOPHONE CAMEROON

Thesis presented for the degree of
Doctor of Philosophy

School of Education
University of Durham

July 1993

Volume One of two volumes

FELICITY GRACE BREET

The copyright of this thesis rests with the author.

No quotation from it should be published without his prior written consent and information derived from it should be acknowledged.

UNIV DURHAM
14 JAN 1994

Verbal Interaction in Mathematics Lessons in Anglophone Cameroon

Abstract of a PhD thesis submitted in July 1993 by Felicity Breet, School of Education, University of Durham, England.

The verbal interaction between teachers and students during mathematics lessons in Anglophone Cameroon is the primary focus of this study. Strategies for facilitating language oriented In-Service Training activities to meet the training needs of such teachers form a secondary focus.

Specifically three research questions are asked. Firstly, how do teachers and students interact in English whilst teaching and learning mathematics? Secondly can a model of these patterns be created and thirdly can such a model be used with teachers to enable them to increase the amount and range of student language in mathematics lessons.

Following a review of relevant research, the need for a study which will provide answers to these questions is clear. The methodology of such research is also reviewed, and thus the present study is rooted in existing practice both in terms of its content and its research design.

The data, audio recorded lessons, are transcribed and the patterns of verbal interaction observed classified via a grounded theory. These patterns are described collectively and then individually so that changes made during the phase of intensive INSET can be observed.

The study shows that the participating teachers were able to use their new awareness of their own patterns of verbal interaction to experiment with innovative ways of interacting with their learners some of which led to an increase in the amount and range of student language use.

The implications of this study for INSET programmes are many. Enabling teachers to be more aware of their own language use is advantageous and provides the basis for long term changes in classroom procedures. The study also offers a research process which can be used to illuminate verbal interaction in other contexts such as discussions between doctors and their patients or during formalised conflict resolution.

I confirm that no part of the material offered has previously been submitted by me for a degree in this or in any other University.

Signed .....

Date .....

The copyright of this thesis rests with the author. No quotation from it should be published without her prior written consent and information derived from it should be acknowledged.

GLOSSARY

In this thesis the following abbreviations are used.

1. Within transcribed data;

T	teacher utterance
ST	student utterance
SST	same student
STS	students speaking at the same time but not in chorus
CH	students speaking in chorus
...	a pause/ a short silence during which the speaker retains the floor
//////	unintelliglible speech
[[	mark two utterances which begin at the same time

2. When giving examples from transcribed data;

T1	Teacher one
T2	Teacher Two
T3	Teacher Three
T4	Teacher Four
T5	Teacher Five
T1T2L3	Teacher One Tape Two Line three
T4T1L333	Teacher Four Tape One Line three hundred and thirty three

3. When referring to participating schools;

G.B.H.S. Bamenda	Government Bilingual High School Bamenda (Teacher One)
C.C.M.	College of Commerce Mendankwe (Teacher Two)
G.S.S. Mankon	Government Secondary School Mankon (Teacher Three)
C.C.C. Mankon	College of Commerce Mankon (Teachers Four and Five)

CONTENTS

Glossary . . . . . PAGE 4

Preface 11

Introduction 14

1 CHAPTER ONE 22

ANGLOPHONE CAMEROON AND ITS EDUCATION SYSTEM

1.1. Historical perspectives 22

1.2. The Republic of Cameroon 23

1.3. The contemporary education system 28

1.4. Teachers' experience of INSET 38

1.5. The role of the Inspectors and Advisers . . 40

1.6. Areas of importance in the relationship between mathematics and language in Anglophone Cameroon 41

2 CHAPTER TWO 44

THE RELATIONSHIP BETWEEN LEARNING MATHEMATICS AND LANGUAGE

2.1. The relationship between learning mathematics and language where the medium of instruction is not the learner's first language 45

2.2. The relationship between learning mathematics and language where the medium of instruction is not the learner's second language 52

2.3. Research questions 63

3 CHAPTER THREE 66

SELECTING RESEARCH METHODS AND DESIGNING THE RESEARCH PROJECT

3.1. Small scale research into the verbal behaviour of teachers during mathematics lessons 66

3.2. Verbal behaviour in science lessons;a large

scale project 71
3.3. Verbal behaviour and the pre-service training of teachers 72
3.4. Research in other lessons;the selection and analysis of data 74
3.5. Evaluation of the above research 76
3.6. The selection of research methods 77
3.7. Research design 85
4 CHAPTER FOUR 88
FIELDWORK AND DATA COLLECTION
4.1. School Selection 88
4.2. Phase One: Data Collection 95
4.3. Phase Two: Data Collection 103
4.4. Phase Three: Data Collection 143
4.5. Completion 147
5 CHAPTER FIVE 149
CREATING A THEORY
5.1. Transcribing Recorded Lessons 150
5.2. Creating the Descriptive Analytic Model . . . 156
5.3. The Model 161
6 CHAPTER SIX 176
ANALYSIS OF THE PHASE ONE DATA
6.1. Teacher One 176
6.2. Teacher Two 196
6.3. Teacher Three 220
6.4. Teacher Four 240
6.5. Teacher Five 263
6.6. Summary 284

7 CHAPTER SEVEN 288

ANALYSIS OF THE PHASE TWO DATA

7.1. Overall Picture 288

7.2. Teacher One 292

7.3. Teacher Two 302

7.4. Teacher Three 313

7.5. Teacher Four 323

7.6. Teacher Five 340

7.7. Conclusion 349

8 CHAPTER EIGHT 351

ANALYSIS OF THE PHASE THREE DATA

8.1. Overall Picture 351

8.2. Teacher One 353

8.3. Teacher Two 362

8.4. Teacher Three 369

8.5. Teacher Four 378

8.6. Teacher Five 384

8.7. Conclusion 394

9 CHAPTER NINE 396

CONCLUSIONS AND INSIGHTS

9.1. The Research Questions Answered 396

9.2. Difficulties 397

9.3. Successes 401

9.4. Further Research 403

9.5. Conclusion 408

10 BIBLIOGRAPHY 410

ILLUSTRATIONS

page

1. THE REPUBLIC OF CAMEROON WITH NORTH WEST PROVINCE HIGHLIGHTED . . . 26

2. ANGLOPHONE CAMEROON 27

3. THE LANGUAGES OF NORTH WEST PROVINCE 35

4. A VIEW OF THE COLLEGE OF COMMERCE MENDANKWE . . 91

5. CITY COLLEGE OF COMMERCE MANKON 94

6. INSIDE CLASS 2B AT GOVERNMENT SECONDARY SCHOOL MANKON 219

7. INSIDE CLASS 3B AT CITY COLLEGE OF COMMERCE MANKON 325

FIGURES

page

1. SUMMARY OF GCE "O" AND "A" LEVEL RESULTS 1990-91 37

2. SUMMARY OF RESEARCH DESIGN 85

3. SUMMARY OF TEACHER OBSERVATIONS IN PHASE ONE 96

4. SUMMARY OF OBSERVATION OF CLASSES IN PHASE ONE 96

5. SUMMARY OF LESSONS RECORDED IN PHASE ONE 100

6. SUMMARY OF TEACHER OBSERVATIONS IN PHASE TWO 137

7. SUMMARY OF LESSONS RECORDED IN PHASE TWO 139

8. SUMMARY OF TEACHER OBSERVATIONS IN PHASE THREE 146

9. SUMMARY OF LESSONS RECORDED IN PHASE THREE 147

10. SUMMARY OF TEACHER ONE ELICITS (PHASE ONE) . . . 194

11. SUMMARY OF TEACHER TWO ELICITS (PHASE ONE) . . . 217

12. SUMMARY OF TEACHER THREE ELICITS (PHASE ONE) . . 237

13. SUMMARY OF TEACHER FOUR ELICITS (PHASE ONE) . . 261

14. SUMMARY OF TEACHER FIVE ELICITS (PHASE ONE) . . 282

15. SUMMARY OF TEACHER ELICITS IN PHASE ONE 285

16. SUMMARY OF TEACHER ONE ELICITS(PHASE TWO) . . . 300

17. SUMMARY OF TEACHER TWO ELICITS (PHASE TWO) . . . 311

18. SUMMARY OF TEACHER THREE ELICITS (PHASE TWO) . . 320

19. SUMMARY OF TEACHER FOUR ELICITS (PHASE TWO) . . 337

20. SUMMARY OF TEACHER FIVE ELICITS (PHASE TWO) . . 347

21. SUMMARY OF TEACHER ONE ELICITS (PHASE THREE) . 360

22. SUMMARY OF TEACHER TWO ELICITS (PHASE THREE) . 367

23. SUMMARY OF TEACHER THREE ELICITS (PHASE THREE) . 376

24. SUMMARY OF TEACHER FOUR ELICITS (PHASE THREE) . 382

25. SUMMARY OF TEACHER FIVE ELICITS (PHASE THREE) . 392

PREFACE

British Government support for the In-Service training of teachers (INSET) in Cameroon began in the early seventies. One British Adviser, working within the Ministry of National Education with teachers of English at the Primary level in Anglophone Cameroon, was posted to Bamenda, and one English Language textbook writer was posted to Yaounde to prepare materials to use in Francophone Primary schools.

By the late seventies the British Overseas Development Administration was offering a number of scholarships to experienced English teachers to enable them to study Applied Linguistics at the post graduate level in Britain. This was to ensure that a cadre of trained experienced teachers was available to work with the British Advisers and to ensure that there would be Cameroonian Advisers to continue the professional development activities for teachers of English, begun as part of these projects. It was assumed that in time the British ELT Advisers would be withdrawn leaving INSET in the hands of their Cameroonian colleagues.

In the early eighties the Cameroonian Ministry of Education asked ODA to introduce similar projects in secondary mathematics and physics education having

UNIV DUNELM

identified these as key subjects for the development of science and technology. This led to the creation of three subject specific projects:English, Maths and Physics, each with two British Advisers, one in North West and one in South West province.

Initially each subject team defined its own role within an overall brief of increasing the number of students passing National exams at the end of their secondary school education. However in 1987, as I took up my post as English Language Teacher (ELT) Adviser in North West Province, the Ministry of National Education and ODA agreed to integrate the three projects, to facilitate more coordination between each subject and within the two provinces.

During the earliest discussions between the newly formed team, agreement was reached on the important role played by language in the learning of all subjects. As a consequence of this agreement, it was decided that the ELT Advisers should aim to develop ELT INSET which could increasingly be organised by the more experienced teachers, thus allowing more time for the Advisers to work within the areas of maths and physics. Initially their role within these subjects would be to bring teachers of different subjects together to identify the difficulties they observe and/or face when teaching and to begin to

develop a programme of INSET which would address these.

The process of integration proved difficult. As this was a unique project within Cameroon and within ODA-supported INSET internationally, there were no models to follow so we learnt by trial and error. By September 1988 it became clear that the ELT Advisers did not have time to work within all three subject areas and devise worthwhile programmes. To minimise the risk of operating an ad hoc approach to the integration of Mathematics, Physics and English INSET, it was agreed that the ELT Adviser in South West Province, based in Buea, would spend more time in Physics related activities and I would focus more on Mathematics teaching and learning.

Thus began my investigation into the complex subject of teaching and learning Maths in English as a second language, out of which came the need for this research.

INTRODUCTION

The research which grew out of the activities described briefly in the preface was undertaken between September 1990 and June 1993 when I was based at the School of Education, University of Durham as a PhD student.

The starting point was the language of those classrooms in Anglophone Cameroon in which I had been working, with specific reference to the language used during mathematics lessons. The relationship between language and learning mathematics became the focal point because, as will be shown in chapter two, the current research in this area does not address the specific difficulties faced by teachers of Mathematics in Anglophone Cameroon. As will be seen in chapter one the teachers face classes of up to one hundred students, many of whom speak different languages outside the classroom. Few written materials or other resources are available to enhance the quality of learning and the teachers have to use compulsory schemes of work which were produced at a time when the school year was longer than it is today. Few have had the opportunity to follow initial teacher training courses and those who have completed such courses do not seem fully prepared for the realities which face them in school.

Although In-Service activities for teachers are welcomed by teachers of all subjects in this part of Cameroon, they are expensive and difficult to sustain because of the inadequate road system and lack of financial support from the Ministry of National Education. For mathematics teachers, INSET is particularly frustrating because the problems seem so numerous and yet the ways to empower the teachers to solve their day to day teaching problems seem so few. So much of the information available to them is produced in Europe or related more to mathematics as a discipline rather than to ways of facilitating learning in classes such as those described above. Therefore, although it is of interest, much is perceived as irrelevant by the teachers themselves and thus, is not used to understand and act upon their own classroom practices. This distance, between the research into the relationship between language and the learning of mathematics and the day-to day context of teaching and learning of mathematics alienates and thus disempowers the teachers. Many would like to experiment with teaching methods which might enable more students to learn more mathematics more easily but any such experiments have to be feasible within the constraints imposed by class size, multilingual learners and few resources. For many teachers the difficulties seem insurmountable

and thus they feel unable to act upon their own classroom practices.

This research seeks a way of looking at one aspect of the using language/learning mathematics relationship over which the teachers themselves have some control; that is, the ways in which they and their students use the medium of instruction during mathematics lessons in the early years of secondary education. A greater understanding of this will enable mathematics teachers in Anglophone Cameroon, and elsewhere, to monitor the process of learning and teaching in their own classrooms and thus be more able to experiment with other processes especially those recommended by mathematics educators world wide. Research which empowers teachers to question taken for granted classroom practices is valuable in any context. However such research is particularly important in Cameroon and other countries in the developing world because INSET activities which require outside intervention are expensive and often short-lived. Those with a longer life-span often foster dependency which means that the process of change ends as the outside intervention ceases. To avoid fostering this culture of dependency, that is for the process of change to be self-sustaining, the teachers have to be equipped with skills which enable them to help themselves in the areas of their work over which they have some control. They have some

choice over the ways in which they conduct their lessons in general and the ways in which they use the medium of instruction in particular. The choices they make influence the ways in which their students learn.

This study investigates part of this area of choice; specifically, the answers to three questions were sought. These questions grew out of ideas raised by teachers during INSET discussions in 1989-1990 (details in 1.6.) It will be shown that the answers to these questions will reduce the distance between research into the language of mathematics lessons and the ways in which maths teachers and learners make choices about how they use the medium of instruction, every day.

Firstly, how do teachers and learners in Anglophone Cameroon interact in English as they seek to teach and learn mathematics at the secondary level? Secondly, can a model be devised for these interactions, and thirdly, can this model be used with the teachers to enable them to increase their repertoire of teaching strategies to include those which will encourage their learners to use English more confidently to talk about mathematics during their lessons ?

Data were collected between January 1991 and April 1992 and included three visits to North West Province, Cameroon, two lasting three months and one lasting five weeks. A detailed description of the research design appears in chapter four, the field work and data collection in chapter five and my findings in chapters six to nine.

In order to set the description of the study in context the first chapter introduces Anglophone Cameroon, giving a short summary of the nation's twentieth century history up to and including the political changes of the present day which impinged on the project. As the research is based in secondary school mathematics lessons, the same chapter also includes a picture of the education system of this part of Cameroon so that the present research can be seen in the context of the existing INSET for teachers of mathematics in Anglophone Cameroon.

In chapter two current research into the complex relationship between language and the learning of mathematics is examined in detail both in terms of the situation for those for whom education is conducted in a second language and also for those studying in their first language. This review of existing research will show that it is clearly inadequate in terms of finding answers to the questions asked by teachers in Anglophone Cameroon.

The present study has therefore a vital role to play in the search for answers which would be of practical value to teachers of mathematics in Anglophone Cameroon and elsewhere in the English-speaking world. The three research questions mentioned above form the basis of the research as explained in detail at the end of chapter two.

In the explanation of the research methods chosen to examine the language used during the lessons selected as part of this study it will be shown, firstly, that investigations into classroom language via long periods of observation and recording of language offer excellent opportunities for greater understanding of mathematics lessons and, secondly, that an analysis of verbal interaction can be used to provide a systematic descriptive analytical model of the ways in which language is used in these lessons. The use of such a model, as an instrument of classroom based In-Service Teacher Development and the ways in which the teachers responded to a period of intervention which made use of this model are described fully in chapter four.

The criteria for school selection, and for collecting data via observation and recording are explained in detail in chapter three. The processes of transcribing these recordings and of creating a model of the patterns of interaction observed in

these transcribed recordings are described in chapter five. This composite model is based on the discourse observed in the recorded lessons of all the teachers participating in this study. In addition, in chapter six, the model is used to describe the individual teachers' use of language during phase one of the research.

The ways in which the composite model evolved during phase two of the research, the five teachers' individual profiles in terms of this model, and the ways in which students elicited language are shown in chapter seven. A similar explanation for phase three is given in chapter eight. All the changes to the composite model, to the individual profiles of each teacher's language use or to the ways in which students elicited language, over the period of time covered in this research are thus clearly observable.

Chapter nine concludes the thesis. It includes an analysis of the ways in which the patterns of interaction changed during the periods of lesson observation and data collection. The value of such research in the search for methods which enable teachers to become more aware of their own teaching strategies and more confident about experimenting with alternative classroom practices is also discussed in this chapter. The development of such self awareness and self confidence is the beginning

of a process of empowerment. This is a necessary starting point for any long term, self-sustaining teacher development.

Chapter nine also includes an analysis of the strengths and weaknesses of this study with suggestions for further research. A full bibliography is included at the end of the thesis, the transcripts of all recordings being appended in a separate volume.

CHAPTER ONE

ANGLOPHONE CAMEROON AND ITS EDUCATION SYSTEM

INTRODUCTION

In this chapter the context in which this study took place will be described. It includes a brief summary of Cameroon's recent history and a description of the contemporary education system with specific reference to language and mathematics. In 1.4. the teachers' experience of INSET and their attitudes to such activities are described followed by an explanation of the way in which this research grew out of a series of meetings between teachers, Inspectors and Advisers of English, Maths and Physics.

1.1.HISTORICAL PERSPECTIVES

Anglophone Cameroon came into being as a result of a reorganisation of the ways in which West and Central Africa were governed after the First World War. Until then most of the area now called Cameroon was a German colony; however after 1916 the northern and eastern parts were claimed by France and the western part by Britain. In September of that year the area was divided between the two colonial powers although this division was not formalised and approved by the League of Nations until 1920. Until 1945 the Cameroons were a League of Nations

mandated territory and from 1945 until 1961 a United Nations Trust Territory,administered by France and Britain (via Nigeria) with the administration monitored by visiting missions. In 1961 after a plebiscite, there was a further reorganisation, part of northern Cameroon joining Nigeria to leave Southern Cameroon and East Cameroon to become the new United Republic of Cameroon.

1.2. THE REPUBLIC OF CAMEROON 1991

The Republic of Cameroon is administered as one nation with the seat of government in Yaounde. It is made up of over two hundred linguistically diverse tribes (Chia 1992 personal communication) occupying an area which ranges from the deserts of the north bordering Lake Chad, to the tropical rain forest of the coastal area and the east and the rugged volcanic mountains of the west. Approximately one fifth of the country is officially Anglophone and the rest is Francophone. The development of the nation, based on oil revenue and agricultural self sufficiency, has been maintained since the Republic of Cameroon came into being although in the last few years the effects of the world wide "economic crisis" have been felt. Since 1989 the government has not appointed any new civil servants in certain sectors, including primary school teachers, as it does not have money to pay them. Prices have risen sharply for both everyday necessities and more luxurious items. Civil servants' allowances were cut in 1991 and all government funded salaries were cut

by up to one third in December 1992. The previously stable one party government has been challenged by a nationwide movement towards a more democratic form of government. The people of the Anglophone provinces have played a major role in this process. Bamenda was the venue for the launching, on May 26th 1990, of the political party declared illegal at that time but legalised in 1991. Since then the rapid move towards a multiparty democracy has continued and some changes in the system of government have taken place. These changes have come about mostly as the result of pressure from a well orchestrated programme of civil disobedience.

The system of government is still highly centralised with all channels of administration passing through the appropriate ministry in Yaounde. In the field of Education this includes all admissions to government funded schools and teacher training colleges and until very recently the University. Now that new Universities have been created they are able to admit their own students. Teachers' postings are organised by the Ministry of National Education and teachers can be called upon to work anywhere in the country. All syllabuses and exams are prepared centrally and disseminated via a system of provincially based Pedagogic Inspectors for each subject area.

The population of Cameroon is predominantly agricultural and predominantly young. It is estimated

that over 55% of the population is under twenty (Gwanfogbe 1988:35) and that this percentage is increasing.

The two Anglophone Provinces of Cameroon, North West and South West are predominantly agricultural. In North West there has been a great reliance on coffee production and the production of potatoes, cassava, corn and beans. Almost everyone has access to some land for agricultural use; food production has rarely been a problem in twentieth century Cameroon although those growing cash crops for export have been hit by a crisis in the world markets in the last five years.

The mountainous nature of the two provinces and the untarred roads have a profound influence on everyday life. In Education, the students and teachers often face long delays in going to and from school especially those sent to schools out of their home area. For example in September which is towards the end of the rainy season it can take two days to travel from Bamenda to Kumbo along a main road of just one hundred kilometres. This problem coupled with the inadequate system of post and telecommunications means that teachers may often be absent from school for several days because they need to be in Yaounde to deal with an administrational problem or because they have to travel home to fulfil their family duties.

ILLUSTRATION 1. THE REPUBLIC OF CAMEROON WITH NORTH WEST PROVINCE HIGHLIGHTED (Gwanfogbe 1988:6)

ILLUSTRATION 2. ANGLOPHONE CAMEROON (Macmillan map 1988)

1.3.THE CONTEMPORARY EDUCATION SYSTEM

The two parts of the country maintain the languages, education systems and external examinations they inherited from their colonial governments. Although all Cameroonians should in theory be able to use English and French for all official purposes throughout the country, in practice English can only be used freely in the two Anglophone provinces. There is an uneasy alliance between those Cameroonians who speak English as their first official language and those who speak French.

All government documents are produced in French and translated into English when possible. Most educated Anglophones have had to become fluent in French in order to succeed in their chosen field. Recently more Francophones have been learning to use English as the bilingualism policy agreed by the government becomes more of a reality, both within the education system and in business and industry. However this move towards official bilingualism is very slow because it is the minority group, the Anglophones, who are providing the momentum. For the majority of Francophones, English is a not a language they want or need to use within their own country.

1.3.1. Primary Education

Primary school education lasts seven years for most Anglophone children. A few very bright pupils may leave

after six and some less able children will take longer as they are required to repeat a year or sometimes two as a result of failing the end of year exams. Children in urban areas start school when they are about seven years old although this entry age is dropping in bigger towns due to the introduction of nursery school which admit children at four or five for one or two years. In rural areas the ages of children in class one varies,with some as old as ten. In North West Province, in 1987, 47,504 children began in Primary class one and 19,241 began class seven. The total number of children registered was 234,276. (Source; annual report of Education in North West Province 1987.)

In North West Province all primary and secondary education is officially taught in English (with the exception of French lessons). However in many Primary schools the English of some teachers is not always adequate and thus Pidgin is used in the classroom. At the end of the Primary school years there are two written exams which all children take: the First School Leaving Certificate and the Common Entrance. The first is the easiest and is passed by almost everyone. The second testing English, Maths and General Knowledge divides the children into those who are eligible for free secondary education in a Government school (less that 30%) and those who are not. In North West Province many of those who do not "pass into list A" seek entry into non government post primary education. In 1987 5,319 students

entered secondary education in North West Province and 3527 began their fifth year. (Source; annual report of Education in North West Province 1987)

1.3.2. Post Primary Education

There are two main types of post primary education; secondary general and technical.

1.3.2.1. Secondary Education

The first is the most widespread, there being seventy two secondary schools in NWP in September 1991. The courses offered follow a broad general curriculum leading to GCE Ordinary level examinations. English, French and Maths are now compulsory subjects although passing the exams is not yet essential for entry into sixth form education. O'Level courses last for five years and A'Level for two. All these external exams were "inherited" from the University of London's Examination Board although all subjects now have their own Cameroonian Boards to set and mark both O' and A' level papers. Some subjects still send their questions to London for moderation before the selection of specific items takes place. In North West Province there are also three "Bilingual Secondary schools" where Francophone students follow the courses offered in the Francophone Provinces. These courses are taught in French. The two

groups of students, Anglophones and Francophones do not have any classes together.

1.3.2.2. Technical Education

Technical education follows the system in place in the Francophone provinces ie a four year course leading to the Probatoire and a course of a further three years leading to the Baccalaureat. Courses are divided into two main strands; commercial and industrial. Students who are not able to qualify for either of these courses and who are being educated in rural areas may attend a rural training centre. The official language of all these types of school is English. However, because of the small number of Anglophones with Technical Teaching qualifications French and Pidgin are often heard in the classroom.

Secondary general courses tend to have the most status as the academic route is still seen as providing better chances of employment.

1.3.3. Three Types Of School

1.3.3.1. Mission schools

Both secondary and technical education are offered by three separately funded groups. The students who have good results at the end of Primary school and whose

families can afford the fees may attend a mission school, run by either the Baptist, Catholic or Presbyterian churches. These schools range from well established, highly thought of "schools for future leaders" to newer schools which are still in the process of establishing themselves. Less than 5% of the secondary school population study in a Mission school where the expectation is that students will be boarders and will study in smaller than average classes which are well resourced. Because of these characteristics and their highly selective entry procedures these schools tend to have excellent examination results.

1.3.3.2. Government Schools

Government planning allows for approximately 30% of the primary school population to move into government post primary education where all the teachers are graduates and parents are required to pay only for the uniform and books. Some families find this too expensive but most manage by buying second hand books and sharing items between more than one child. The government quota is exceeded in urban centres such as Bamenda where the number of children leaving primary school has outstripped the number of Government School places available at the post primary level even though new schools are opened every year. Each school can therefore interview and select the applicants they prefer from those who have qualified.

The curriculum in these schools is controlled by the Ministry of Education: classes usually have up to eighty students registered and this coupled with the fact that overcrowding forces the school to end the school year for Forms one to Four to allow space for O' Levels in mid May means that the quality of education offered depends almost entirely on the ability and commitment of individual teachers.

1.3.3.3. Lay Private Schools

For those who have not been able to gain admittance to one of the above types of school there are schools owned and run by private individuals or groups of people. These lay private schools range from those set up to serve the needs of a small community by a group of successful people from that community (known as "elites"), where the education level of the teachers may be low and the aspirations of the students limited; to those in large towns which offer retake courses to students who failed O' and A' level courses often in government schools. Some classes will be taught by graduate government employed teachers earning extra money part time. In some schools there may be classes of well over a hundred students. Fees vary according to the facilities offered by the school and it is common for students to have to drop out during the year because they are unable to finish paying their fees. Staff turn-over

tends to be quite high as many see teaching in Private schools as a temporary way of earning a living whilst applying for a place at the Ecole Normale Superieure (ENS) or University.

1.3.4. Language

Although English is the main official language of North West Province, the lingua franca is an English-based Pidgin. In the towns such as Bamenda the Pidgin sounds quite like English although including structures, idioms and items of vocabulary from French and the main local languages eg Mankon, Nkwen, Mugagka and Bafut. In rural areas the Pidgin sounds much less like English because it is more strongly influenced by the structures, idioms and items of vocabulary of the dominant local language eg Lamso in Kumbo. Thus in urban schools, for teachers of all subjects and their students, one perceived problem is that the boundaries between Pidgin and "grammar" (standard English) is often unclear. The students mix the two languages freely and many seem not to know when they are using the official language and when they are using the lingua franca. This worries the teachers because Pidgin is banned in school as a low status unwritten language. However it is used by everyone, as a language of intimacy, to bridge gaps between speakers of different languages and of different generations and particularly between those who have had a formal education and those who have not.

ILLUSTRATION 3. THE LANGUAGES OF NORTH WEST PROVINCE

(Chia 1992)

1.3.5. The curriculum

Every secondary school is expected to provide four hours of English Language lessons a week, many also provide two of English Literature. As a compulsory subject at GCE O' level the English Language examination has a powerful effect on the methods of teaching and learning commonly observed. The large classes, few resources and inadequately trained teachers make it difficult for teachers to teach in a communicative way although there have been some changes in syllabuses and methods during the last five years due to the INSET programme for teachers and the development of a network of Teacher Associations. The emphasis is still on the pronunciation of discrete sounds, reading comprehension based on literary texts and the writing of narrative essays. French is also taught as a compulsory subject and most schools offer three hours a week to secondary general students and two to Commercial and Technical students.

A third subject, mathematics, is also compulsory for all Cameroonian children although after primary schools the type of mathematics taught varies greatly depending on whether the class is working towards an Anglophone or a Francophone examination. As the classes tend to be large and the classrooms under-resourced the usual method of teaching is via a short lecture, a demonstration of how to put the "rule" into practice, followed by the

students using the rule to solve similar problems. The best students learn to manipulate the rules but rarely have the opportunity to grapple with the underlying concepts. There are few textbooks or other materials on which independent learning might be based so the only source of mathematical knowledge is the teacher.

The O' and A' level results for mathematics reveal the seriousness of the problems faced by the teachers and their students.

FIGURE 1 SUMMARY OF GCE O' AND A' LEVEL RESULTS 1990-1991 (supplied by the Provincial Inspectors for Mathematics in north West Province 1992)

DATE	EXAM	NUMBER ENTERED	PASS	
1990	O Level	10748	3377	31.4%
	A Level	1929	1158	60%
1991	O Level	11930	3878	32.5%
	A Level	2132	1176	55.2%
1992	O/A Level	Not yet available		

1.4. TEACHERS' EXPERIENCE OF INSET IN NORTH WEST PROVINCE

Over the last decade there has been an ODA funded INSET project for the teachers of English, maths and physics. This has led to the establishment of a resource centre for teachers of these subjects and a regular programme of INSET activities led by the British subject Advisers and the Provincial Pedagogic Inspectors. Syllabuses have been redrafted and changes suggested to the Ministry, textbooks have been adapted and examinations are being reviewed. The latter is a particularly difficult task as Anglophones perceive any suggested changes in the exams as interference by the predominantly Francophone Government and refuse to cooperate. The changes which have taken place have been small and have been restricted to the introduction of new question types into existing exams rather than more radical changes in the ways of assessing proficiency or monitoring learning.

1.4.1. Attitudes to INSET

Professional up-dating in all three subjects is seen in a positive light and teachers participate in INSET activities willingly provided that they do not have to spend too much of their own time and money reaching the venue. There has been a move away from a large number of activities centred on Bamenda to more meetings and workshops based in schools around the Province. In this

way teachers without their own cars, or teachers unable to leave home for more than a few hours, eg women teachers, have had access to INSET. Teachers of English have established mobile libraries of methodology books and source materials, housed in small suitcases which travel from school to school with members of their local teachers' association. This has enabled a greater number of teachers to read and reflect on current methodology. A similar scheme exists for packs of materials for Physics practicals.

Teachers in and around Bamenda are accustomed to being invited to the Teachers' Centre for workshops. These have been both subject specific and interdisciplinary. Within these workshops the training methodology has varied according to the organisers and the topic. The range has included; lectures with discussions, small group brainstorming and problem solving, peer micro teaching, evaluating materials, making resources and planning lessons. Some teachers have also begun to make use of the Teachers Centre as a place to prepare their lessons or as a central point of a social network. The centre is open during normal office hours even when all the Inspectors and Advisers are out visiting schools or running INSET activities, as there is a permanent administration officer. The centre is occasionally used after office hours by various special interest groups.

1.5. THE ROLE OF THE INSPECTORS AND ADVISERS

The Provincial Pedagogic Inspectors (PPI's) main role in the education hierarchy is to respond to directives from the Ministry of National Education via the National Inspectors for each subject or the Provincial Delegate for National Education. This responsive role assumes that they are not expected to initiate any activities within their provinces. In this way their role contrasts with that of the Advisers whose terms of reference refer specifically to the initiating of INSET activities.

The PPI'S work includes inspecting schools and observing teachers to advise on their promotion. The Advisers are not expected to participate in these activities although they and the PPI's work together to observe students from Ecole Normale Superieure on teaching practice and to facilitate INSET activities whenever possible. As the PPI's are not provided with transport or reimbursed for journeys made in their own cars, it is very difficult for them to visit schools outside the Bamenda area unless they adapt their programme to that of the Adviser who has a Land Rover financially supported by ODA.

The PPI's have usually been teachers in their main subject for several years and have often taken courses leading to a Masters degree as part of the British

Government scholarship programme. They take part in the planning,implementation and evaluation of the INSET activities initiated by the three British Advisers, and frequently travel to school based activities with their colleagues. However as they do not receive any financial support if they have to spend the night out of Bamenda, which is inevitable due to the time it takes to reach some schools, they cannot participate in all the INSET activities which take place in the province but outside Bamenda. They are available in the Teachers' centre, where they are based, for teachers to consult and maintain an advisory presence there when the Advisers are out of the office.

1.6. AREAS OF IMPORTANCE IN THE RELATIONSHIP BETWEEN MATHEMATICS AND LANGUAGE IN ANGLOPHONE CAMEROON

During the academic year 1989-1990 teachers of English, maths and physics came together, voluntarily, at joint meetings organised by the INSET teams, to discuss the issue of language in relation to themselves, their subject and their students. These meetings were arranged as one way of implementing the Ministry of National Education/ODA initiative to integrate the INSET of these three subjects. As the sustainability of any changes made was essential the teachers were invited to participate in the discussions which would lead to future INSET activities. In this way decisions made as a result of these meetings would be jointly owned by the INSET team

and the teachers themselves. During the discussions it became apparent that there were several areas which the teachers thought were of paramount importance. Some of these areas were brought to the meetings' attention via questions about what was known elsewhere about a particular point whilst others were articulated less clearly. Establishing a list of these areas was a way of defining possible areas of exploration, opening discussions about who might make themselves responsible for reading and/or research into each area and how future INSET could be made most relevant for the teachers. The list below is a summary of the areas of interest drawn up by the ELT Adviser in North West Province in June 1990, taking into account the questions asked and points raised during the inter-subject INSET activities 1989-1990.

1.6.1. Areas the INSET teams and teachers thought important by June 1990

1 The influence of the dominant or favoured language on thinking about maths in English.

2 The role of technical and specialist vocabulary and the confusion between words with both a subject specific meaning and a meaning in ordinary English.

3 The role of groups of words such as determiners, logical connectors (because,therefore, if ..... then)

and those with relative meanings, for example, longer, longest, more than, less than.

4 The vocabulary and style of the English used in textbooks.

5 The vocabulary and style of the English used in examinations

6 Teachers' English Language using skills especially in speaking and writing

7 Students' English Language using skills especially in listening and speaking.

8 The ways in which students and teachers interact in English during mathematics lessons.

These areas all offer some opportunities for research. In the next chapter the current research into the complex relationship between language and learning mathematics and its relevance for Cameroon will be reviewed. It will become evident that this study seeks to illuminate an area of teaching and learning mathematics in English as a second language which has been neglected. The study will be conducted in ways which will empower maths teachers in Anglophone Cameroon to be more aware of their own classroom practices and thus more able to experiment with other ways of facilitating learning.

CHAPTER TWO

THE RELATIONSHIP BETWEEN LEARNING MATHEMATICS AND LANGUAGE

INTRODUCTION

The research into the complex relationship between language and mathematics can be subdivided into three major trends. The first is specialised mathematical language and the difficulties this can pose; the second, the role of language in the development of mathematical thinking; and the third, the ways in which language is used by both teacher and students during maths lessons. For the purposes of seeking answers to the questions raised by the INSET teams in North West Province as itemised in chapter one, the research in these three areas can be reviewed with reference to classes where the medium of instruction is not the learners' first language. Because there has been insufficient research in such classrooms the area is also reviewed in contexts where the medium of instruction is the learners' first language. This will provide a broad theoretical base on which to build this study.

2.1.THE RELATIONSHIP BETWEEN LEARNING MATHEMATICS AND LANGUAGE WHERE THE MEDIUM OF INSTRUCTION IS NOT THE LEARNER'S FIRST LANGUAGE

2.1.1. The Language of Mathematics

The language of mathematics in English in itself poses some second language learners with particular problems because;

> "mathematical symbolism in its now internationally accepted form, is a shorthand, the bulk of which has been devised by speakers of a few closely related languages." (Austin and Howson 1979:176)

According to Watson mathematics;

> "is a specifically Indo-European cultural product and learning mathematics will be easier for children whose language is Indo-European." (1988:263)

This suggests that learning the language of mathematics and learning to differentiate between mathematical English and ordinary English is particularly problematic for speakers of languages not of the Indo-European family; for example those in West Africa.

Attention has been focussed on areas of language use which may pose particular problems for those whose mother tongue is not of the Indo-European family. For example Strevens investigating the importance of prefixes and suffixes in mathematical English, stated;

> "there is a major difference in mental preparation for mathematical learning between a learner whose language makes use, in some recognisable form, of the international Greek-Roman terminology; prefixes such as pre- post- anti- sub- and arithm- and a learner whose

> language contains neither these items nor any translation of them." (1969:169)

In a study which looked at the ways in which children of four different mother tongues; Punjabi, Mirpuri, Italian and Jamaican, growing up in Britain, reasoned deductively in mathematics, Lloyd Dawe (1983:348) found that the development of the ability to use logical connectives for example "if ..... then" "either .....or" for reasoning and argument is,"vital in understanding and using mathematical language". Kane (1967:296) also drew attention to the ways in which mathematical English differs from ordinary English in that letter, word and syntactical redundancies differ and the grammar and syntax in mathematical English is less flexible than in ordinary English. He suggested that this inflexibility is a particular difficulty for some second language learners.

Other research has investigated the correspondence between words and the way in which concepts are labelled in different languages. For example Bishop's (1979) research with speakers of different languages in Papua New Guinea showed clearly that many English words could not be translated directly and thus might be the cause of misunderstanding. As Brodie points out;

> "some students might have difficulty distinguishing between 'side' and 'edge' because one word expresses both concepts" (1989:17)

Students of certain language groups might have to learn to see a concept in a new way before they can work fluently in English. Taiwo (1968:168) points out that

although the concept of zero exists in Yoruba there is no corresponding notation and thus zero plays no part in the Yoruba number system. In Tanzania there have been attempts to prevent this situation from becoming problematic by choosing or creating a word in Swahili to label a mathematical concept so that learners can first learn the concept in their lingua franca and then learn to use it in English eg "kiovu" (navel) has been introduced and is now used for centre. (Mmari 1975:169)

2.1.2.Thinking mathematically in a second language

At the 1974 UNESCO conference in Nairobi, Strevens put forward four questions to assist in the classification and systematic discussion of the ideas about learning to think mathematically in a second language. Do the teacher and learner share the same first language? Do the teacher and the learner share the same culture? Do the teacher and the learner share the same logic and reasoning system? Is there a match between the language, culture and logic/reasoning system of the learner and the teacher? (1969:163). Research in the learning of mathematics conducted in Papua New Guinea indicates that;

> "the structure of the [learners'] first language determines the kind of classification available to children and hence to a large extent the nature of the concepts they form." (Philp 1973:168)

The UNESCO conference went on to discuss and agree that different languages support mathematical concept formation, precision and systemization in different ways:

> "All cultures have the essential structural elements of language necessary for a mathematical system: conjunction, negation and quantification." (Gay 1974:49)

so that speakers of different mother tongues will vary in the ways rather than the ability with which they learn to manipulate and use the international symbolism of mathematics but; "no group of people is barred from any aspect of cognitive discovery or experience." (Brodie 1989:10)

Although this question of how some mother tongue languages might influence the ways in which speakers approach English medium learning is of much interest, as Zepp (1981:61) points out it would be almost impossible to investigate every learner separately particularly in multilingual environments such as those in Cameroon.

Berry notes much of the research to date has had little impact on mathematics education and, "little concrete action at the instructional level has occurred." (1985:21) Thus in terms of the value of research for those teaching and learning mathematics in English as a second language and the appropriate allocation of limited resources, research into classroom activities might bear more fruit than research into the cognitive structures of various languages particularly for the teacher in an

English medium system where every class contains speakers of many different mother tongues.

Certain aspects of learning and teaching mathematics in a second language have received considerable attention. The most obvious of these is the notion of readability. Austin and Howson point out that;

> "Written materials still remain major determinants of both the curriculum to be followed and also of the language used within the classroom." (1979:170)

This is of particular importance in well-resourced classrooms and in situations where the learners will take tests or exams prepared in such a way as to require good reading skills eg in African Universities. In such situations, factors such as the content, style, format, organisation and vocabulary of mathematics texts must be taken into account as must the reader's ability to read efficiently at a suitable speed in the appropriate language. Austin and Howson advise teachers to;

> "use simple sentence constructions and avoid long sentences ..... introduce only a few new words at a time; use the active rather than the passive voice; avoid conditional clauses and the hypothetical." (1979:173)

This is not to say that teachers and writers should deliberately include verbal hints or linguistic clues in their mathematical materials as to do so may encourage children to find the answer without necessarily understanding the reasoning required. (Aitken 1972:369)

Much of the research mentioned earlier on the use of logical connectives, prefixes and suffixes grew out of the belief that the major problem in second language mathematics was the students' ability to read mathematical texts in English and a desire to write materials in ways which reduce the influence of language issues. Whilst not wishing to suggest that the language used in written materials is not important, I agree with the Secondary Mathematics Individualised Learning Experiment (SMILE) project team who insist that;

> "translating instructions for teaching [into the learner's mother tongue] .... trying to avoid the use of all language and concentrating on the "language of mathematics" are a very simplistic solution .... and are of limited use."
> (1985:216)

For those students who have reached a level high enough to be exposed to mathematical texts as a tool of individualised learning, or those in school systems where this is the norm, the readability of texts and the students' reading skills are of great importance. However there are many people learning mathematics in English who do not have access to written materials except those written on the blackboard or prepared for and by the teacher for end of term tests. In poorly resourced classrooms even the latter use few words as paper is used sparingly if at all. For these students the learning rests on the teacher's ability to read and understand written materials and use of oral language in the classroom. The most important language skill for the learners is therefore not reading but listening and for

the teachers the use of the medium of instruction fluently and confidently to explain, to illustrate, to ask questions orally in the classroom.

Whilst accepting the value of the research noted above, it is clear that there is little available which could be used to empower teachers such as those working in Anglophone Cameroon to make the learning of mathematics easier for their learners. The language of instruction, English, has to be accepted as a given, as have the class sizes and lack of resources. The multilingual composition of many classes and the government's need to minimise differences between people of different language groups to promote national unity means that looking into the relationships between learning maths and speaking one or another Cameroonian language seemed inappropriate.

As there is insufficient research in maths lessons where English is not the first language of the teacher and learners, it is worth looking at research conducted in first language classes to provide a broader base from which to begin to design a study which is Cameroon-specific and which could lead to the empowering of maths teachers in Anglophone Cameroon and elsewhere in the Anglophone world.

2.2. THE RELATIONSHIP BETWEEN LEARNING MATHEMATICS AND LANGUAGE, WHERE THE MEDIUM OF INSTRUCTION IS NOT THE LEARNER'S SECOND LANGUAGE.

2.2.1.The language of mathematics

According to the Cockcroft Committee, set up in Britain in 1978 to consider the teaching of mathematics required in further and higher education, employment and adult life generally, maths is perceived at all levels as,"a difficult subject both to teach and to learn" (The Cockcroft Report 1982:67). Many of those who begin maths courses drop out or fail to reach the expected level at the expected time;

> "A small number reach a standard which enables them to study mathematics at degree level but many others (.....) advance only a short distance along the mathematical road at school (The Cockcroft Report 1982:67)"

Language and language issues are viewed as one important factor by all those seeking to understand this situation fully, regardless of whether learning is taking place in a first or a second language. The Cockcroft Report states unequivocally that the committee believe that;

> "Language plays an essential part in the formulation and expression of mathematical ideas." (1982:89)

The report "Mathematics from 5 to 16" setting out a framework within which each school might develop a mathematics programme appropriate to its own pupils, (DES

1987:49) continues, "language difficulties are often a barrier to mathematical progress." Quilter and Harper (1988:125), researching into the reasons why university graduates had disliked and/or done badly in mathematics at school, noted that language issues were seen as an important factor leading to disaffection from mathematics. This was in association with other variables such as personality and anxiety, although it was not weighted as heavily as relevance of content or teaching methodology.

Mathematics is one subject where the understanding and use of subject-specific words, phrases or ways of describing ideas is required if one is to progress past the most basic level. Torbe and Shuard (1982:1) argue that "the sheer compression of mathematical language and the abstract nature of formula can form a barrier" to learning. Kerslake (1982:41) adds that there are numerous examples of very specialised forms of language used in mathematics but nowhere else and that the use of special symbols and formulae grows more complex during secondary level mathematics as the concepts being manipulated become more abstract. An intuition that there is an almost overwhelming amount of special vocabulary in the learning of mathematics is born out in Richards' research during which the number of times specialist vocabulary was used in lessons was counted by observers, revealing that;

"the scores in the science group [which included

> maths] ..... support the contention that in these subjects pupils are overburdened with technical vocabulary." (1979:90)

However it is not only the very precise specialist terms which can cause learners difficulty. One idea may be expressed in several different every day words, making the precise communication of ideas uncertain eg "divide", "go into", "share", "how many ..... in". (Bell 1970:126) identified a basic vocabulary of three hundred and sixty five words in common use outside mathematics as well as within, which everyone needs in order to deal with basic mathematical topics such as quantity, measurement, time, money, position eg "on", "at", comparisons eg "bigger", "longer", questions eg "who", "what" connectives "but", "because", "therefore". Rothery pointed out that there are varying degrees of relatedness between words which look and sound the same but which carry different meanings in maths or when used elsewhere, giving the example that;

> "gradient has more similarity of meaning in the two contexts than does product." (1980:344)

Mathematicians would argue that precise terminology is required in the learning of maths, as concepts are not negotiable. Thus, whether the language used is highly specialised and abstract or everyday and concrete its precise use in relation to mathematical thought is essential. However, teachers of mathematics do not always use language unambiguously in their lessons. Wood (1988:192) highlights the difficulties which can be caused by the use of terms in mathematics which are

"parasitic" upon words used in everyday speech and writing. They look and sound the same but mean something different and can therefore be used in ways which are confusing for the learner eg "face", "radical", "mean", and "degree", or the contrasting use of prepositions such as in the mathematical phrase; "the area inside a room".

> "Many confusions can occur as a result of differing linguistic usage with the teacher, most often speaking mathematical English while the student interprets it as ordinary English." Pimm (1987:104)

Pimm gives a telling example eg Teacher "Let 'n' be a number" Pupil "But 'n' is a letter" (Pimm 1987:18)

2.2.2.Language and mathematical thinking

The debate over the precise relationship between language and thought has not been restricted to those concerned with the relationship between language and mathematics. However the ways in which learners use language to understand a mathematical concept well enough to think about it and manipulate it in relation to another concept is a vital factor in this relationship. It is especially important in secondary school mathematics as one purpose of teaching maths at this level is to enable learners to go beyond the development of individual or primary concepts, to understand the ways in which concepts relate to one another as secondary concepts (Stones 1970:233) in a hierarchy of understanding.

Language and thought are inseparable in people at the secondary school level. Vygotsky's assertion that;

> "The relation of thought to word is not a thing but a process, a continual movement back and forth. (....) Thought is not merely expressed in words it comes into existence through them." (1962:125)

or Piaget's overview that;

> "language and thought are linked in a genetic circle where each necessarily leans on the other in independent formation and continuous reciprocal action." (1954:274)

describe their interdependence succinctly.

Given that learning mathematics involves "building up the structure of successive abstractions" (Skemp 1970:85), language plays a vital bridging role between known and unknown concepts. To succeed in mathematics, the learner has to mentally arrange and classify lower order concepts in such a way as to facilitate the development of the new abstract concepts of a higher order. They are;

> "first formed and then (.....) utilized to guide explanation, inquiry, productive thinking and problem solving in situations which arise independently." (Servais et al 1971:163)

and;

> "language can be used to speed up the formation of a concept by helping to collect and separate contributory examples and non-examples."(Skemp 1970:81)

Thus language may be used by the teacher talking to the learner or when learners talk to each other or indeed when learners talk to themselves silently or aloud.

2.2.3.Language in maths lessons

The traditional mathematics lesson in Britain is teacher centred with much of the time taken up by the teacher talking. Fletcher (1960,1970:272) provided evidence that; "Mathematics teachers talk more than social studies teachers ....." organising lessons which include; "more convergent questions, make more directing statements and elicit and reject fewer pupil responses" than do teachers of other subjects. A common procedure is that the teacher gives a definition of the concept to be learnt, explains it and then according to Torbe and Shuard; "talks to pupils, asking them questions" (1982:5) intended to facilitate the learning and use of the original definition. In other words;

> "the teacher is constantly monitoring all communication systems by checking whether or not all pupils are on the same wavelength." (Stubbs 1983:106)

In recent years there have been widespread changes in the ways in which younger children learn mathematics. One "identifiable change (.....) is the increasing demand on pupils to read and write" (Bell et al 1983:279) texts being used as a medium of instruction and to provide the opportunity for further practice. Rothery (1980:280) suggested that in order to minimise the difficulties which may be caused when a learner has to read whilst learning or practising the use of mathematical concepts, teachers and those concerned with materials production should aim to improve the texts themselves, improve the

way teachers use texts and improve the reading ability of the learners. Thus the style used in textbooks and workcards would include short sentences written as far as possible in the present tense, simple words, few conditionals such as "if", "suppose", "given that", a minimal amount of expository material and sentences which require the reader to remember clauses presented previously eg "Harry is twenty six. Tom and Sarah are twins. If they (.....) find their ages." These suggestions are similar to those noted earlier for materials written for those studying maths in a second language.

Rothery's second suggestion that teachers might make better use of materials implies that a change in methodology would be necessary to enable teachers to organise more discussion of written materials. This was not the case when The Cockcroft Report criticised secondary education methodology where the examination system was criticised for requiring;

> "teaching of a kind which, instead of developing understanding, concentrates on the drilling of routines in order to answer examination questions." (1982:131)

This has only recently begun to change as a result of the new assessment procedures in the General Certificate of Secondary Education.

Instead of the pattern noted above, Cockcroft suggests that mathematics teachers at all levels should aim to include opportunity for the following in all their lessons;

> "exposition by the teacher, discussion between the teachers and students, between the students without the teacher, appropriate practical work, consolidation and practice of fundamental skills and routine problem solving and investigation." (1982:71)

To enable the above activities to become a common feature of secondary school mathematics, many teachers would have to review their assumptions about how mathematics learning takes place. A major assumption underpinning the traditional model of a lesson is that by listening a lot and speaking a little learners will acquire the same internalised system of understanding the relationship between concepts as the teacher has. Many teachers feel uneasy about making the changes suggested by Cockcroft, believing that there are; "right and wrong answers ..... with clear cut methods to be taught and learnt for finding them." (Pimm 1987:47)

These assumptions are being challenged on many fronts. Section four of the DES report Mathematics from 5 to 16 on classroom approaches requires the reader to consider the following;

> "There is much to discuss in mathematics, the nature of the problem (...) the relevance of the data (....) the strategies which might be used (.....) and the concepts which need to be

> clarified (.....) useful discussion can (... ...) take place between pupils without the involvement of the teacher." (1987:39)

Wood (1988:195) believes that, "children have to regulate their own thinking in mathematics" whilst Torbe and Shuard(1982:5) support the idea that, "understanding has to grow individually in each pupil's mind."

The Secondary Mathematics and Science (CSMS) team (Hart et al 1981:214) suggest that mathematics teachers might consider moving away from what they call the "I'll show you" methods of teaching to one based on a "Let's discuss this" model, arguing a strong case for a more verbally interactive, discursive approach to the teaching of mathematics at the secondary level.

The type of language use which seems to figure prominently in the writing of many in this field is that known variously as hypothetical, tentative or exploratory language. This means that language is used as thoughts are organised, to suggest, try out and negotiate understanding for oneself marked by the use of tentative words and phrases eg "could have", "probably", "you'd think";

> "Many spoken formulations and revisions will often be required before an acceptable and stable expression can be agreed upon." (Pimm 1987:32)

Barnes (1969:109) who looked at language across the curriculum, shows the context of this language style in a concise table;

	INTIMATE AUDIENCE	DISTANT AUDIENCE
SIZE	small group	full class
SOURCE OF AUTHORITY	the group	the teacher
RELATIONSHIPS	intimate	public
ORDERING OF THOUGHT	inexplicit	explicit
SPEECH PLANNING	improvised	pre-planned
SPEECH FUNCTION	exploratory	final draft

The classrooms in which exploratory language use would be most common would be those in which the teacher of mathematics planned to work more in the "hypothetical mode" than in the "expository mode" (Bruner 1985:15). In British education at the primary level there has been a shift towards such a way of promoting mathematical learning as reflected in the National Curriculum but at secondary level in Britain and in education systems where the teacher maintains a more traditional role, such as in Cameroon, the changes in the way teachers and learners use language have been less marked.

2.2.4. Summary

Whether the focus is the language of mathematics, the role of language in the development of mathematical thought or the ways in which language is used in the mathematics classroom, the situation is complex and under-researched. For those teaching and learning mathematics in English when it is not their mother tongue the situation is even more complex. It is essential therefore that research is conducted in all the different types of schools where English is used as the medium of instruction for speakers of other languages.

Much of the present research, based in British, American and Australian schools has been conducted in classes where there is likely to be a percentage of learners using English as their mother tongue and where the teacher may be a native speaker of English. In the context of African education the role of mother tongue education has been examined as have classes in areas where there is one dominant mother tongue eg Berry's work in Botswana (1985) or Taiwo's in Nigeria (1968) or Gay and Cole in Liberia (1967). In a general sense all of this research is of interest to both linguists and mathematics educators because it focuses attention on the interface between these two fields of research.

However, the same interface in educational systems in which there is a multiplicity of first languages

represented in different proportions in every class and in countries where some children may be literate in their mother tongue and some may speak a language which is not written seems to have been neglected by both linguists and mathematics educators.

2.3. RESEARCH QUESTIONS

2.3.1.Unanswered questions

One area which is as yet under-researched in relation to the teaching and learning of mathematics in English in Anglophone Cameroon is that of the language used by teachers and students during lessons.

The idea of investigating this area, that is the ways in which teachers and learners interact in English during lessons, led to a further analysis of the questions listed at the end of chapter one. From these eight broad questions three specific ones were selected. The criteria for selection were the researcher's own interest in classroom processes as reflected in the language used and the potential practical value of the answers to these questions for the teachers of mathematics in Anglophone Cameroon. The search for ways to encourage these teachers to feel able to experiment with new classroom practices acted as a stimulus for this study and as a guide when these research questions were formulated.

The first is: How do teachers and learners interact in English as they seek to teach and learn mathematics at the secondary level in Anglophone Cameroon? As it could not be assumed that an existing model of verbal interaction would be found to adequately describe the processes identified in answer to this question a second question was formulated: Can a descriptive analytical model be devised for these interactions? Finally because the research grew out of INSET and will feed back into further INSET the answers to a third question were also sought; Can this model be used with the teachers participating in the research to enable them to use a wider range of teaching strategies; including those which might encourage their learners to use English more confidently to talk about maths during maths lessons?

As these questions have not been asked in terms of second language medium of instruction education in Cameroon and elsewhere in Anglophone Africa, it is hardly surprising that answers are not to be found in the current literature on learning mathematics in English in Africa. However, questions similar to question one have been asked in Britain and the United States of America. Such research requires examination to see if the answers found or the research methods used offer any insights for this research.

For this reason four research projects are reviewed in detail in the next chapter. Although the cultural and linguistic contexts in which they were conducted are not similar to those in Cameroon and thus the specific content is not necessarily relevant, a discussion of their approaches to classroom language is useful as part of the process of identifying research methods which would provide data for my research questions.

CHAPTER THREE

SELECTING RESEARCH METHODS AND DESIGNING THE RESEARCH PROJECT

INTRODUCTION

In this chapter a small number of research projects will be reviewed: the first two because they were small scale projects conducted in mathematics lessons, the third because it was a much larger study of verbal behaviour during science lessons and the fourth because an analysis of the verbal behaviour of student teachers of Biology was used as part of their pre-service training. Following this, reference is made to three ways of approaching data collected during formal secondary school lessons. Specific aspects of the methods used in each project will be highlighted as they were instrumental in the process of selecting research methods which would lead to answers to the three research questions. The methods selected and the research design are described in detail at the end of the chapter.

3.1. SMALL SCALE RESEARCH INTO THE VERBAL BEHAVIOUR OF TEACHERS DURING MATHS LESSONS

An early example of research which sought to identify the verbal behaviours of mathematics teachers, particularly those related to students achievement was that conducted by Smith in 1977 in the United States of

America. Twenty teachers of mathematics, all with at least one year of teaching experience, were asked to teach a twenty minute algebra lesson to students in their first year at High School. They were given a list of objectives as guidelines and a textbook to use in class. The lessons were audio recorded, transcribed and reproduced. This was necessary as each transcript was to be coded by more than one coder looking for evidence of nine variables in teacher discourse. The first two variables were total lesson time and percentage of teacher talk which do not specifically address the issue of types of verbal behaviour. The remaining seven, selected from earlier studies into what constitutes "good "teaching, (Smith 1977:195), were quantified via close examination of the transcripts. They were;

a) vagueness terms ; for example the use of negated intensifers such as, not all and indeterminate quantification for example; a couple,or few.

b) teacher responses of ok

c) mazes that is a unit of discourse that doesn't make any semantic sense.

d) teacher initiated student responses and

e) pupil initiated student responses

f) lesson objectives (evidence of) and

g) examples and applications (variables selected by this team of researchers)

The students were given a fourteen item test after the lesson, covering the content which the teachers had been asked to teach and the results of these tests examined for correlation with the analysis of the transcripts.

Smith reports that three variables were correlated positively with student achievement, namely evidence of the teacher's objectives being reached, the percentage of relevant examples per lesson and the average number of "OKs" per minute of teacher talk. She asserts that;

> " This may provide a clue to a more global variable that positively influences student learning. Such a variable likely involves organisation, structuring and clarity of lesson." (Smith 1977:202)

Although this research did focus on the language used whilst mathematics was being taught and learnt, the isolation of nine variables and their quantification is limiting. The experimental nature of the research and the artificial length of the "lessons" does not persuade me that this is the way in which teachers and students necessarily interact in mathematics lessons on a day to day basis. The absence of an analysis of student language is also problematic in terms of trying to understand all the verbal behaviour of those teaching and learning mathematics in a particular lesson.

Research which focussed on the discourse observed during maths lessons taught by non native speaker teaching assistants was conducted in the University of Michigan in 1985. Although the age and mathematical experience of the students was far removed from the students in Cameroon, the methods used to discover, "what constitutes teaching discourse that is communicatively competent" (Rounds 1987:643) are worth examining as part of the search for a way of exploring the verbal interaction of Cameroonian maths lessons in a way which will empower the participating teachers to make changes to their everyday practices.

Five fifty minute videotapes of two native and three non native English speaking teaching assistants were recorded during the second week of the school year (in order to avoid differences in classroom procedures as a result of the teachers' greater or lesser familiarity with a particular class). The teachers were selected by the supervisor in the maths department, two because they were successful, two because they were less successful and one because it was thought he had particular difficulties with using English. The same teachers were observed teaching other classes so that the researcher could be confident that the recorded lesson was representative of their habitual teaching behaviour. The video tapes were then reviewed and discussed separately by the teaching assistants, their students and their supervisors. The reviewers were asked to point out

anything they found "unusual, interesting or problematic," (Rounds 1987:647) to guide the researcher towards those aspects of the lesson which were perceived as noteworthy by the participants themselves. Rounds argues that this method of supplementing recorded data facilitates its interpretation if the researcher "attempts to understand an event by studying it as it unfolds naturally and by obtaining retrospective commentaries from the actors" (Rounds 1987:647)

Having looked at various features of discourse as a result of the observations and discussion Rounds sums up her findings ;

> "communicatively competent classroom discourse is based on a) an understanding of the student teacher relationship expected in American university classrooms; b)an understanding of the ability of silence to contribute or detract from the creation of fluency; c)an awareness of what students are doing while the teacher is performing, especially a sensitivity to their note taking task; and d) an acceptance of the fact that teaching involves more than proficient transmission of information and that elaboration is highly valued by students". (Rounds 1987:666)

What stands out as valuable from Rounds' work is the ways in which she collected her data and analysed it in conjunction with the participants' own opinions about what was and was not worthy of their attention. This process would seem to offer valuable insights into both the collection of classroom language data and the search for a research method which would establish the role which an analysis of classroom language could have in the In-Service Training of Teachers in Cameroon.

3.2. VERBAL BEHAVIOUR IN SCIENCE LESSONS:A LARGE SCALE PROJECT

Both the research projects described so far have used a small number of short micro lessons as their basis. In research which chose a much larger number of participants, Lemke, looking at sixty science lessons in three schools and a University in New York City observed and audio recorded whole lessons seeking;

> "The strategies that teachers and students use in building personal relationships, defining roles and expectations and manipulating the possibilities of the classroom situation."(Lemke 1989:1)

The teachers, fifty eight male and two female, were all of European descent and varied in their teaching experience from the newly trained to those approaching retirement. Lemke selected extracts from his large number of transcripts to investigate four classes of activity:the principal science situation types, the principle strategies by which content is expressed, the rules observed by teachers and students concerning a "proper" way to talk science, and the relationship between the teacher observing or breaking rules and the likelihood of students showing attentiveness to the lesson. He began by working with one extract and when he felt he had established a mode of analysis which was satisfactory in terms of the above classes of activity he then used the same mode with other extracts.

From these three research projects a possible approach to research methods began to appear. Observing and audio or video recording everyday lessons would provide transcribable language data. The recordings and transcripts could then be discussed with the participants to verify their accuracy and representativeness and used in the confirmation of a classification system of the patterns of verbal interaction observed.

3.3. VERBAL BEHAVIOUR AND THE PRE-SERVICE TRAINING OF TEACHERS

In the research described so far in this chapter the value of the research for pre or in service teacher training purposes was not addressed. Brown and Armstrong (1977) experimented with an approach to one aspect of classroom language use as part of the pre service training of Post Graduate Certificate of Education (PGCE) students. In this research ten topics in Biology were offered to the students. They were required to teach two topics to approximately twelve, twelve year olds in two ten minute lessons. Half the group were given training in how to explain well between the two lessons and half at the end. This training included structured video feedback of their own lesson and an instruction booklet. After the lessons, matched groups of pupils were given a multiple choice test on the topic of their lesson and asked to complete a rating form for their teacher. The analysis of the lessons were then matched with the students'

achievement test and their ratings of the teachers' ability to explain well.

Brown and Armstrong rejected both the coding of observable behaviour in real time during lessons and a purely ethnographic approach to classroom life in favour of taping and transcribing. They argued that the cognitive processes used by learners may not be immediately obvious to an observer but as they are revealed in the language used during the lesson, their research required tapes and transcripts as data.

They acknowledge that their System of Analysing Instructional Discourse (SAID) owed much to the work of Sinclair and Coulthard (1974) and Bellack et al (1966). However they also noted that as they were less concerned with the nature of verbal interaction than with;

> "the structure of and sequence of explanatory processes - with the pedagogy of explaining rather than the linguistics of discourse" (Brown and Armstrong 1978:28)

it is not surprising that although their method of data collection and the notion of using the analysis of classroom language as part of teacher development seem useful in terms of planning my own research their system of analysis is less valuable as it was not designed to describe the language used by teachers and learners in interaction.

3.4. RESEARCH IN OTHER LESSONS:THE SELECTION AND ANALYSIS OF DATA

Barnes (1969) analysed the lessons he observed in more linguistically oriented terms, discussing the nature of the questions asked by teachers and the ways in which these constrain the ways in which their students participate in their lesson (see chapter two for more details). He analysed only those features of classroom language which seemed to him to be of interest and thus although what he reported is useful as a potential research method I feel that a more systematic way of selection would lead to a comprehensive descriptive analytical model of the patterns of interaction observed in a particular lesson.

Sinclair and Coulthard on the other hand also set out "to handle discourse produced in one type of classroom" (Sinclair and Coulthard 1975:112) (that is a classroom in which the teacher is the centre of all activity where "chalk and talk" would be the most likely mode of teaching) and did have a clearly defined set of criteria for their descriptive apparatus before they began. Following their recording and transcribing of six twenty minute lessons they aimed to produce a descriptive apparatus which was finite, with symbols or terms which were precisely relatable to the forms in which they appeared in the data and which described the whole data. Building on a basic notion of structure in linguistics,

"there must be at least one impossible combination of symbols" (Sinclair and Coulthard 1975:16) That is if a two symbol descriptive system allows all two symbol structures, " it is worth looking at three symbol structures" (Sinclair and Coulthard 1975:17) to find which combinations of symbols do and do not appear in the data. Once an impossible combination has been revealed it becomes possible to make a structural statement.

In writing about their research they made complimentary reference to the work of Bellack et al (1966), as did Brown et al (see above) noting that the classification of language behaviour during lessons in this research fulfilled three of the four criteria mentioned above. Although the hierarchical organisation of a lesson into pedagogically defined games and sub games is attractive, the analysis does not include symbols which are clearly defined according to their exponents in the data.

What Bellack et al (1966), Barnes (1969) and Sinclair and Coulthard (1974) all have to offer this particular study, is a way of approaching data collected during lessons and transcribed in its entirety without a pre determined "shopping list " of categories to look for. Each group of researchers no doubt had previous research in mind as they began, which to a certain extent may have

guided their intuitions but as Sinclair and Coulthard state categorically;

> "When we began we had no preconceptions about the organization or extent of patterning in long texts. Obviously lessons are highly structured but our problem was to discover how much of this structure was pedagogical and how much linguistic."(1975:19).

3.5.EVALUATION OF THE ABOVE RESEARCH

From this review of some of the research conducted during maths, science and other lessons which sought to investigate the language used by teachers and students, it can be seen that existing research cannot provide answers for the research questions; How do teachers and learners interact in English as they seek to teach and learn mathematics at the secondary level in Anglophone Cameroon ? Can a descriptive analytical model be devised for these interactions ? Can this model be used with the teachers participating in the research to enable them to use a wider range of teaching strategies; including those which might encourage their learners to use English more confidently to talk about maths during maths lessons ?

Elements of each of the projects referred to in this chapter were however helpful in the process of making informed decisions about the selection of subjects, processes of data collection, strategies for the analysis of classroom language data and ways of using the data and the model with the participants as part of INSET activities. The decisions made during this process are now examined in detail.

3.6.THE SELECTION OF RESEARCH METHODS

The first of my research questions asked how language is used by teachers and learners in interaction during mathematics lessons in Anglophone Cameroon secondary schools. Research methods were sought which would capture such language use, in ways which would facilitate close analysis. Following the review of classroom based research earlier in this chapter, the recording of whole lessons, taught as part of the normal school time table over a long period of time, seemed the best way to begin data collection. Such lessons would give as natural a picture as possible of the ways in which language is used in mathematics lessons on a day to day basis.

Coding verbal behaviour as it occurred during lessons was rejected as a method of data collection partly because of the practical difficulties of deciding what ought to be coded but mostly because of the difficulties connected with reducing language and interaction to a manageable number of predetermined codes, in real time, and then being unable to check these codings later.

Thus it was decided that the lessons would be recorded. Audio recording was selected rather than video recording to minimise the;

> "certain reactivity effect [which can be expected] when sophisticated research equipment is introduced into a social situation," (Mehan 1982:62).

Video cameras are not commonly seen in North West Province and thus would have disrupted the lessons being recorded and consequently interfered with the natural patterns of interaction.

As the verbal interaction recorded in this way in the form of tapes and transcripts would need to be analysed in terms of the classroom context, prolonged periods of classroom observation were envisaged. None of the research examined in chapter three made detailed reference to the observation of lessons but I felt it would be difficult to analyse tapes made during lessons unless I had actually observed them and kept detailed field notes of all that I noticed, particularly in terms of that which could be seen but not heard, for example blackboard work. I also felt that it would take the teachers some time to become accustomed to having a tape recorder (with or without an observer) in their lessons and that the joint experience of lessons by the teacher and the researcher would facilitate any discussions of what had happened during a particular period.

The problems of being an outsider by virtue of my race, culture and academic speciality were considered at this time. Having lived and worked in Bamenda for four years I was well known in all the schools in North West

Province as the English Teaching Adviser. In this capacity I had visited all the schools regularly and worked alongside the teachers of English in many different ways. I speak Cameroonian Pidgin adequately and understand local cultural expectations sufficiently to function as an accepted outsider in both professional and social contexts. My status as an adviser, who was also female, had been an issue when I first arrived in Bamenda in 1987 (all the other British Advisers being men) but by 1991, when this research project commenced it was of little concern to those involved.

As a non-mathematician I hoped to be able to cultivate a non-judgemental approach to the lessons I would observe without difficulty. I felt that the teachers would be less threatened by a non-mathematician than they might be by an observer from their own discipline because they could retain their status as specialists in the subject whilst I retained mine as a language specialist. In this way our discussions would take place on an equal footing which I felt to be important if the teachers were to experiment with language use in their own way.

To avoid collecting data which would be distorted by the teachers and students using language in a very self conscious way a prolonged period of observation was planned at the beginning of the research.

In addition to observation notes made during lessons, the field notes would also contain information about anything going on before or after the lesson as observed or as reported by the teacher during pre and post observation discussions. In this way the data collected during lessons could be set in the larger context of the school day.

The tapes recorded in this way with their transcripts and the field notes made during the lessons could then be discussed by each teacher and the researcher separately as well as by the whole group of teachers and the researcher. Teachers' meetings would result in further data in the form of notes made on the discussions of past lessons and the planning of future lessons. The teachers' comments on the developing model of the patterns of verbal interaction observed would also be available during the final stages of data analysis so that the model created to answer the second research question would both grow out of and feed into the intervention period planned to answer question three.

The selection of an approach to the analysis of the data thus collected reflected the process recommended by Sinclair and Coulthard in their 1975 work; that is of beginning not with a model into which data has to be fitted but with the data itself allowing the theory to grow from there. As Glaser (1978:31), explaining his view of grounded theory stated,

> "we collect data in the field first, then start analysing it and generating theory"

and

> "Concepts emerge from the field [to be] checked and rechecked against further data."(Woods 1985:51)

Only when the theory seems well grounded in the data being examined are other theories examined to allow for the integration of the new theory. Given that current research does not offer a model which seemed likely to be appropriate for a second language medium of instruction classroom and given my hesitation about the application of European models to data collected in non-European settings this seemed to be the only appropriate way to approach answering questions two and three.

Within this general approach to the research methods, cultural appropriateness was a key concept at another stage of the process, not only as the method of analysis was decided. Question three, seeking to find out if a descriptive analytical model of the interactions observed during the lessons required intervention. It was decided that such intervention activities should not be too different to those to which the teachers had become accustomed during previous INSET activities. The Adviser and Inspectors for mathematics had previously invited them to attend short meetings in the teachers' centre to discuss topics ranging from schemes of work to lesson planning. With this in mind I felt that inviting them to

short meetings in the teachers' centre to discuss the language of their own classrooms would be useful and non-threatening. Therefore in addition to the shorter, informal discussions which could take place in school pre and post observations the teachers would be invited to attend meetings after school in the teachers' centre where they could meet each other and discuss their ideas with the researcher and with each other. In this way it was intended that the researcher would be a facilitator of these meetings but all those participating would be equal resources in the discussion of their own lessons. I felt that this equality was essential if the teachers were going to feel able to build on their growing perceptions of verbal interaction in their own way, in their own teaching.

Having decided that the answers to the three research questions would be sought via classroom observation and the recording of lessons and that the data collected in this way; tapes, transcripts and field notes would be supplemented by notes made during informal discussions with teachers in schools and during teachers' meetings, the final methodological decisions concerned the selection of participants.

Given the proposal that the research would include long periods of observation and recordings made of whole mathematics lessons being taught as part of the normal school day and given my wish to collect data which would

enable me to answer my questions in depth, it seemed wise to choose an approach which would limit the number of participants. If there were a small number of teachers/classes participating in the study it would be possible to visit each one more than once a week to observe and record several lessons and thus collect the data required.

From the decisions already made, it seemed that a case study approach would be the most suitable way to collect the data needed to answer the three research questions. As Walker explains;

> "Case study is the examination of an instance in action (.....) The study of particular incidents (....) and the selective collection of information (....) allow [the] case study worker to capture and portray those elements of a situation that give it meaning." (Walker 1980:33).

A case study approach would facilitate the collection of data as described above, so that a "rich holistic account" (Merriam 1988:28) could be established. This would be particularly valuable in the search for the answer to question one. An approach which allows the researcher to "make ... strange" (Delamont 1985:178) taken for granted patterns of verbal interaction would also be valuable as the intervention required to answer question three was planned.

This approach would allow for long periods of observation and close contact with a small number of participants. Thus within the constraints imposed by time and by the poor condition of the roads, especially during the rainy season, a limited number of schools would be invited to participate in the study.

Schools would be selected in order to have cases from a range of similar but different secondary school contexts. As mentioned previously, time would be a major constraint as would the distance between schools particularly during the rainy season so it seemed wise to select schools which were within easy reach of Bamenda so that I could reach the schools easily and so that the teachers would be able to reach the teachers' centre easily for our teachers' meetings.

Given that most of those attending secondary schools in this area are students at either government or lay private schools, cases would be drawn from both types of school. The criteria for school selection would include; size and location in terms of urban or rural, the linguistic make-up of the student population and the educational background of their families and the level of training received by teachers in the school post A'level. At least one of the participating teachers should be female and one male. Once the schools had been selected and access negotiated via the appropriate channels in the Ministries of National and Higher Education, those

teaching Form One mathematics would be asked if they would like to participate in the study. Form One classes would be selected in order to avoid classes preparing for National exams (forms four and five) or for important promotional exams (form three).

It was now possible to draw up the research design which would ensure that the data collected would be rich and deep enough to allow for the close analysis needed to find out how teachers and learners interact in English as they seek to teach and learn mathematics at the secondary level in Anglophone Cameroon. With the data collected as above it would also be possible to answer the questions; Can a descriptive model be devised for these interactions? and can this model be used with the teachers participating in the research to enable them to use a wider range of teaching strategies; including those which might encourage their learners to use English more confidently to talk about maths during maths lessons?

3.7.RESEARCH DESIGN

The research designed to find answers to the three questions above, was divided into three phases spread over a period of four school terms beginning in January 1991.

DURATION	DATES	AIM	TECHNIQUES
PHASE ONE			
One term	Jan-March 91	Negotiate access Select schools	
Five months	April-Aug 91	Collect base line data of verbal interaction in maths lessons to create a preliminary model of the verbal interaction to take back to the teachers	Observation of teachers and classes Audio recording of selected lessons transcribing of tapes preliminary analysis of tapes
PHASE TWO			
One term	Sept-Dec 91	intervention short term monitoring of verbal	intervention INSET activities classroom observation

		interaction in selected classes	audio recording of selected maths lessons
PHASE THREE			
half a term	March-April 92	long term monitoring of verbal interaction	classroom observation audio recording of selected maths lessons

The research summarised in this chart is described in detail in the following chapters.

In this chapter the process of selecting methods of data collection for this study has been described. Five studies have been reviewed. Although the cultural and linguistic context in which these studies were conducted differed from that in Anglophone Cameroon and thus the content was not comparable some of the procedures described were noteworthy. Their influence is clearly evident in the research design which concludes this chapter.

CHAPTER FOUR

FIELDWORK AND DATA COLLECTION

INTRODUCTION

In this chapter the procedures employed to select participants, negotiate access and collect the observation notes and recordings of lessons required are described in detail. The data collection was conducted in three phases as planned (see 3.7.) beginning in January 1991 and ending in April 1992.

4.1. SCHOOL SELECTION

The study was to be based on classroom observation and the recording of lessons in schools in the Bamenda area of North West Province. Given that it was felt more productive to observe and record the same teachers and learners over a long period of time, four schools were selected, aiming for an in-depth, rich picture of selected classes rather than a more superficial but broad picture of many classes. The schools were selected on the basis of the size and location, the linguistic make up of the student population and the educational background of their families, and their funding by the government or private enterprise. In this way it was possible to look at classes which represented the four most common school situations in North West province (see chapter one).

The first school is a very large town centre High School, funded by the Government and therefore with many more applicants than places each year as parents are not required to pay fees for their children. Class size is restricted by Ministerial decree to fifty four. Nevertheless it is not unusual to find classes of over seventy students in Form One. This is because there are more primary school students "passing into list A" (see 1.3.1) than government school places. Many of the students at this school come from the families of civil servants, that is with parents who have completed primary, secondary and often tertiary education. Because many of these civil servants are posted to Bamenda from other parts of Cameroon the school includes students and teachers of many different mother tongues. For example in 1991 one Form One class included speakers of seventeen different mother tongues. The school includes one section for Anglophone students, taught in English and one section for Francophone students taught in French. The teachers in this school have either a Teacher's Certificate or a Degree from the University of Yaounde and have chosen a career in teaching.

The second school is four kilometres outside Bamenda in a village where almost everyone speaks the same mother tongue. It is a small private school (see illustration 4) supported by a group of "elites" (see chapter one) for the benefit of their home community. The students who

come to this school have not qualified for a free Government school place via the Primary School Common Entrance examination. Many of the students come from homes where the parents have not completed secondary education and some from homes where neither parent has completed primary school. Due to the declining economic situation, in particular the worldwide collapse of the coffee market, many of these parents are unable to pay school fees for their children. This results in fewer students attending school either because they are withdrawn by their parents or because the school excludes them from classes until they pay at least some of their fees. One consequence of this is that the classes in this school vary in size from week to week but rarely (in 1991) reached more than fifty in Form One. Most of the teachers have A' Levels as their highest qualification and many see teaching in the school as a stepping stone to another educational course or career. As can be seen in the illustration, the school is made up of four separate one storey buildings each containing two classrooms. There is also an office for the Principal and a small staffroom.

ILLUSTRATION 4. College of Commerce Mendankwe Cameroon

April 1992

The third school is a new Government funded secondary school established in October 1990. The teachers were re-posted from the High school mentioned above and have similar qualifications. It is situated about ten kilometres from the centre of Bamenda in a small but important rural community, the home of one of Bamenda's most important traditional chiefs. Approximately half the students speak the language of the local area whilst the rest speak one of the four or five neighbouring languages. At the beginning of the research the school was housed in a Primary school and was made up of only three classes, all in Form One.

The fourth and last school to be included in this research is a large private school on the edge of Bamenda (see illustration 5). Because of its convenient location and good reputation it is able to select the most able students from many applicants. However it should be noted that none of the students have qualified for a free Government school place and thus were not amongst the most successful Primary school leavers. The teachers range from those who have a Teachers' Certificate or degree from the University of Yaounde to those who have recently finished High School having succeeded in A Level courses. Classes may include up to ninety students although some are much smaller; for example the Commercial classes which are for students who will take fewer O'levels than most students. As can be seen in the

illustration the school has several blocks, one of which is a new two storey building which includes six classrooms. There are more than twenty teaching rooms in the whole school, a staffroom, several offices and a small dormitory for the few students who attend the school as boarders.

The school has a wall around its grounds, entry being through a high gate which is closed during lesson time. The area in front of the high building is the assembly area and a handball court.

ILLUSTRATION 5. City College of Commerce Mankon Cameroon

April 1992

4.2.PHASE ONE:DATA COLLECTION

4.2.1.The first visit

These four schools were approached in January 1991. During the first visit the purpose of the research was discussed with each Principal and free access to Form One Mathematics lessons requested and given. The Principal of each school was asked for permission to approach whichever teacher had been allocated to teach Form One at that time. As there were two teachers sharing the five relevant classes at the fourth school I included both in my research hence five teachers were asked if they wished to participate.

Each teacher was then approached. The research was explained in terms of the need to understand more about the language needed to learn and teach Form One Mathematics and permission to observe lessons was requested and given. It was left to each teacher to decide how to explain the researcher's presence to each class and also when the observations would take place.

4.2.2.Lesson Observation

Once a timetable had been provided by each teacher it was possible to plan a programme of observations. During the first two weeks the aim was a) to watch each teacher teaching different classes and b) to watch each

Form One class with different teachers in different subjects. This was in order to give everyone concerned the opportunity to become accustomed to being observed and tape recorded, to experiment with different recording locations in each classroom, and to practise making field notes whilst using the tape recorder, a Sony Professional recorder with an omnidirectional microphone capable of picking up speech from all corners of the classroom.

Figure 3.Summary of Teacher Observations in Phase One

TEACHER ONE	TEACHER TWO	TEACHER THREE	TEACHER FOUR	TEACHER FIVE
1D	5G	1C	1COMM	1A
08.01.91.	10.01.	09.01.	11.01.	11.01.
1B	1G	1A	1COMM	1C
11.01.91.	10.01.	09.01.	18.01.	14.01.
1A	5G	1B	1COMM	1B
11.01.91.	15.01.	28.01.	22.01.	18.01
1C	1G	1C	1COMM	1B
15.01.91.	22.01	30.01	25.01	22.01.
1B		1A		
16.01.91.		30.01.		

Figure 4. Summary of Observation of Classes in Phase One

SCH1/1A	SCH2/1G	SCH3/1B	SCH4/1COMM	SCH4/1B
MATHS	MATHS	PHYSICS	MATHS	PHYSICS
11.01.91.	10.01.	17.01.	11.01.	11.01.
GEOGR	CHEMISTRY	HISTORY	ACCOUNTS	THEORY OF SPORT

16.01.91.	15.01.	18.01	14.01	14.01.
BIOLOGY	ENGLISH	GEOGR	THEORY OF SPORT	MATHS
16.01.91	15.01.	24.01	14.01	18.01.
MATHS	MATHS	MATHS	MATHS	MATHS
25.01.91	22.01	28.01	22.01	22.01.
MATHS		PHYSICS		
28.01.91.		30.01.		

4.2.3.First Observations

During the first observations all the teachers and all the classes seemed self conscious; the teachers paid visual attention to the researcher, various individuals turned to look before or after they spoke and the children moved their chairs away to make a bigger space around the recording location and the researcher.

However after two visits to each school and spending some time in each staffroom, I noted that the teachers were beginning to do things which were not "best behaviour", such as arriving late for class (Teacher One) telling the students they were stupid (Teacher Two) being very angry with their class (Teacher One) and sending students outside for behaving badly (Teacher Three). This suggested that they were becoming oblivious to my presence. At least two of the teachers also spoke to me in Pidgin outside the class. At this point it didn't seem

to make any difference whether the tape recorder was switched on or not.

During this period it became apparent that the strategies I had used previously to observe teachers would not be the most appropriate in this context. As an Adviser all the observations I had conducted were evaluative in some way. For the purposes of this study I wanted to observe in non-evaluative ways as the observation notes were to supplement the audio recordings (to be made later) and to help me fully understand the contexts in which the verbal interaction I wanted to investigate had taken place. (see chapter nine for a further discussion of this).

The students seemed to become accustomed to being observed during the third lesson. At this time they began to acknowledge the researcher outside the classroom and take an extra chair into the classroom without being asked. In School Two they seemed to relax much more quickly probably because the researcher had lived quite near to the school for four years and therefore was well known to most of the students. After two visits to this school it was noticeable that the students often used Pidgin or Mendankwe within the hearing of the researcher whereas in all the other schools students switched to English when the researcher was present for most of this first phase.

The Commercial class at School Four seemed to be the most aware and self conscious during all the lessons observed; the assumption is that this is because there were far fewer students in a much bigger room, for these lessons. They also looked older than the average Form One class and much less motivated to learn Maths as they knew that they were unlikely to take the subject through to O'Level. Thus they were more easily distracted by a visitor.

4.2.4. Recording

The second part of this phase of research began on January 22nd 1991 when the first recording was made at School Four. The timing of recordings was arranged in such a way that each class at each school was recorded at different times of the day and all the possible different combinations of lessons were included in the recording programme, for example, two lessons on consecutive days, a double lesson and a lesson after the school had not been visited for a week. The teachers were not told exactly when the first full recording was to be made, "test recordings" having been made at least once before in each class during the initial observations. It was suggested that if the teacher felt that recording or indeed observing a particular lesson would be inappropriate in any way they could ask the researcher to leave. This did not happen at all during any phase of the research although all the teachers did suggest that I

might not find a particular lesson very interesting, for example when they were giving a written test.

Figure 5.Summary of lessons recorded in Phase One

	T1/1A	T2/1G	T3/1B	T4/1COMM	T5/1B
1	31.01.91.	23.01.	30.01	25.01	25.01.
	8.20AM	8.00AM	9.30AM	8.45AM	8.45AM
2	01.02.91	29.01.	05.02.	31.01.	29.01.
	11.10AM	10.30AM	10.15AM	10.15AM	8.45AM
3	13.02.91.	14.02	18.02	12.02	15.02.
	12.50PM	8.45AM	8.00AM	1.05PM	8.05AM
4	21.02.91.	20.02.	26.02	22.02	18.02.
	8.20AM	8.00AM	10.15AM	8.45AM	2.20PM

No differences in language use or behaviour observed in the unrecorded lessons were noted during those which were recorded.

For each lesson to be recorded the researcher arrived in time to go into the class with the teacher, carrying the tape recorder and the microphone concealed in a handbag with just the bulb of the microphone exposed. The recordings were monitored via tiny earphones so that there was as little unusual equipment as possible visible to the teacher or the students.

4.2.5.Field Notes

Detailed notes were taken during all observed and recorded lessons. They included everything which could be seen such as work on the blackboard or very noticeable body language and reference to any words, phrases, jokes and so on which might be difficult to understand outside the classroom. The difficulties faced during the early stages of observing and note making are explained in 4.2.3. By the time recording began these difficulties had been resolved. Notes were also made as to times when the class seemed particularly interested or uninterested and of incidents outside the classroom heard or responded to inside. The tape recorder was switched off when the teacher indicated that they considered the lesson to be finished.

4.2.6.Collection of Background Information

Once each teacher and class combination had been recorded four times, a copy of the recording of one of their own lessons was made as a present to each. This was given to them after they were informally interviewed about where they had been educated, what qualifications they had, what languages they spoke and how they felt about being observed. They were also asked if they had any ideas about the ways in which studying mathematics in a second language might affect learning. This gave some idea of where the discussions planned for phase two might

UNIV DUNELM

begin. Finally each class was visited to collect information about the mother tongue of each child, so as to check that the linguistic composition of each class was as it had been assumed. This was done by asking every child present to write down their name and the name of their mother tongue, that is the language they used at home when talking to their parents and grandparents. If they didn't know the name of this language, and many didn't, I asked them to write the name of the place they thought of as their family home; their "village". I was then able to check the name of the mother tongue spoken in these villages.

4.2.7.Future Plans

Each teacher agreed to take part in the next phase of research planned for September although at this time none could promise to be in the same school for the next academic year. It should be noted that at this time Cameroon was moving into a period of political instability which made everyone hesitant about planning future events.

4.3.PHASE TWO:DATA COLLECTION

4.3.1.Context

At the end of September 1991 all the schools in Cameroon were instructed, by the Ministry of Education, to open as usual although one week later than planned. In North West Province the campaign of civil disobedience, known as Operation Ghost Town, organised by the newly formed political opposition had been in force from April and was still continuing. This meant that from Monday to Friday every week all activities which might generate income for the government were prohibited by popular consent. From the point of view of teachers and secondary school students this meant no public transport on school days and limited access to day to day trading to buy food or to trade, which is how many students usually earn extra money to pay their own school fees at this time of the year.

Some schools in Bamenda opened on time and received considerable publicity in the government controlled national media as examples of institutions not participating in "Ghost Town". On Thursday 26th September 1991 there were several radio announcements issued by the government guaranteeing children's safety on the way to and from school, in an attempt to persuade parents to send their children to school. However at the beginning of the first week of October most of the schools which

had opened, closed again as they were not able to guarantee the safety of their students during lesson time. Two of the schools participating in this study remained open and a third was open but with very few students attending; the fourth closed completely. The number of students attending the schools which did open was very small as many parents kept their children at home either because they were opposition supporters or because they were afraid to defy the opposition sponsored boycott which was now being seen as part of "Ghost Town", enforced by unofficial vigilantes. Members of staff were expected to be in school during working hours (7.30am to 2.00pm).

In the middle of the first week of October an opposition march and rally in Bamenda were declared illegal by the Provincial administration and broken up by large numbers of armed gendarmes. For three days Bamenda was cut off from the rest of the country by road blocks and subjected to an unofficial state of emergency with armed police and gendarmes searching the town for "agitators". No vehicles moved into or around the town and no schools opened. Several young opposition supporters were seriously injured by grenades or killed by guns during this time including two from one of the schools in which I was working. During this time the "education family" was in a state of shock and many people felt that the political situation had now

deteriorated to a point from which civil war was the only possible next step.

4.3.2.Difficulties faced by the Teachers

The teachers were thus facing many dangerous and difficult situations every day. Only one of the teachers involved in this research has his own car so the other four had to walk long distances to get to school or try to find someone who might be driving towards their school at about the right time of the day. They could only shop for food on Saturdays which created difficulties for those who don't own refrigerators. If they or any member of their family were ill they would have to walk to the nearest clinic. For two of them this would take at least an hour and even then they might not be able to find doctors or nurses as they may not have been able to get to work.

In addition to these problems, the teachers in the two fee paying schools were aware that until their students returned and paid their fees they would not receive any salaries. In fact it was November before they received any payment for August and September. This meant that two teachers were also coping with debts to landlords and difficulties in providing for their families throughout most of phase two.

Apart from these practical difficulties a major problem was the constant stress experienced by everyone in Bamenda at this time: no one was sure when the next confrontation might take place nor when the school boycott might become the focus of attention for either side, so tension ran high throughout this period. The school which remained closed (School Four) did so because it is situated in the part of Bamenda where the opposition party has its main office so that all the school's activities were easily noted by the more extreme and potentially violent supporters of "Ghost Town". To go to and from this school from Bamenda town, one had to pass through a road block where personal documents were inspected and all vehicles searched for arms and incriminating papers.

4.3.3.Implications of this context for the activities planned for this phase

As the schools were not open fully and as it was not safe to move around the town by car, from Monday to Friday, the sequence of events planned for this period of research had to be re-organised. It was decided to go ahead with the first teachers' meeting in order to see if the teachers were willing and/or able to continue in the research and if so to discuss how to proceed. It was not possible to make contact by telephone as only one of the schools has a phone and this didn't seem to be working at the time. At this stage it was not clear if the schools

would open at all and/or whether I would be able to move safely from school to school within the next few weeks. However, I was encouraged to persevere with my research by the Provincial Delegate for Education and the school Principals and by the teachers once I was able to make contact with them. Despite all the difficulties presented by the radical changes in the ways in which ordinary people were making their feelings clear to the government, the "wind of change" which was blowing through Cameroon at this time did mean that change was in itself viewed in a positive light. As society questioned traditional ways of organising itself so it became easier for the teachers to question the traditional ways in which they worked.

4.3.4.Negotiating Access.

Immediately after the worst confrontations of this period had ended I was able to meet the Provincial Delegate for National Education in his official capacity and receive his permission to continue my research. He also sent an official message to the teachers via the local radio station requiring them to attend a meeting in the Maths Teachers' Centre without stating any reason. This was to protect me from any suggestion that I was defying the opposition boycott by organising a meeting and to protect the teachers from suggestions that their meeting might be in any way political. Despite this assistance it was still necessary for me to make informal

contact with a representative of the official administration and of the major political opposition party to keep them informed of what it was that I was hoping to do. There were very few foreigners left in the Bamenda area at this time so I was very visible and therefore felt the need to explain myself to both groups.

4.3.5.The First Teachers' Meeting

The first meeting of this phase of research took place on Saturday 5th October in the Maths Teachers' Centre Bamenda. Four of the five teachers came in despite the obviously unsettled situation. In my research diary I wrote; "I can't help feeling that trying to do educational research in the middle of this chaos is a bit odd- I wonder what the teachers think-will they want to maintain a semblance of normality by going on or ..... ?"

Item one on the agenda was a brief summary of the possible areas of interest in the relationship between mathematics and language (see handout number one "Mathematics and Language").

HANDOUT NUMBER ONE;MATHEMATICS AND LANGUAGE

The relationship between mathematics and language is a complex one. Research has looked at this issue from several different points of view.

1. The Language of Mathematics

Mathematics is one subject where the understanding and use of special words, phrases or ways of describing ideas is required. However it is not only this very precise vocabulary which can cause learners difficulty. There are aspects of everyday speech which are essential to mathematical learning including words of attributes; big, long, words of position; on, at, words of comparison; bigger and words of question, who, what, how many. Connectives such as ; but, however, because, and therefore are also very important. There are words which have a meaning in mathematical English and another meaning in ordinary English such as; face, mean and degree. *

2 Language and Thought

Language and thought cannot be separated;

> "The relationship of thought to word is not a thing but a process, a continual movement back and forth ... Thought is not merely expressed is words it comes into existence through them."
> Vygotsky 1962

Thus the language used by both teachers and students plays a vital bridging role between known and unknown concepts. To succeed in mathematics the learner has to mentally arrange and classify lower order concepts in such a way as to facilitate the development of the new abstract concepts of a higher order, this can only be done through the medium of language.

3 Learning Maths in a Second Language eg English

For those studying maths in a second language all the above are true. In addition there are several special difficulties to be considered. There has been much research into the relationship between several languages (mother tongues) and the language needed to succeed in mathematics in English. For example some students might have difficulty in distinguishing between side and edge because one word expresses both concepts in their mother tongue *

The UNESCO conference of 1974 agreed that all cultures have the essential structural elements of language necessary for a mathematical system eg conjunction, negation and quantification. So speakers of different mother tongues will vary in the ways rather than the ability with which they learn to manipulate and use the international symbolism of mathematics. *

4 Readability

The readability of written materials has also attracted a lot of attention and has led many groups to produce guidelines for those writing textbooks, exams or word based problems. eg Austin and Howson;

> "use simple sentence constructions and avoid long sentences ..... introduce only a few new words at a time, avoid conditional clauses and the hypothetical."

5 Language in the Classroom

In the Cockcroft Report (UK 1982) it was suggested that;

> Mathematics teaching at all levels should include opportunity for * exposition by the teacher; * discussion between the teacher and pupils, and between the pupils themselves; * appropriate practical work; * consolidation and practice of fundamental skills and routines;* problem solving, including the application of mathematics to everyday situations; * investigational work." (Cockcroft 1982;71)

in order to facilitate the maximum amount of learning in the minimum amount of time. This means that all maths teachers in both first and second language classrooms should be looking for ways to add techniques to their personal teaching method so as to provide more opportunities for students to use their own language to talk about maths and thus to use language to help them bridge the gaps between known and unknown concepts. *

* = a point to be discussed in the context of Anglophone Cameroon.

This handout was used to show the teachers where my personal interest lay and how it was only a small part of all the possible areas worth exploring. I wanted to avoid spending time during meetings discussing aspects of the learning mathematics/ language relationship which were

not my concern in this study. I used the image of the spokes of a wheel to show how all the areas of interest began in the classroom and were connected to each other in one way or another. During the discussion of the points raised in this handout I returned to some of the points they had made to me during the short interviews I conducted at the end of phase one. This was done to try and maintain a balance between the ideas they had raised and the ideas I was likely to introduce in this and later meetings. We all agreed that students would probably learn maths more easily and remember more if they could talk about their work in English. As the teachers pointed out, the students were unlikely to do this anywhere except in class so I suggested that more language using activities might be integrated into everyday maths lessons. As Brissenden notes;

> "there is wide support, founded on both practice and research, for the view that modifying established patterns of communication can assist children's learning in very significant ways." (Brissenden 200:1988)

The teachers agreed with this in principle, pointing out that the same idea had been raised during various INSET meetings but that the ways of doing this had not been sufficiently discussed.

Following this we talked through the handout "A New Way of Looking at the Language of Maths Lessons."

HANDOUT TWO A NEW WAY OF LOOKING AT THE LANGUAGE OF MATHS LESSONS

Based on the observations of maths lessons made earlier this year, I would like to explain the language of maths lessons in the following way.

Almost all lessons were divided up into four stages; revision of the previous assignment, a new topic worked through on the board, silent seat work sometimes broken up by the extra teaching of a common problem and finally setting the next assignment.

Within each stage the DISCOURSE is divided up into TRANSACTIONS of different lengths each one dealing with one conversational point (similar to a paragraph in writing). Within each transaction there are a number of EXCHANGES where the teacher says something to which the students respond. These exchanges are the basic unit of this type of discourse analysis.

Most exchanges begin with some words from the teacher (an utterance) ; either to TEACH or to MANAGE the class. Although the way different teachers manage their classes is interesting it is outside this project because I am mostly concerned with TEACHING EXCHANGES. Most teaching exchanges are made up of three moves (three utterances).

I (initiate) which begins the exchange

R (respond) in reply to I

F (follow up) which comments on R

In most of the classes I recorded most of the I and F moves are taken by the teacher and vary in length from quite short to very long utterances.

The R moves are almost entirely taken by a student utterance and are often just one or two words. Where there is a longer utterance the students were often reciting a definition or reading something from the board or a book. * The teacher controls what happens in these exchanges via what they say in the I move. That is, whatever they do in the I move creates the opportunity for the student to do some things in the R move and excludes the opportunity for them to do others.

For example; all the teacher utterances made in the I position of the lessons I observed can be grouped as ELICIT, INFORM and DIRECT. An inform is where the teacher tells the class something and a direct is when the teacher asks the class to do something. The most interesting from our point of view (because they form such a big part of all your lessons) are those called elicit ie those where the teacher says something which requires the students to say something in return. These often but not always look like questions. It seems that maths teacher elicits here require the students;

to remember a fact

to remember a process

to apply reasoning

to make a hypothesis

to focus on their language use

to show participation

all except the latter being similar to the maths teacher elicits observed in some native speaker classes.*

All of these types of elicits are necessary and important. The ideas I would like to discuss do not interfere with them. What I am interested in is how we might add to or alter what happens in the I move so as to create more opportunities for more meaningful language use during the R move or leading up to the R move and to consider how to make more use of what is in the F move. Other people's research in Africa and in Europe has suggested that students who talk more about maths as they are learning, learn more and remember more. *

Examples of all the above appear in the extracts from your lessons for us to discuss.

They agreed that their lessons were usually divided into four stages. The only trained teacher present said that the ENS course had laid down this pattern as

obligatory and the others pointed out that they had all been taught in the same way. They pointed out that the stage I called "silent seat work" was usually referred to as "consolidation".

The idea that interaction could be viewed not in terms of isolated utterances but in terms of exchanges, most of which were begun by teachers was of great interest to the group. From my research diary; " They liked the idea and agreed that they were "in charge" of each exchange". The three move pattern, of Teacher INITIATE, student RESPONSE and Teacher FOLLOW UP was illustrated with reference to the patterns observable in the transcripts of their own lessons (see chapter five for details of how these patterns were identified). They were obviously relieved to be reminded that the aim was not to analyse their use of language in terms of correct vocabulary, grammar or pronunciation although less satisfied with the idea that these aspects of the students' language were not the concern of this research either.

They showed interest in the type of exchange which seemed to require students to show participation but not necessarily understanding. They agreed that they all did expect their students to show participation at various times during the lesson. One of the teachers suggested that this habit stemmed from the ways in which an audience is expected to behave during speeches at

meetings or when listening to stories told in traditional settings; the others all agreed.

Having listened to an explanation of the next phase of research and understood that it would entail more meetings, observations and recordings the teachers all agreed to participate as best they could under the circumstances. They said they wanted to have something other than politics and the unofficial state of emergency to think about, thus answering the question I had asked myself in my research diary.(see 7.5.)

A second meeting was arranged, this time on a Sunday afternoon, in the Maths Centre. Sunday was chosen because it was one of the two safer days to move about the town and Saturdays were very busy doing the week's shopping for food, kerosene for cooking, newspapers etc and for catching up on local news with friends from other parts of the town.

It was not possible at this meeting to make any decisions about which classes might be observed as the teachers hadn't yet received their timetables. It should be noted that as the staffing of all schools is completed only when the number of students enrolled is known, final timetables are drawn up after student registration has been more or less completed. This is often two weeks after the beginning of term, a temporary timetable being used in the interim.

4.3.6.The Second Teachers' Meeting

The second meeting took place on Sunday 13th October in the Maths Centre in Bamenda. As noted in my diary, "All five teachers attended our meeting and all seemed quite enthusiastic". They were pleased to receive an envelope folder to keep their handouts in and a small contribution towards the cost of their journeys to our meetings. They also received a letter for each school Principal outlining the plans for this phase of research. This was done in order to make sure that everyone officially involved in the research either as a participating teacher or as part of the authority structure was fully informed, on paper, about the day to day research activities. This was felt to be particularly important as previous educational research had included questionnaires and the collection of statistics, thus the purpose of my classroom observation and discussions with teachers needed to be made transparent.

The handout on aims (see handout three, Aims) then became the focus of discussion. the ideas for this handout grew out of discussions between the researcher, the Adviser and the Provincial Inspector for mathematics. This informal discussion was held to ensure that the INSET conducted as part of this study did not contradict or interfere with the INSET activities planned for the teachers of maths in North West Province. The handout was designed with "gaps" so that the teachers could add notes

from the discussion. However as they chose to make their notes elsewhere this practice was not repeated in later handouts.

HANDOUT THREE; AIMS

The overall aim of the INSET activities this term is to experiment with ways of increasing the opportunities for students to use English to talk about maths during maths lessons. The concern is not only to increase the quantity of language used by the students but also to widen the range of language uses so that there are;

1 more opportunities for students to clarify their understanding of maths terminology

2 more opportunity for students to explain and justify their (right and wrong) answers

3 more opportunities for student to use "exploratory talk" with each other and with the teacher

4 more opportunities for students to practise asking maths related questions of each other and of their teacher.

There will be a maximum of nine teaching weeks available this term and as this is so short it is hoped that you will continue to experiment with your own activities between December and my next visit to Cameroon.

Following a short explanation of each aim the teachers chose first to consider how they might promote activities requiring the use of exploratory talk, possibly because it was the one they found most difficult to understand. They could see from the extracts of transcripts from their own lessons that the students currently had few opportunities to think things through in English by talking and agreed that they "talked to themselves" in English when faced with a difficult mathematics problem. They also felt that they found it impossible to know what was going through a student's mind when they arrived at an incorrect answer and that anything which might help them to pinpoint misunderstandings would be helpful for everyone. Thus although the term "exploratory language" was new to them the ideas behind the term were not. The discussion ranged

from how difficult they would find it to organise group work with such large classes, how to organise group work in such a way that everyone participated rather than allowing one person to do all the work whilst the others just copied, to how to monitor whether groups were working in English or any other language. The teachers felt strongly about this issue. They argued that the students should not use languages other than English in the classroom because the teacher might not be able to understand what the students were talking about and would thus be out of control. As mentioned in Chapter One Pidgin is not thought of as a language in its own right but as poor English so the teachers reported that they would comment on its use and require the speaker to repeat themselves in "grammar", (a standard form of English.) My suggestion that it might be helpful to occasionally use Pidgin or any other common language was met with surprise and disagreement.

It was felt that asking students to talk to each other, in pairs, for short periods of time, would be possible, so the discussion then moved on to how and when the use of exploratory talk could be promoted via pair work activities.

(See handout four for some of the ideas I took along to this meeting. These ideas were collected from various sources. Some came from the teachers themselves during my school based discussions with individuals during phase

one, some came from my own experience as an English teacher and some came from discussion with the maths Adviser and PPI in the Teachers' Centre, Bamenda. This handout was put together so that the teachers would have something concrete to take away with them. It is important to remember that at each meeting we couldn't be sure if/when we would meet again or when schools would begin teaching.)

HANDOUT FOUR; IDEAS

The following is a collection of ideas which will be discussed with the teachers collectively and individually so that they can select those which seem most relevant and possible for them to try. These activities will also be used as a starting point for a discussion of other mathematical activities through which they can work on one or more of the specified aims. It is important to note that none of the techniques should be seen as linked to one topic or one teacher or one class.

AIM:

1 <u>To increase the opportunities for students to clarify their understanding of maths terminology.</u>

Games to begin or end a lesson.

eg twenty questions; teacher whispers a word connected to the most recent topic to one student and the other students have to ask questions to find out what the word is; the teacher can give clues by asking questions

but the player can only respond yes or no. If the class haven't guessed after twenty questions the player tells them the answer and some one else is given a new word.

or are there any similarities between a "this" and a "that" how many can you think of.

or what might this word mean by its sound or the way it looks ? Does it look like any other word you know?

or Teacher whispers a word to a student who then gives one word clues eg I am thinking of a geometric shape; this shape has three sides; and after each clue students may try to guess the word as quickly as possible.

2 <u>To increase the opportunities for students to explain/justify their answers</u>

eg by adding a move to the traditional I.R.F. exchange eg how do you know that after the students' Response. The actual words would have to be chosen by an individual teacher. Students might be asked to tell the teacher directly or explain to their neighbour first (See THINK-TELL-SHARE in 3).

or during quiet seat work the teacher could

talk to students on a personal basis asking questions like "Tell me how you are going to work this one" or "What did you do to get here ?"

or at the end of a lesson with all the books closed and the blackboard clean;with your neighbour plan how you would answer if I asked you, "What have you learnt today ?"

or "Can you think of any examples of what we have learnt today in your own life ?" after a short time students can volunteer to give their summary of the lesson to the whole class.

3 <u>To increase the opportunities for students to use "exploratory talk" with each other and with their teacher.</u>

eg At any stage of the lesson when the teacher has made an elicit in the I move, the class can be asked to THINK of their answer, TELL somebody near them, listen to their answer and SHARE their answers with the class and with the teacher

or The teacher can experiment with various ways of accepting a R move so that students feel they can "try out" answers ie the

teacher can try following up a response in ways which encourage the speaker to keep going or to explain again in different words.

or any other ways of giving the students a chance to rehearse their ideas before asking them to speak to the whole class.

4 <u>To increase the opportunities for students to practise asking maths related questions</u>

eg at the beginning of a lesson working in pairs the students take it in turns to ask their neighbour a questions and then answer one of theirs about the work which was completed in the previous lesson. They should be prompted to ask questions beginning what do you remember about ..... ? Tell me what you learnt yesterday (but in words appropriate to the students) The teacher can listen to these questions and answers and note any interesting questions to ask the whole class at the end of the exercise.

or at the end of an explanation about a new topic or the revision of a previously taught topic everyone is asked to write a question in the back of their exercise

books, they then show the question to their neighbour and discuss it while the teacher looks at some questions and chooses those which s/he wants to answer en masse. The other questions should be looked at again on an individual basis.

or each teacher should decide on the words and phrases they would be happy to hear from the class when they would like more explanation or information. eg "Please sir can you explain that again?" or "Excuse me madam I don't understand what you mean by ..... " The teachers should also decide on the words they will use to reply to such student I moves productively.

NB ALL THESE IDEAS ARE STARTING POINTS FOR OUR DISCUSSION YOU DON'T HAVE TO TRY THEM IF THEY DON'T SEEM USEFUL TO YOU.

Teacher Three suggested that a class could be asked to do a problem and then compare their work with each other and explaining and defending their answers, this being contrasted with the idea of setting a problem for a pair of students to work on co-operatively, in terms of the different sort of language required. Teacher One

suggested that teachers could "think aloud" whilst working things out on the board and that students could be asked to do likewise when asked to come to the board to work through an example.

The second aim to be discussed at this meeting was that referring to "asking students to explain and justify their answers", regardless of whether they were right or wrong. The discussion initially revolved around Teacher One's argument that there wasn't any point in asking Form One students to explain in English because they didn't know how to do it. Other teachers thought that they would learn to explain better if they had the opportunity to do so; the meeting then moved on to consider what exactly the teachers would have to say in order to promote this kind of student language use and how they could support their students as they struggled to express themselves in English.

I suggested that the teachers might like to consider experimenting with various ways of following the typical IRF pattern of the teaching exchange with something else. For example to I R new I (labelled I2) for example; why? how do you know that ? and the teachers suggested they could also try (in I2) where has that come from ? tell me how you got that ? This might be done publically during whole class activities or more privately with an individual talking to a teacher whilst the rest of the

class is working on their own. The teachers agreed to consider these ideas further before the next meeting.

I offered the group four options for the continuation of our work; to abandon the research, to meet individually so that they could remain in school and I would travel to them, to wait a week or two until things had settled down and then meet again or to meet again next week. The teachers chose to attend a third meeting a week later to finish the discussion of the aims collected in the AIMS handout and to bring any ideas they had about how to experiment with ways of encouraging more student language during their lessons.

At this point I gave out an observation sheet I was considering using; (see handout five) both for when I was observing them teaching and when they were recording their own observations about their teaching. They seemed a bit unsure about how they might use it themselves but agreed to look at it in detail before the next meeting.

HANDOUT FIVE; SELF OBSERVATION

Use this chart to record one lesson in which you tried to introduce a new techniques.

Date; Time; Class;

Which of the aims we have discussed were you thinking about when you planned this lesson?

How did you use it?

What was the techniques or activity you wanted to use?

How did you use it?

What happened?

What comments would you like to make on the aim, the techniques, or what happened during the lesson?

As a result of this lesson what would you like to discuss with the rest of the group

---

At this time the opposition were still asking supporters to boycott activities from Monday to Friday but as the government had begun to make minor concessions the tension had eased a little and legal rallies and marches had begun again. The numbers of students going to school was increasing a little every day but as the media had reported that a High School had just been burned to the ground in Douala, many parents were still very

nervous about letting their children attend. However as most students in other parts of the country had returned to school the older students felt that they were putting themselves at a grave disadvantage in terms of O'Level and other National exams. Between 15th and 18th October,I managed to visit each of the four schools in this project, mostly to match the teacher's commitment and to keep the Principals personally informed about our work so far and to see if it was possible for the research project to continue in their school. It took several days before timetables could be finalised although three of the five teachers did know exactly which classes they would be teaching during the next week.

4.3.7.The Third Teachers' Meeting

The third meeting took place on Sunday 21st October in the Maths Teachers' Centre, Bamenda. Teachers Three, Four and Five came on time.

Teacher Five began by saying that he'd been looking through his scheme of work for this term trying to see how and when the ideas about language that we had discussed last week could fit in. He felt that there weren't any opportunities for more language use in some topics; "because there isn't anything to discuss." The other teachers agreed in principle although the topics they named were various. We agreed that perhaps imagining huge changes was unwise and that just considering how

small changes might be made in the words used when eliciting language from the students would be enough.

During the ensuing discussion the teachers all discussed the ideas they had since the previous meeting. They had considered several game-like techniques eg a form of twenty questions and ways of trying to get students to explain their understanding of terms or ideas in written tests. It was agreed that if using language became something that a student could earn marks for, more students would be encouraged to participate verbally. One idea which emerged from an article collected from the Maths Centre was THINK-TELL-SHARE, whereby a teacher asks a question, tells the class to think of the answer, tell their neighbour and then decide how they might share their answers with the class. This increases the amount of time each learner has to use exploratory language with their neighbour before having to use final draft speech for their public answer. According to the notes I made during this meeting I felt my role was mostly; " to keep nudging them back to language use issues" in order to keep our attention on the agreed goal which was to experiment with teacher language use in order to promote a wider range of student language-using activities.

At the end of the meeting it was agreed that everyone would begin teaching as soon as possible and would try to be "language aware" when planning and

teaching. One issue that the teachers felt was important was how to teach students to ask more maths related questions. It had been previously agreed that students found this very difficult and at this point the teachers seemed to be expressing the need for advice. I suggested that they could decide for themselves the form of language that they would like the students to use to begin a question and then dictate it to the students at the beginning of term so that it was written on page one of the students' exercise books with any other rules they wanted their classes to note. This didn't seem to be a useful idea for them as they felt that it was the work of the English teachers to make decisions about correct English and to teach it to their students.

4.3.8.Lesson Observation

The observation of lessons in this phase of the research began chaotically as the teachers' timetables were altered two or three times a week. Teacher One had a firm timetable quite quickly and invited me to attend the one double lesson he had with a new Form One class as he intended; "to use a lot of practical work in the second half of the lesson." I felt that this continues to marginalise language using activities but as at this time I was already trying to develop a non-judgemental observers' role I accepted his invitation for the first two weeks.

On visiting Teacher Three I discovered that the school was about to be transferred from the Primary school in which it had operated for a year to a new site because they no longer had enough classrooms to cope with their new entry. This meant that everything had to be moved about three kilometres by the students themselves, on foot, so that teaching couldn't begin immediately. By the time I visited Teacher Four and Five they had begun teaching and had already begun experimenting with the type of exchange which began "How do you know?" Their comments were that the students didn't know what to say so time was wasted while the teacher explained the idea. They planned to continue experimenting acknowledging that the first attempts to use a new technique are always likely to be time consuming. Teacher Five had also given as an assignment the task of coming to class with one or two questions about the previous lesson in mind ready to ask another person in the class.

The teachers agreed to try and complete a self evaluation sheet after every lesson in which they were being consciously "language aware".(see handout five above)

4.3.9.Selection of classes

The teachers selected the classes they wanted me to observe taking into consideration that I did not want to interfere with the teaching of the classes in the Upper

School, particularly as they had missed so many lessons and would thus be finding it difficult to complete the scheme of work before the exams.

Teacher One chose a new Form One class because that was the only lower school class he was teaching. Teacher Two asked me to continue watching the class I had observed in March which was now Form 2G. A similar request came from Teacher Three although she pointed out that there were several new students in this class as a result of transfers and that some of these students were a long way behind in the syllabus.

Teacher Four wasn't allocated any Forms One or Two for this academic year so suggested that his two classes of Form Three were both watched because one (3B) was quite large (ninety) and one, the Commercial class (3COM) was quite small (forty eight). Finally, Teacher Five, offering the same reasons as his colleague suggested I observe two of his Form One classes because 1A included ninety eight students whilst 1COM had only forty eight. Thus I had seven classes to observe, three in Form One, two in Form Two and two in Form Three; two having been followed from the beginning of 1991; three at the same level as those recorded earlier in the year and two others.

Having agreed this the teachers were left alone for a week as I felt they needed to see their classes for a

few lessons without any distractions. They were all under extreme pressure at this time as, in addition to the on going political turbulence, each school requires each teacher to complete several documents about what they propose to teach in the coming year within a few days of receiving their timetables.

When observations began it was decided to adhere to the general pattern of a) meeting the teacher before the lesson to discuss what areas of our discussion they were interested in, b) observing the lesson to see if I could see any evidence of the above, c) watching for any opportunities where student language could have been exploited and d) discussing the above points with the teacher afterwards.

At this stage I still intended to fill in an observation sheet for every lesson to use in the post lesson discussions.

4.3.10.Observations

Once the observation period began it became obvious that the guidelines I had given myself were unsuitable because they encouraged the teachers to think about me and what they thought I might be looking for rather than on what they wanted to do. The idea of asking the teachers to tell me what they might be doing was dropped and I tried to develop a more non-judgemental role where I recorded any examples of student language use and

instances where students could have been asked to contribute but weren't.

At the end of each observation I didn't discuss any of the notes although I did sometimes ask questions about the lesson's topic. Usually I just thanked the teacher and indicated when I might come again. As part of the aim at this point was to enable the teachers to feel relaxed when I was in their class I watched them teaching both the class selected for observation and others.

4.3.11.Further Observations

During the week beginning Monday November 4th I observed each teacher at least twice. I saw instances of attempts at small group work, a class being encouraged to ask questions by the teacher asking the students some sample questions and then asking the class to ask him similar questions and finally the class asking each other questions. Another class tried the THINK-TELL-SHARE technique (discussed at the last teachers' meeting) and three teachers introduced questions requiring an answer in words into their mid term tests.

In one class I saw a clear example of how a half understood word can cause a problem. Students had been asked to measure an angle and many tried to do this using a ruler. Apparently they did not associate the word "measure" with a protractor only with a ruler.

Teacher Three was taken ill at this point and was absent from school for nearly three weeks.

Following several of the observed lessons I stayed in school to sit with the teacher in a less focussed, social way and found this to be very helpful as it was often during these chats in the company of their colleagues that the teachers began to discuss their feelings about teaching, classroom discipline, the purpose of education and so on. Because I felt it was both informative and a simple way of allowing the teachers to become less shy with me I began to arrange my observations, in each school, to follow or precede either a break time or a free period for the teacher I was there to observe.

Figure 6.Summary of Teacher Observations in Phase Two

TEACHER1	2	3	4	5
5.11.91.	4.11.	7.11.	4.11.	1.11.
1E	2G	2B	3B	1C
9.10AM	8.00AM	9.30AM	10.15AM	8.30AM
12.11.91.	6.11.	7.11.	4.11.	1.11.91
1E	2G	2A	3COM	1COM
9.10AM	8.00AM	11.30AM	11.35AM	9.30AM
19.11.91.	6.11.	5.12.	11.11.	8.11.
1E	4G	2C	3COM	1C
9.30AM	8.50AM	8.00AM	11.35AM	8.45AM
26.11.91.	11.11.	5.12.	18.11.	8.11.

1E	2G	2B	3B	1COM
9.10AM	8.00AM	9.30AM	10.15AM	9.30AM
	13.11.91.	10.12.	18.11.	15.11.
	2G	2B	3COM	1C
	8.00AM	8.00AM	11.35AM	8.45AM
	18.11.91.		27.11	15.11.
	2G		3B	1COM
	8.00AM		10.15AM	9.30AM
			27.11.91	19.11.
			3COM	1C
			11.35AM	11.35AM
				28.11.91
				1COM
				10.15

4.3.12.Interviews with Principals

During the week beginning Monday 11th November all four school Principals were interviewed, partly to check the facts and figures collected in March and partly to give them the opportunity to ask me any questions about the research. The only question asked in each school was whether or not I thought the teacher was teaching well. In each case I side-stepped a direct reply by saying that it depended what exactly they meant by "teaching well" and that from the point of view of this research I was very happy with what I was seeing.

4.3.13.Recording

During the last few days of November the tape recorder was taken into each of the classes involved in the research and "dummy" recordings made. The classes who were recorded earlier in the year paid no attention at all, the new big classes were curious for the first part of the lesson but as only a small number of students could see the equipment the overall effect was limited. In the two smaller Commercial classes the students were obviously curious so I visited their classes more often than I had originally planned so as to allow them to be come accustomed to the presence of an observer with a tape recorder.

At this point it became obvious that trying to record all the verbal interaction taking place in every lesson would be difficult with one omnidirectional microphone. This was because as teachers began to include more student - student interaction there were times when many people were speaking at once. This issue will be returned to later in the comments on phase three and in chapter nine.

Recording commenced on Monday 2nd December and was completed, except for the teacher who was ill, by Tuesday 10th December.

Figure 7. Summary of Lessons Recorded in Phase Two

TEACHER	1	2	3	4	5
	3.12.91.	4.12.	12.12.	2.12.	3.12.

1E	2G	2B	3B	1C
9.10AM	8.00AM	9.30AM	10.15AM	8.30AM
			2.12.91.	3.12.
			3COM	1COM
			11.35AM	1.05PM

4.3.14.Fourth Teachers' Meetings

The purpose of this meeting was to sum up the term's work and to decide how the teachers would monitor their own teaching during the second term.

A new self observation sheet was designed taking into account comments made by the teachers about handout five. The new format was accepted and all the teachers agreed to try to fill in at least one such form each week next term, leaving them with the secretary in the Maths Centre for me to collect on my return. (see handout six).

At the end of the meeting I raised the topic of notes on the blackboard with reference to the ways in which teachers had been allowing incorrect notes to be left in students' exercise books. I did this with some reluctance only because I was specifically requested to do so by one of the school principals. I recognised that by doing so I was stepping out of my previous non-judgemental role but felt that at this stage of the intervention process I could do so. After some discussion during which the teachers resisted all suggestions that they should collect in these books to correct the notes

it was agreed to ask the Mathematics Adviser to address this issue in INSET meetings next term. I realised afterwards that I should have done this without raising the issue in this meeting.

HANDOUT SIX;

PLEASE TRY TO FILL IN AT LEAST ONE OBSERVATION SHEET EVERY WEEK OF THE SECOND TERM AND SEND IT TO THE MATHS ADVISER

NAME; DATE;

CLASS; TIME;

When you were planning your lesson were you thinking about any of the language aims we have discussed, if so which ones ?

What were the techniques or activities you wanted to use?

How did you use them?

What were the exact words you used to organise this activity?

What happened during the activity?

What did you notice about the students use of language? Either what they actually said or the way they behaved during the activity?

As a result of this activity is there anything you would like to discuss with me or with the group next term?

Thank you very much for your help. See you next term.

4.3.15.Final Meeting With Individual Teachers

During the last week of this phase I arranged to meet each teacher individually to ask them how they each felt about being observed and whether or not they felt they had altered the way they elicited language from their students. Each short meeting was different as it appeared that each teacher sought to tell me what they thought I wanted to hear. Two points of interest emerged.

Firstly that the teachers had all found the presence of an observer who did not criticise quite stressful for the first three weeks. They had felt that I was probably judging their teaching but just not telling them so I showed them extracts from my notebooks, based on their

own lessons so they could see how I had been trying to record what I saw without making comments on whether or not I liked the way they were teaching. After about three weeks this feeling had subsided and they all reported that after this they had often forgotten that I was in the classroom. In future research it might be useful to discuss such field notes with the participants much earlier in the intervention process.

Secondly it seemed that one of the perceived advantages of increasing the amount of student language use is that the teacher will have to do less work; ie if a student finds something difficult and the teacher asks another student to explain it, this helps the teacher to have a rest!

One other point of interest was that teachers four and five, working in the same school reported that they had found talking to each other about the changes they were trying out helpful. This was both in terms of reviewing strategies they had tried out and also discussing the possible consequences of ideas before they were tried out. This peer support was unexpected because as is mentioned earlier in this chapter I had not expected to have two participating teachers in one school.

4.3.16.Completion

Fortunately at this point Teacher Three returned to school so I was able to complete my observations and recordings with her as well as discuss her feelings about the research. Like the other participants, she felt it being observed had been a positive experience, explaining that this was because it motivated her to be innovative eg with group work which she was now using at the end of all her double periods. She reported that she felt more confident trying new things when I was in the classroom because if something didn't work she would be able to discuss it with me afterwards. This was the clearest explanation of one way in which observation had a positive effect on classroom practice. This phase of research came to an end on December 15th 1991 in time for the teachers to concentrate fully on the writing and administration of end of term tests.

4.4.PHASE THREE:DATA COLLECTION

4.4.1.Purpose

The third and final phase of the research took place in April 1992. The purpose was to follow up the teachers who had been observed earlier to see if they had continued to experiment with different strategies of eliciting language from their students and to see what sort of strategies they might choose to use when observed.

4.4.2.Negotiating Access

On Thursday 2nd April 1992 The Provincial Delegate for Education was approached for permission to continue with the research. Permission was granted so the Principals of each school were visited and permission from them granted too.

4.4.3.Observation

Given that all the classes had been observed for a term at the end of 1991 and two classes had also been observed for a term earlier in the year, a long period of observation wasn't necessary. I arranged to observe each class at least once during the week beginning Monday 6th April. Teacher five made a request that I observe a different Form One class this term as the one I had

observed before Christmas was now being taught by a student teacher. He reported that he had been experimenting with his language use in all his classes so I agreed. I had collected a small number of self observation sheets from the Maths Adviser, I took these to the teachers individually and used them as the starting point in an initial discussion to link phase two to phase three. They had all found self observation difficult and teacher two had not felt able to fill in any of the sheets.

Figure 8.Summary of Teacher Observations in Phase Three

TEACHER 1	2	3	4	5
	08.04.	06.04.	07.04.	09.04.	06.04.92
	1E	2G	2B	3B	1COM
	8.00AM	8.00AM	8.20AM	8.50AM	1.05PM
		08.04.		14.04.	09.04.92
		2G		3COM	1A
		8.00AM		1.50PM	10.15AM

By the 9th April I wrote in my research diary; "It seems that none of the classes are worried by my presence so I think I can just go ahead and record as from next week- certainly the two classes who have seen me coming and going for such a long time."

4.4.4. Recording

The recordings in this phase were made via the same process as those in phases one and two. However, as

mentioned earlier the method proved to be less successful during this phase than it had previously. This was because the teachers were encouraging their students to talk to each other and this pair or group work discourse could not be captured in recordings made by one omnidirectional microphone with a static location. However all the teacher-student interaction was recorded and as this made up the greatest part of every lesson useful data were collected.

Figure 9.Summary of Lessons Recorded in Phase Three

TEACHER	1	2	3	4	5
	21.04.	15.04.	14.04.	16.04	15.04.92
	1E	2G	2B	3B	1A
	9.10AM	8.00AM	8.00AM	8.00AM	10.15AM
			20.04.	21.04.92	
			3COM	1COM	
			11.35AM	1.05PM	

4.5. COMPLETION

Once the recordings had all been made I arranged a social event for all the teachers to mark the end of the research. They all felt that they had made changes to their classroom language during the research period, particularly teachers Three and Four. I agreed to let each teacher have a copy of whatever I finally wrote about their lessons and that a copy of my thesis would be placed in the Maths Teachers centre for permanent

reference. The teachers repeated that they were quite happy for me to use the names of their schools and their own names if I needed to do so.

Following this meeting I visited each Principal to thank them for their support and to leave a letter showing that my research was now finished so that their school records would be complete.

The Provincial Delegate for National Education requested that he be shown a copy of the thesis before it was presented to the Maths Teachers Centre and reminded me of the need to send a report to the Ministry of Higher Education and Research to declare that my research had been completed successfully.

In this chapter the details of the period of fieldwork has been described. Attention has been drawn to the context in which this study was completed and the ways in which this influenced the planned data collection procedure.

CHAPTER FIVE

CREATING A THEORY

INTRODUCTION

At the end of each phase, data were available in the form of audio recordings, notes (made during lesson observations) and notes from discussions with the participating teachers. The recordings had to be transcribed so that the verbal interaction between students and teachers could be analysed. As explained in chapter four a model of these patterns of verbal interaction was to be raised from the phase one data as a grounded theory and discussed with the participants during phase two. A composite model was to be built up to describe all the verbal interaction observed in the lessons of the five teachers who participated in phase one. This was done to provide a complete picture of the interaction between teacher and students in the five classes selected to represent the four most common school situations in North West Province. (See 4.1. for details) However, in order to be able to observe changes in the teaching strategies of individual teachers it was thought necessary to describe which parts of the composite model were observed and recorded in each individual teacher's lessons. These individual descriptions appear in chapters six, seven and eight with details of how the patterns of interaction changed during phases two and three. Also

included in these chapters are details of the student/teacher exchanges which are headed by a student elicit.

5.1. TRANSCRIBING RECORDED LESSONS

There are many possible ways to transcribe language data ranging from the "minimally helpful to the complicatedly tedious" (Edwards and Westgate 1987:58).

It is important to be mindful of the fact that transcripts are best viewed as an accompaniment to the recordings themselves and not as first hand data and that transcribing is in itself the beginning of the classification process;

> "The researcher's highly problematic task remains therefore that of devising ways of capturing and displaying for analysis in the first place, enough evidence from the relevant channels of communication for the observers' interpretations to approach the reliability of those originally made by the participants and upon which they acted." (Edwards and Westgate 1987:70)

Noting Milroy's reminder that "transcription of any kind is invariably a selective process, reflecting underlying theoretical goals and assumptions," (Milroy 1987:117) the conventions adopted were those which would provide transcripts revealing the interaction between teacher and students as clearly as possible and thus be most useful in the search for the answers to the research questions listed in Chapter Two.

5.1.2. Conventions used in transcripts

It was decided to create transcripts which had line-numbered text showing turns taken and including all the words and pauses heard. Words were spelt in a standardised form regardless of idiosyncratic pronunciation rather than using phonetic transcriptions of individuals' realisations, following the advice of Atkinson (1992:28)

> "If one represents a great deal of speech in non standard spellings, then the reader will likely find it barely intelligible, though it may be comprehensible in its original form. Further an over-liberal use of non standard spellings can create a negative typification of the character in the text."

Punctuation and capitalisation were excluded, to avoid the researcher imposing her own understanding of structure on the language used by the students and the teachers. Pidgin words were spelt as they were heard using English spelling conventions, there being no standardised orthography for Cameroonian Pidgin as yet.

The teacher's turns were identified by T, an individual student's turn by ST, a group of students speaking at the same time but not in chorus by STS and by a group of students speaking in chorus by CH. Although individual students were not coded separately, partly because it was not felt to be necessary for this piece of research and partly because in such big classes it was very difficult to identify individuals, a code of SST was

use to show when a student maintained an interaction by taking a second or even a third turn after the teacher had spoken. On some occasions an outsider's voice could be heard and this was coded V. This was usually a visitor to the class for example with a message for a particular student. Utterances were assumed to continue from one numbered line to another unless a new turn was marked.

Pauses were marked in three ways. A short hesitation was marked by three dots ... . The exact length of these hesitations vary from teacher to teacher as they are heard in relation to the speaker's speed of speech. This type of hesitation appears either to separate units of meaning within an utterance,(see example below) or when the teacher is writing or reading off the blackboard.

eg Teacher One Tape One Line 295 (T1T1L295)

295 T let's go to number two ... you are supposed to
296 find q if a is seventy ...

Although the typical pattern is one pause before the speaker continues, at other times the teacher remains silent for longer. If the pauses continued for over one line of transcript as happened when the teacher had asked the class to do something silently before answering this was marked at the end of the line by ... ... > and an extra space put in before the next line of text. For example;

Teacher Three Tape Two Line 479 (T3T2L479)

479 T two a another example five ab divide by a five

480 ab divide by a ... ... ////////////// you start

481 writing ... ... five ab divide by a ... ...

482 ... ... >

483 ////////

In cases where the pause followed an utterance said with a rising tone it was marked * because it was a pause repeatedly used as if it were a word requesting a student response. For example;

Teacher Five Tape One Line 177 (T5T1L177)

177 T the

178 second point b is negative two ... negative two

179 ... negative two for x and negative two for *

180 CH for y

181 T for y

Inaudible contributions are marked in two ways; ////////////// (see above for an example) broken into shorter sequences if more than one speaker is involved, or the utterance is not continuous eg //// //// ///// ///// .

Finally if two utterances occurred at the same time they are marked by [around the first sound of each. For example;

Teacher Four Tape Two Line 59 (T4T2L59)

59	T	if that is a str straight
60		line sum of angle is equal to one hundred and
61		[eighty
62	CH	[eighty

5.1.3. Sample passages to illustrate the above conventions

Teacher Three Tape two beginning line 100 (T3T2L100)

101	T	if we expand six b to
102		the fourth power what will be //////////
103	STS	b times
104	T	b to the fourth power ... you
105	ST	b times b times b times b times

Teacher Five Tape four beginning line 234 (T5T4L234)

234 T is a kite a

235 a parallelogram

236 STS no

237 T have an answer /////// ah

238 ST no

239 T no why ...

240 SST because they meet ... ... because the four

241 sides meet

242 T because the four sides ...

243 CH meet

5.1.4. Additional Notes

It was assumed that the language data would speak for itself. That is, the transcripts would include little if any explanation of the non-verbal components of teacher-student interaction or additional descriptions of what might have been seen but not heard during the lesson eg blackboard work. Although field notes had been made during each lesson observation these were not to be included within the language text itself but were to be added to the transcript numbered with the same line number as the spoken text requiring further explanation. This was to be done at the beginning of each transcript in the form of a glossary. This was found to be necessary in only a small number of cases, mostly those where a word or phrase with a specifically Cameroonian meaning

had been used and required explaining in English. No details of what was happening were included, not because the non- verbal components of interaction are without value but because these transcripts were being prepared for use in the analysis of the verbal interaction only.

To facilitate the use of the recordings and the transcripts together, each page of transcript ends with a note of the tape recorder revolution counter number.

Although extracts from these transcripts are used to give examples of the descriptive analytical model later in this chapter and in chapters six, seven and eight, all the transcripts of all the recordings made, are available in the appendix so that the representativeness of extracts can be verified by other researchers.

5.2. CREATING A DESCRIPTIVE ANALYTICAL MODEL

The lessons which were recorded and transcribed during phase one (January to March 1991) were analysed in terms of the verbal interactions between the students and the teacher. As no appropriate existing model was available, it was necessary to build up a model by close analysis of the tapes and transcripts.

The procedure reported by Sinclair and Coulthard in 1975 was used as a starting point. In an attempt to account for the discourse of lessons they had begun their

analysis of transcribed lessons by looking at the smallest unit of discourse first;

> "To avoid the danger of confusing pedagogic with linguistic structure we determined to work upwards from the smallest linguistic unit" (Sinclair and Coulthard 1975:20).

In this way they built up a hierarchical system of ranked units which finally described each lesson completely. They established that a basic unit of interaction was the EXCHANGE a three phased interaction begun and ended by the teacher's Initiation and Feedback with a student or a group of students speaking in between (Response). This three move pattern appeared clearly during the first tentative examination of the Cameroonian schools data and thus was integrated into the model.

Another set of Sinclair and Coulthard's (1975:28) terms was used after an initial survey of the data indicated that it would be useful. Their assertion that all the language used by a teacher in Initiating moves could be classified in one of three ways proved to be true. That is they were either an INFORM, an utterance which conveyed information but which did not require the students to respond verbally or non verbally, a DIRECT which requires the students to respond non verbally, or an ELICIT which required the students to respond verbally.

The first stage in the analysis of these data was to take one transcript of one teacher (the first lesson

recorded, which was with teacher four) and isolate all the language used by the teacher in Initiating moves. As the aim of the analysis was to describe patterns of teacher-student verbal interaction, in such a way that the description could be discussed with the teacher-participants, all the teacher informs and directs were separated and excluded from the analysis because they did not lead directly to student responses. Thus all the elicits and the student responses which followed were noted. Within the exchanges headed by a teacher elicit it was observed that there were two distinct classes. Firstly there were exchanges which communicated a message about mathematics and secondly there were exchanges which communicated a message about the management of the lesson. As the focus of this study was specifically verbal interaction with a mathematical message, the latter were excluded from the process of theory building at this point.

Thus those teacher elicits heading exchanges with a mathematical message were then grouped together according to intuitions about their similar internal linguistic structure. That is, each elicit and its response was examined and compared and contrasted with others. Its function and its form were used to guide the researcher towards a loose grouping of utterances which seemed similar. These groupings were then checked and rechecked until it seemed that a firm classification could be described. A preliminary description of each group was

then made. This process was then repeated with the other phase one recordings for the same teacher.

This preliminary classification taken from the data collected in teacher four's lessons was then put to one side and the process repeated with data collected in the lessons of the other four teachers looking at the data from one teacher at a time.

Once there was a classification of elicits made by teachers in the Initiating move of maths teaching exchanges it became necessary to define the typical form of a group.

To ensure the fullest possible picture of verbal interaction, the ways in which students elicited language from their maths teacher were collected and classified separately but following the same procedure as above, that is beginning with one the student elicits in one lesson and building up a picture from there.

The ways in which students elicited language from their teacher were thought to be important for two reasons. Firstly, during lesson observations it was clear that students rarely elicited information from the teacher by asking a question even when asked to do so by the teacher. Secondly, during the earliest discussions with the participating teachers they reported feeling frustrated by the students' refusal or inability to ask

questions about points which they didn't understand. Teacher one felt it was impossible for Form One students to ask questions because they didn't know enough English at this stage (recorded in my research diary on October 13th after I asked the teacher to air his views for the benefit of all participants). Teachers three and four felt that it was unrealistic to expect young students to ask direct questions in class because this was too far from the ways in which they had been allowed to behave at Primary school or at home where they had learnt by watching and listening. They reported that young children in the Bamenda area do elicit information from their seniors but not by asking direct questions. The strategies used include showing the senior person something and waiting for them to accept it or advise as to how it might be done better. Or they may elicit information from a peer or someone just a little older in a similar way. These points were raised on several occasions, often during informal discussions before or after lesson observations, and led to my decision to note the ways in which students elicit language with a mathematical message from their teachers during lessons so that this information could be used as the basis for further discussion during phase two.

Thus the data which were selected for the next stage of analysis were made up of exchanges headed by teacher elicits with a mathematical message and exchanges headed by student elicits. As the very nature of an elicit

presupposes a response, the classification system includes reference to the typical response elicited.

5.3. THE MODEL

In this section the term "model" is used to refer to my systematic, descriptive representation of the patterns of teacher-student verbal interaction, described in linguistic terms but kept at a level of complexity which was appropriate to its use as an instrument of INSET with the participating teachers.

This model identifies all the teacher elicits with a mathematical message as belonging to one of seven classes. Each class has characteristic features in terms of linguistic form and the students' responses. No typical forms belong to more than one class of elicit.

This description defines all the possibilities observed in the data collected in Phase one. Details of the exact forms used by each teacher with extracts from the transcripts of their lessons appear in Chapter six.

5.3.1.Type one teacher elicits

Type one elicits appear in the transcripts of all five teachers' lessons. They are typically all questions

in which the teacher asks the students to provide information.

Type One A elicits include an interrogative word such as "who", "what", "why", "where", "which" and "what" and a phrase which identifies the information required by the teacher. The interrogative word may appear before this phrase or after, the whole question occasionally being followed by the teacher giving the answer. The teacher may also nominate a student to answer the question before or after the interrogative word and occasionally give the class a clue as to where to look for the answer.

(CLUE)+(NOM)+WH-WORD+INFO REQUIRED+ (NOM)+
(CLUE)+(ANSWER)

Teacher One Tape One line 31 (T1T3L31)

31 T what is their value they are the same use an appropriate word appropriate word or

(CLUE)+(NOM)+INFO REQUIRED+WH-WORD+(NOM)+ (CLUE)
+(ANSWER)

Teacher Two Tape Two line 282 (T2T2L282)

282 T ... um so you have that three x is equal

283 to what [forty seven

284 CH [forty seven

Type One B elicits include a question, that is an utterance seeking information, formed by the use of the auxiliary verbs; "can", "has/have","do/does/did" and "is/are" and a subject/verb inversion preceding a phrase indicating the information sought. As in type One A the utterance may include a nomination of the student required to answer and or a clue as to the location of the answer.

(CLUE)+(NOM)+AUX+SUBJECT+INFOREQUIRED+(NOM)+ (CLUE)

Teacher Three Tape Three Line 243 (T3T3L243)

243 T you how do we solve this one ... ...

5.3.2.Type two teacher elicits

This type of elicit which is used by all the teachers recorded is characterised by the use of a statement plus a question tag ending .

The form Type two a is typically a short positive statement that is an utterance conveying information, followed by a shortened

yes-no question containing an operator a negative particle and a pronoun which repeats or refers back to the subject of the statement. The typical response is in the affirmative.

POSITIVE STATEMENT + NEGATIVE TAG = AFFIRMATIVE RESPONSE

Teacher One Tape Two Line 208 (T1T2L208)

208 T now the supplement we got the supplement when
209 you took eighty and subtracted the other angle
210 from it that's what you did isn't it
211 CH yes sir

There is another form Type two b which includes "not so" acting as a tag even though it does not appear in the form as defined above. This usually appears following a positive statement but twice appears following a negative statement in Teacher Three's lessons. In all cases the student response is in the affirmative.

POSITIVE STATEMENT+NOT SO = AFFIRMATIVE RESPONSE

Teacher Two Tape One Line 138 (T2T1L138)

138 T eleven is equal to eleven not so

NEGATIVE STATEMENT+NOT SO = AFFIRMATIVE RESPONSE

Teacher Three Tape One Line 72 (T3T1L72)

72 T we cannot subtract unlike terms so three r and
73 eight are not like terms not so
74 STS yes madam

5.3.3.Type three teacher elicits

These elicits are characterised by a word identifiable as a specialist mathematics term, often but not always connected with a mathematics operation (addition, subtraction, multiplication or division). There are two varieties;

Type Three A elicits are typically in the form of short complete statements which are responded to as if they were yes/no questions although they don't contain an interrogative word or a subject/verb inversion to indicate that the teacher is asking a question.

INFORMATION+MATH OPERATION WORD+INFORMATION+
PHRASE WHICH COMPLETES STATEMENT= YES/NO

Teacher Five Tape One Line 88 (T5T1L88)

88 T you add four you see you add four to this
89 negative four plus four is zero ...
90 CH yes sir

Type Three B elicits are typically in the form of an incomplete statement of fact which the students respond to by supplying the missing piece of information as if the elicit were a question. This class excludes utterances including an interrogative or a subject verb inversion.

INFORMATION+MATHS OPERATION WORD+PHRASE WHICH DOES NOT COMPLETE STATEMENT=MISSING INFORMATION

Teacher Four Tape Three Line 492 (T4T3L492)

492 T two times five is

493 CH ten centimetres

5.3.4.Type four teacher elicits

This class of elicits are in the form of questions to which the students respond either "yes" or "no". There are three varieties;

Type Four A These elicits are characterised by a positive statement of factual information plus a short positive utterance which functions as a yes/no question. The form of this checking type utterance varies from single word utterances eg "eh" or "uh","right" to utterances including a subject verb inversion eg "am i right" to

statements which require the students to agree eg "then i can go ahead."

POSITIVE STATEMENT+WORD OR PHRASE REQUESTING CONFIRMATION=YES

Teacher One Tape One Line 65 (T1T1L65)

65 T uh hu that says its the angle b a and b are
66 adjacent angles because they have a common they
67 share a common line ... do you like that
68 CH yes sir

Type Four B This is a very small class of elicits. The typical form is a negative statement followed by a positive yes/no question such as,"is that clear".

NEGATIVE STATEMENT+PHRASE REQUESTING CONFIRMATION= YES

Teacher Two Tape One Line 330 (T2T1L330)

330 T that step is only to check the answer its not
331 part of the solution is that clear
332 CH yes

Type Four c These elicits are all in the form of statements,positive or negative, which the students respond to as if they were yes/no

questions. They do not contain an interrogative, a subject/verb inversion or the checking type utterances which characterise types 4a or 4b. The typical form includes the personal pronoun "you" a verb in the present tense and a short informative phrase. Two of the teachers also occasionally use the personal pronouns "I", "we" and "everybody" and on one occasion a verb in the past tense is used.

YOU+VERB IN THE PRESENT TENSE+POINT REQUIRING CLARIFICATION = AFFIRMATIVE OR NEGATIVE RESPONSE

Teacher Two Tape Three Line 135 (T2T3L135)

132 T you look for the
133 coordinates of intersection
134 CH ////// no
135 T <u>you know what the intersection means</u>
136 CH yes

Teacher Five Tape Two 344 (T5T2L344)

344 T everybody is happy with
345 this
346 STS no no sir no

<u>5.3.5 Type five elicits</u>

These elicits are typically in the form of a statement which includes one of the following imperatives; read, say, tell, list, give,listen, start, go, divide, multiply, solve, see, explain, draw, take, make,or change. The response is always appropriate to the imperative.

STATEMENT INCLUDING A VERB IN THE IMPERATIVE FORM

Teacher One Tape One Line 96 (T1T1L96)

96 T <u>tell us</u> exactly what supplementary angles are

<u>5.3.6.Type six elicits</u>

These elicits appear in the form of a statement conveying a piece of information, which may or may not be left incomplete by the teacher. The students complete the statement either without the teacher's accompaniment or in unison with the teacher. There are five different sub groups within this class.

STATEMENT+COMPLETION IN UNISON WITH THE TEACHER

STATEMENT+COMPLETION WITHOUT TEACHER

<u>Type six a</u> These are statements which the students complete by making use of anaphoric

reference. The students make use of words or phrases which they have heard;

a)in the previous lesson

b)in the teachers' turn which immediately precedes the incomplete statement or

c)in a student utterance which immediately precedes the teachers incomplete statement.

Completion is often with one word often the last part of the required item. It is often not a major content word for example it may be the word "degrees" or "angle" at the end of a teacher statement "so the answer is sixty [degrees". This type of elicit is used by all the teachers to head an exchange which signals them ending a section of work. Sometimes the teacher elicit/choral completion of the same phrase is repeated more than once.

Teacher Five Tape Three Line 34 (T5T3L34)

30	T	why do you
31		think it is an ... equilateral triangle ...
32	ST	//////////////
33	ST	because all the sides are the same
34	T	<u>because all the sides are [the same</u>
35	CH	[the same

<u>Type six b</u> These elicits are completed by the students usually in chorus making use of a deictic reference within the utterance itself or one

immediately preceding it. These deictic referents include, "here", "there", "this one","next one" and "look".These occur typically when the teacher is guiding the class through an example on the blackboard or in their workbooks.

Teacher Four Tape Four Line 205 (T4T4L205)

203 T it is a straight line ... drawn from
204 the centre to a point it means to any point
205 i can still draw from this centre to this point
206 it will still be the * [radius
207 CH [radius

Type six c The students make use of an aural context cue to complete these statements usually but not always without the teacher finishing their statement. This clue may be the first letter or syllable of a word, the first word of a definition already known to the students. It is characteristically used where the word or phrase is known to the students and when the correct word or phrase has been given in a response but pronounced in a way unacceptable to the teacher.

Teacher Four Tape Three Line 107 (T4T3L107)

107 T by definition we said a triangle is a plane
108 figure made up of ... [three sides

109 ST [three sides

Type six d This type of elicit includes a wide variety of linguistic forms all beginning with a logical connector (see LLoyd Dawe 1983;331) that is a word which links the statement as a proposition with another proposition in reasoned argument. For example, because, so, therefore,since, or and if. These statements are completed by a word or phrase which has not been heard during the lesson in which they appear nor is an aural context cue given.

Teacher Five Tape Three Line 153 (T5T3L153)

153 T seven centimetres therefore the area will be
154 half ... times four times
155 STS seven

Type six e The final type of elicit in this class includes statements including a cohesive tie to which the students respond. For example the teacher utterance "if we do something to one side you must do it to the * [other side". The underlined phrases showing the cohesive tie. The ties are; "more than/less than", "right or/wrong","greater than/less than", "either/or", "right hand side/left hand side", "one side/the other side", "connect but this one to/that one", "set a /and another set b", "francophones/anglophones", "this is called the x

axis/and this is called the y axis", "so on/and so forth","smaller/larger" and "one two three/ four".

Teacher Four Tape Three Line 202 (*T4T3L202*)

200 T so when you construct yours ... the third side
201 we don't care about the third side that a third
202 side can be more than four or [less than four
203 CH [less than four

5.3.7.Type seven teacher elicits

All the teachers use a wide range of linguistic forms following a response which is heard as incomplete or unacceptable in that it is not the response required, it is not heard clearly or in the case of a choral response it is not produced by enough students. Thus these elicits appear in the feedback slot of a typical exchange. They function as loops returning the discourse to the point before the unacceptable student response or as clues guiding the students to where they should look for the correct response. The most common forms of loops are a repetition of the unacceptable response, sometimes with a rising tone or words such as "eh", "um", or "what".

(T ELICIT+UNACCEPTABLE RESPONSE)+LOOP = NEW STUDENT RESPONSE

Teacher Four Tape Three Lines 236 and 238 (T4T3L236)

233 T seventeen over

234 three as a mixed number is what ...

235 STS five and ////////////

236 T uh

237 CH five and //////////

238 T five and

239 CH two thirds

And a common form for a clue is a short statement including a deictic reference such as "we are now looking for" "one is not over here or "if you place it correctly".

TEACHER ELICIT+UNACCEPTABLE RESPONSE+CLUE=NEW STUDENT RESPONSE

Teacher One Tape Four Line 264 (T1T4L264)

260 T good four ...

261 SST five six

262 T six

263 SST eight

264 T eight now the complement of a union b the

265 complement of a union b

266 STS i sir i sir i

267 T the complement of a union b yes

268 ST one and seven

This then is the descriptive model created to account for all the teacher elicits with a mathematical message recorded as part of phase one. It was built up from the recordings and transcripts made in the lessons of the five participating teachers and formulated at a level of complexity suitable for its purpose as a means of illuminating the patterns of interaction present in those lessons.

CHAPTER SIX

ANALYSIS OF THE PHASE ONE DATA

INTRODUCTION

In this chapter the model described in outline in Chapter five, will be detailed in terms of its features as observed in the lessons of each individual teacher during phase one of the study. A clear picture of the ways in which each teacher elicited language from their students during phase one is necesary, in order to monitor any changes to these patterns during phases two and/or three for each individual teacher.

6.1 TEACHER ONE

Teacher One, working in the large, town centre Government funded High School,(see 4.1 for details) is the most experienced teacher observed during this study. He completed his initial training at Ecole Normale Superieure in 1978 and has taught in various schools before he was transferred to his current post in 1983. He is a long standing member of the Maths Teachers' Association and has been elected to various positions of responsibility over the years. He has therefore been exposed to and has participated in a number of INSET activities. He was observed and recorded teaching class

One A which included seventy six students speaking a number of different mother tongues, mainly; Bafut, Bali, Metta, Mendankwe, Kom, Limbum, Babanki, Mankon, Oku and Lamso.

In the phase one recordings (four lessons recorded between 31.01.91 and 21.02.91) examples can be seen of the seven classes of teacher elicit described in detail in 5.4. This teacher (T1) uses a wide variety of language forms within each class of elicits (details below) often nominating a particular student to respond by eye contact and "yes". For example;

TEACHER ONE TAPE ONE LINE 36 (T1T1L36)

34 T who else

35 has remembered something else from yesterday

36 ... <u>yes</u>

6.1.1. Within Type 1, Teacher One(T1) uses elicits which require two different types of response. In the first a closed number of acceptable responses are expected, notably a specific piece of information already known to the teacher and yes/no. The interrogative forms used include; <u>how many/much, what, who and which,</u> in type 1a, and in type 1b <u>have, can, do.</u> For example, T1T1L88

88 T if two angles are

89 adjacent how are they

T1T1L179

179 T what is the

180 supplement of forty five ... supplementary

181 angle ... the supplement of forty five

In contrast there are examples of forms which elicit less predictable responses. For example in type 1a typical forms would be; what do you know about ----, why do you think, what do you want us to do and what do you know about -----. There is just one example of such a form in type 1b and that is; can you say it another way. For example;

T1T4L30

30 T who would like to do it in a better way ...

yes

Type 1 elicits appear throughout every lesson of the phase one recordings.

6.1.2. There are only a few examples of type 2a elicits all of which appear in the form of Statement + isn't it and no examples of type 2b which make use of "not so" as a tag. Type 2 elicits do not appear in every lesson recorded during phase one but in the lessons where they do appear (lessons two and three) more than one example can be observed. In terms of the closed/open distinction made above, all of the elicits in this class are closed in that the possible responses are of a limited number.

T1T2L208

208 T now the supplement we got the supplement when

209 you took one eighty and subtracted the other

210 angle from it that's what you did isn't it

6.1.3. Type 3a elicits,characterised by a word identifiable as a specialist maths term typically in the form of a short statement responded to as if they were yes/no questions appear throughout these data. for example;

T1T2L330

330 T so if a is seventy d will be one ten

331 CH yes sir ... yes sir

and type 3b elicits, in the form of incomplete statements completed by the students as if it were a question seeking a missing piece of information, illustrated by;

T1T4L219

219 T second one the complement of b yes

220 ST one ... one four six seven eight

6.1.4. Of the three possible varieties of type four elicit only those belonging to types 4a and 4c appear in this teacher's lessons in this phase of the research. Teacher one uses a wide range of linguistic forms within the class of elicits characterised by a positive statement of factual information plus a short positive utterance which functions as a yes/no question. For example typical forms are; Statement +

is that understood / has everybody seen that / do you like that / can we now go ahead / i can go ahead / i like that

to which the usual response is "yes" or "yes sir" thus placing these forms with those described above as closed.

The various forms of elicits grouped together as type 4c however do not always prospect an affirmative response. Some offer the students a more genuine choice in that they appear to be used when the teacher isn't sure whether or not to proceed. If the response is

negative the teacher recycles the current information into a sequence of exchanges which revise or repeat a teaching point made earlier. For example;

T1T1L340

340 T ... ... you want to go over it again

341 STS no sir no

T1T2L371

371 T you also consider this

372 angle b is also corresponding to this one

373 STS yes sir

6.1.5. Teacher one makes use of a small number of elicits which include an imperative in each of the lessons recorded in this phase. These elicits (type five) include the following verbs in the imperative form, that is in the base form without an ending for number or tense. For example; read, tell us, list, plus this, listen, start and go to the next one. For example;

T1T4L22

22 T ... ... read it

23 ST please sir

24 T read the second one the one in french

6.1.6. The next type of elicits, type six, are completed in all of the five different ways described in 5.4.

Those completed by a response arrived at via anaphoric reference 6a, are the most common, appearing repeatedly in all four lessons. The students often refer back to a previous utterance or back just a few minutes but they may also be expected to remember much further back. For example;

T1T1L195

195 T look at a and look

196 at s look at a and look at * [a

197 CH [a

T1T1L326

198 T i have to use

everything we

199 learnt yesterday all together ... I know

that a

200 and b are * [supplementary angles

201 CH [supplementary angles

Occasionally the teacher accepts an individual response or that made by just one or two students by repeating the elicit in this form so that every student is required to complete the statement by referring to the correct response just heard. For example;

T1T3L281

281 T what relation exists between
a
282 division and a sub sub-division ... look at
283 them ... ////// yes
284 ST a sub division is part of a division
285 T a sub division is part of a * [division
286 CH [division

It should be noted that this type of elicit gives the students the opportunity to participate in the discourse without necessarily displaying new knowledge. As seen in the above examples the completion often

involves the use of words with which the students have been familiar for some time such as "angles" or "division" or with words which they have heard earlier but which have not yet been explained or clarified by the teacher.

An equally wide range of forms is seen in type 6b elicits which are statements completed by the students making use of a deictic reference such as this,this one, here, look, the next, and the first one. These appear within the utterance itself or in one immediately preceding it. They usually occur when the teacher is guiding the class through an example on the blackboard For example;

T1T1L359

359 T good now let us go to the third part so this

360 one implies that ... look at the /////// part

361 g is equal to one [hundred and ten

362 CH [hundred and ten

and T1T4L246

246 T ... now the first one ... what do we want ...

247 we want the complement of the union ... we

248 first of all need to find the union ... a

249 [a union b

250 CH [a union b

The elicits classified as type 6c, that is those in which the students make use of an aural context cue to complete the statement offered by the teacher, appear in two of this teacher's four lessons. He cues an individual student to repeat a definition he has used in a previous lesson ;

T1T1L46

46 T now say it again make a good sentence

47 SST supplementary angles are summed to one hundred

48 and eighty degrees

49 T supplementary angles sum up to

50 ST sum up to

51 T two angles which are supplementary sum up to

52 SST two angles two angles which supplementary sum

53 up to one hundred and eighty degrees

and two occasions cues a student to remember a particular word for example;

T1T1L409

409 T you have not told us of a

410 relationship between c and d ...

411 SST c and d are supp supp

412 T supplementary

413 ST supplementary angles

414 T beautiful

Teacher one makes use of a limited number of logical connectors to link two propositions in reasoned argument in type 6d elicts; therefore, and then, so if, and, because, so therefore, it means and so. Sometimes he

pauses to allow the students to complete the statement, at other times he allows the students to join in as he finishes it himself.

for example;

T1T2L40

40 T if q is one hundred and ten degrees q

41 corresponds to b therefore b should be one

42 hundred and ten and b and a are

43 supplementary so a should be * [seventy

44 CH [seventy

and

T1T2L450

450 T if this one's twenty this one will be [twenty

451 CH [twenty

452 T if this one is one hundred this one too will be

453 CH one hundred

The final group of elicits within type 6 is 6e. In this group several examples of students being sensitive to a cohesive tie are evident, the statement being completed with an utterance appropriate to this tie. The ties noted are; one form in english/ and another form in french, francophones/anglophones, left hand side/ right hand side, one two three four five [six seven,two sets set a and another set [b, so this is ------ this will also be -and -- if a is ---- p too is ---.

For example;

T1T3L16

16 T ... ... when you have two sets ... a set a ...

17 and another set * [b

18 CH [b

and

T1T4L10

10 T ... ... yesterday we said

11 something we said the complement of * we said

12 the complement of a set will be denoted in one

13 form in english and another form in *

14 [french

15 CH [french

6.1.7. The final class of elicits are those which offer additional assistance to the students as they seek acceptable responses to teacher elicits. Loops and Clues both appear after a response which is unacceptable, incomplete or not heard clearly by the teacher. Teacher one often returns the discourse to the original elicit by repeating or it in the same words or rephrasing it. For example;

T1T2L185

185 T what is the supplement of one hundred and

186 twenty one ... yes

187 ST sixty six sixty /////

186 T the supplement of one twenty one ... ... yes

He also praises or repeats the last student response. This echoing elicits additional responses.

T1T3L56

56 T yes ... listen yes list the numbers while i

57 write them down

58 ST one

59 T <u>one</u>

60 SST two

61 T <u>good</u>

62 SST three

63 T <u>good</u>

64 SST four

65 T <u>good</u>

66 SST five

67 ST //////

68 SST six

69 T <u>six</u>

70 SST eight

71 T very good eight

Other forms which appear regularly in this class are; "say it again","louder please" and "i'm still waiting".

Teacher one rarely uses elicits which can be classified as clues. One of the few examples is;

T1T4L273

273 T ok ... the

274 next one is number ... five number five ... is

275 we are now looking for the complement

276 STS a

277 T <u>the complement of a intersection [b</u>

278 CH [b

6.1.8. Thus Teacher one is seen to use elicits from each of the seven main classes of the evolving model during the phase one recordings. The types observed most often are types 1a (elicts which include an interrogative word such as who, where, how many and which) and 6a (statements which the students complete making use of an anaphoric reference). There are examples of these types of elicit in all parts of each lesson recorded. In this phase no examples of types 2b (Statement plus not so) or 4b (a negative statement plus a short yes/no question) and only a few examples of 2a (a short positive statement plus a shortened yes/no question) and 7b (clues) can be seen. Most but not all of the elicits used by this teacher in these data prospect an acceptable response from a closed set of possible answers.

6.1.9. In the lessons taught by Teacher one during phase one there are only two exchanges with a mathematical message which are initiated by a student elicit. One is prefaced by a verbal bid for attention and shows the same student correcting the teacher in a continuation of the exchange.

T1T3L321

321 STS i sir i

322 T yes

323 ST m is the subset of n

324 T m is the subset of n ... wrong

325 SST i said n is the subset of m

326 T good n is the subset of m

The other exchange which appears later in the same lesson is not prefaced by any bid for attention. The student interupts the teacher;

T1T3L480

480 T they are subsets but they are not proper

481 subsets

482 ST improper

483 STS improper subsets improper

484 T they are not proper subsets that's what i've

485 said you don't have to bring anything like

486 improper and all the like

In both cases the student elicited exchange has a different form than most of those initiated by Teacher

one, in that there is no follow up move by the student. The Teacher regains control of the discourse via the utterance which appears as response to the elicit.

FIGURE 10 Summary of Teacher One Elicits(phase One)

TYPE	PHASE ONE	PHASE TWO	PHASE THREE
1A	common	mostly closed	
1B	common		
2A	some		
2B	none		
3A	some		
3B	some		
4A	some		
4B	none		

4C some

5 some

all closed

6A most

common

6B none

6C some

6D some

wide range

of forms

6E some

7A some

7B some

ST few

ELICITS

6.2 TEACHER TWO

Teacher two is one of the untrained teachers in this study. He has four Advanced Level GCE's including Maths and Further Maths. At the beginning of phase one he had been teaching for one term at the small private school on the outskirts of Bamenda where almost everyone speaks the same mother tongue. (See 4.1 for details). There were forty six students in Form one G/C in January 1991, forty two of whom speak Mendankwe as their mother tongue. This teacher had attended one or two INSET workshops before this study began but found it difficult to become a full member of the Maths Teachers' Association because of the cost of becoming a member and travelling to meetings.

In the four lessons recorded between 23.01.91 and 20.02.91 examples of all seven types of elicit detailed in 5.4 were observed.

6.2.1. Type one elicits, especially those classified as type 1a, ie those containing an interrogative word, appear more than any other type of elicit. Teacher two uses; what, how many, how much, which, where, who, to

elicit language in the way described as closed in 6.1. For example;

T2T1L42

42 T so first you subtract what

43 STS five ... five from both sides

and

T2T4L147

147 T who has proved it right .. ..

148 STS ///// //////

and in more open ways when in addition to the above interrogatives Teacher two uses "why" but only twice. For example;

T2T2L518

518 T ////// why did you cancel

519 ST please sir

Elicits classified as type 1b in this evolving model also appear throughout these four lessons. Teacher two elicits a verbal response from one or more students by using an utterance seeking information formed by using

the auxiliary verbs; is/are, can and do/does/did. Again there are examples of those which prospect a response from a closed set of possiblities such as;

T2T2L112

112 T is this an equation or an

113 expression

and

T2T3L80

80 T ... can you find the middle points of each

of

81 the line segments ... is it ... can you

find

82 middle points ...

but none which prospect more open responses.

6.2.2. This teacher didn't use any examples of type 2a elicits in these data but examples of type 2b, positive statements followed by "not so" appear in each of the four lessons recorded in phase one. for example;

T2T1L71

71 T so we subtract what x not so

72 CH yes

Occasionally "not so" is used to reconfirm a student response following an elicit of a different type as in this example;

T2T2L325

325 T ninety four all over what ... [three

326 ST [three

327 T not so

328 ST yes sir

There aren't any examples of the second variation of this type, that is where the statement preceding "not so" is in a negative form.

6.2.3. Type three elicits, which include a word identifiable as a specialist maths term can be observed in these data in both of the forms identified in this model. Type 3a examples include;

T2T2L495

495 T ... what do we do next

496 STS multiply multiply

497 T multiply by

498 STS by four

499 T multiply by four

500 STS eighteen ////// //// ///

and

T2T3L118

118 T ... ... three y plus three c

119 ST equals

120 T equals to

121 CH equation

and type 3b examples;

T2T2L161

161 T seven w is equals to

162 CH forty two

It should be noted that this teacher doesn't use this type of elicit very often. In four lessons there are fewer than ten examples of type three elicits.

6.2.4. In contrast to that, there are a large number of examples of types 4a and 4c elicits in each lesson recorded during phase one. The teacher repeatedly elicits confirmation of a point by using a positive statement plus "eh" and "is that clear". For example;

T2T1L89

89 T so it means that the

90 solution of this equation is x can be equals

91 to three is_that_clear

92 CH yes

and

T2T2L262

262 T you subtract this three fifths from both

263 sides so that x here should remain alone ... eh

264 STS yes

There are fewer examples of elicits classified as 4c, that is elicits which include more than one linguistic form, include a personal pronoun and show the teacher's opinion of the students' understanding of a particular point.

Examples;

T2T3L132

132 T you look for it ... you look for the

133 coordinates of intersection ...

134 CH /////// know

135 T <u>you don't know what it means</u>

136 CH no

137 T <u>you know what the intersection means</u>

138 CH yes yes

6.2.5. The use of elicits which include an imperative is seen only in lessons two and three of this teacher's recordings. <u>He uses solve, look, see and say.</u> He often but not always prefaces the imperative verb with "let's"

thus appearing to make a suggestion rather than issuing a command. The students respond verbally with information which is appropriate to the imperative. For example;

T2T2L759

759 T ok let's just solve number ten

760 STS ///// ////// ///// // ///////

and

T2T3L145

145 T you look for the coordinates of this point

146 CH yes sir

6.2.6. Teacher two makes use of all five variations on type six elicits, that is; statements conveying information which may or may not be left incomplete by the teacher. The students complete the statement either without the teacher's accompaniment or in unison with the teacher.

Elicits of the type 6a appear throughout each of the four lessons recorded in this phase of the study. For example;

T2T1L33

33 T look up the x on this side of the

34 equation is more than the x on this side eh you

35 have two x here and you have only x here ... so

36 you can here we can subtract x from both [sides

37 STS [sides

Occasionally this type of elicit appears immediately after the teacher has received an acceptable response to a previous elicit and wants it to be repeated and confirmed by more students. For example;

T2T1L147

147 T what do we do first

148 CH we add eighteen to both sides

149 T <u>we add eighteen to *</u>

150 CH both sides

151 T ... ... <u>add eighteen to both [sides</u>

152 STS [sides

Type 6b elicits also appear in all four lessons in this phase and in large numbers. These elicits are completed by the students, usually in chorus, making use of a deictic reference within the utterance itself or one immediately preceding it. Teacher two makes use of the following deictic references; this/ one/ number , you have, here you have, the next and number/three, four.

For example;

T2T2L141

141 T ////////// question two was to solve

142 ... question two you were asked to solve ...

143 number one ... seven w [minus

144 ST [minus eighteen

and

T2T3L66

66 T i'm not saying that

67 when you are plotting your own point you should

68 draw like <u>this</u> i'm making because there is no

69 line on the ... [board

70 CH [board

These elicits are often used as the teacher stands by the blackboard and either refers to something already written on it or writes and talks at the same time. Occasionally there are sequences of exchanges where the deictic reference in the first exchange is assumed in the exchanges which follow it. For example;

T2T3L735

735 T <u>the next</u> i will add two is

736 STS eight

737 T eight <u>the next</u> i add two is [ten

738 CH [ten

739 T add two [twelve

740 CH [twelve

741 T add two [fourteen

742 CH [fourteen

743 T add two [sixteen

744 CH [sixteen

745 T add two [eighteen

746 CH [eighteen

747 T then now <u>on this side</u> i also take one space

...

There are fewer examples of type 6c than of the types 6a or 6b in the four lessons being discussed in this section. For example, the students make use of a word or words as an aural context cue;

T2T2L495

495 T what do we do next

496 STS multiply multiply

497 T <u>multiply by</u>

498 STS by four

499 T multiply by four

One syllable of a word is also used to cue a response as in;

T2T4L117

117 T this is the y co ordinate of four of <u>the mid</u>

118 ... [point

119 CH [point

and

T2T4L177

177 T and five fifteen is <u>the mid *</u>
<u>[point</u>

178 CH [point

There are only a few examples of elicits classified as type 6d in the four lessons being analysed here. The four logical connectors used by teacher two are; <u>so, and, because and meaning that</u>.The first of these, "so" is used far more than all of the others put together. For example;

T2T1L467

467 T ... is this the final answer

468 CH yes

469 T yes so x is equals to ... [five

470 CH [five

and T2T3L654

654 T if this is three ten and you write this even

655 if this is the right answer they mark it wrong

656 ... because you have to read what is on your

657 own ... [book

658 T [book

The last group of elicits in type 6, that is type 6e, also appears throughout these data but only in very small numbers. The cohesive ties used by Teacher two are; smaller/larger, this side/also this side, point a and /point b, this one is called the x axis/ this one is the [y axis, one two three four five /six, so on and /so forth, if you didn't -- it is /wrong.

For example;

T2T1L16

16 T you see that the

17 unknown x is found on this side and is also

18 found on ... this [side

19 CH [side

and

T2T1L38

38 T you subtract the smaller x from the larger

[x

39 STS [x

6.2.7. Teacher two uses more than one form to elicit language from the students in ways classified in this model as type 7a and b. In exchanges where the students' response is not acceptable to the teacher either because he couldn't hear it, it was incomplete or because it was not the response required, teacher two "Loops" the discourse, taking it back to the original elicit by repeating the original elicit, repeating the students words, rewording the student response or saying "eh" or "um". For example;

T2T1L5

5 T i'm sure

6 everybody knows how to solve * linear

7 equations with the unknown on one side am i

8 right

9 CH yes

10 T <u>eh</u>

11 CH yes sir

and

T2T4L65

65 T what

66 should we do in order to know point b ...

...

67 STS //// ///// ////

68 T what shall we do in order to have point b

...

69 that is the question ... yes matthew

70 ST mult multiply the /////// by two in the in

the

71 eight and subtract that from ... and

subtract

72 the other from //////

73 T <u>multiply by two or by twelve</u>

74 ST yes sir

Finally this teacher occasionally gives clues as to where the students should look for a more acceptable response than the one given. For example;

T2T3L366

366 T so what was the

367 point of intersection ...

368 ST four sixteen

369 T eh

370 ST foru //////

371 CH three point five three point five

372 T <u>i mean from your books eh</u>

373 STS yes three point five

6.2.8. Summary

During the four lessons recorded during phase one of this study, Teacher two uses elicits from each of the eight types detailed in 5.4. In particular he makes use of type 1a elicits especially those including "what" and type 6b elicits. He doesn't use any elicits of the form statement plus shortened yes/no question (question tag) either with a positive statement (type 2a) or a negative statement (type 4b).

6.2.9. In the four lessons taught by Teacher two during phase one of this study there are eight exchanges with a mathematical message which are initiated by a student elicit. Six are prefaced by a verbal bid for the teacher's permission to speak. For example;

T2T4L134

134 T point b is four three

135 ST please sir

136 T yes

137 SST please sir take that answer and put it there

138 the next

139 T yes let's take that answer and put it there

It should be noted that the elicit is not a request for information but an imperative which the teacher accepts and re-uses to begin the next exchange.

There are three exchanges which are prefaced by a verbal bid for the teacher's attention and include a hypothetical statement. For example;

T2T3L794

794 CH hehehehe

795 ST please sir

796 SST please sir it mens if you want to start your

797 work ... you can number from any number that

798 you //////

799 T the thing is let me tell you ... ...

and T2T2L292

292 ST please sir excuse me

293 T yes

294 SST if that if that ... it was over five

295 three x over five equals to forty seven over

296 five for example if it was three x over two

297 equals to forty seven over three

298 T ok you have asked a very good question that if

299 it was ... shall i wipe this

300 STS yes sir

301 T ok ... let us solve her problem before we

302 continue

Again the teacher reclaims the leading role in the discourse by accepting the student's elicit with an evaluative utterance and intiating a new exchange.

In one exchange (which was difficult to transcribe clearly) there are two examples of student elicits which include interrogative words.

T2T1L389

389 ST //////////// [heard as where is the lcm]

390 T where is what

391 SST lcm

392 T the lcm is four

---

395 SST please sir will it go in a decimal

396 T it will still go

397 ST with fraction

398 T whether it with decimal or with fraction its

399 the same ok

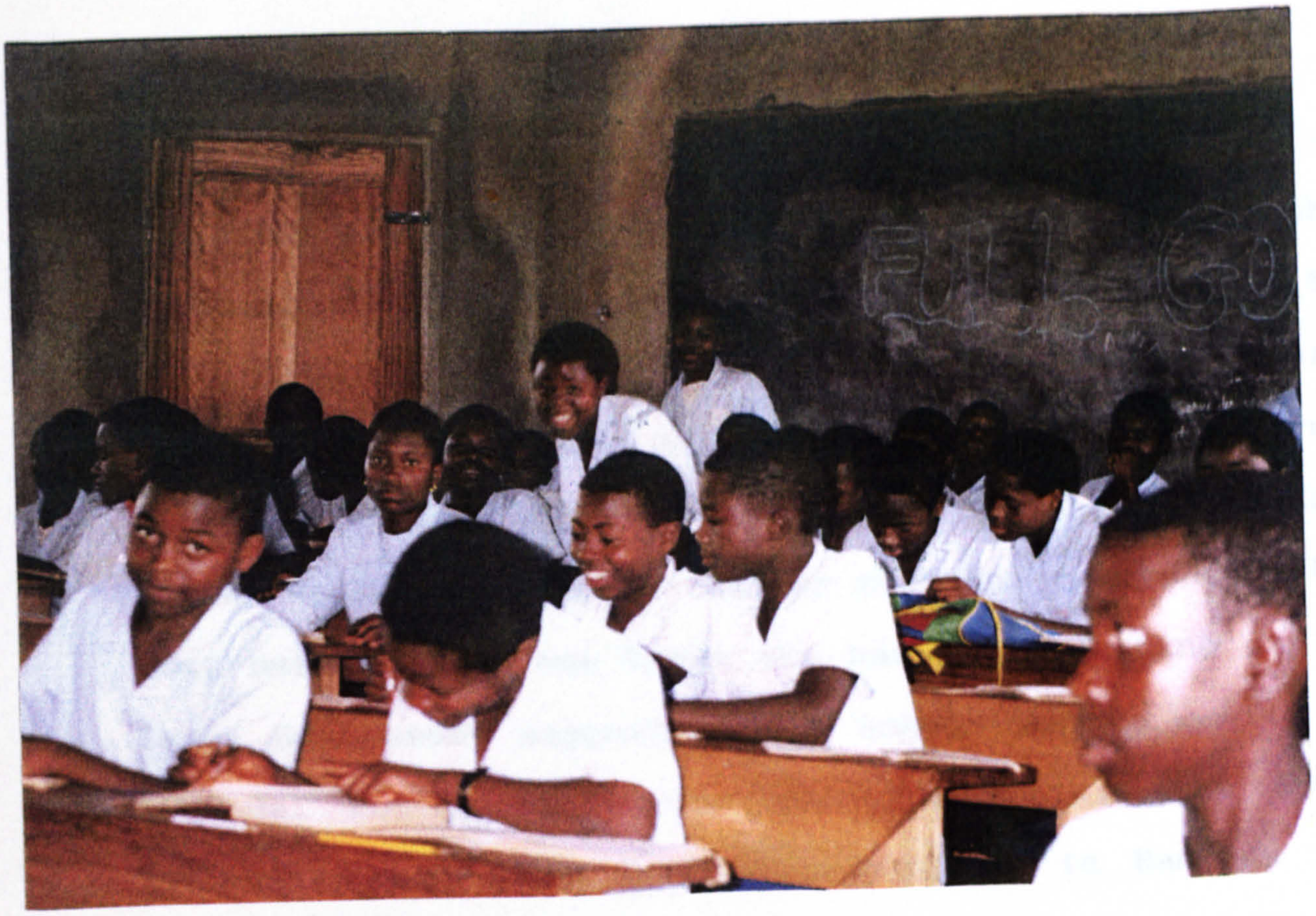
Student utterances which include an interrogative in this way are rare in these data, probably for the reasons outlined in 5.3.

FIGURE 11 Summary of Teacher Two Elicits (Phase One)

TYPE	PHASE ONE	PHASE TWO	PHASE THREE
1A	most common		
	mostly closed		
1B	common		
2A	none		
2B	some		
3A	some		
3B	some		
4A	common		
4B	none		

4C	some
5	few
6A	some
6B	some
6C	few
6D	some
6E	some
7A	some
7B	few
ST	some

ELICITS



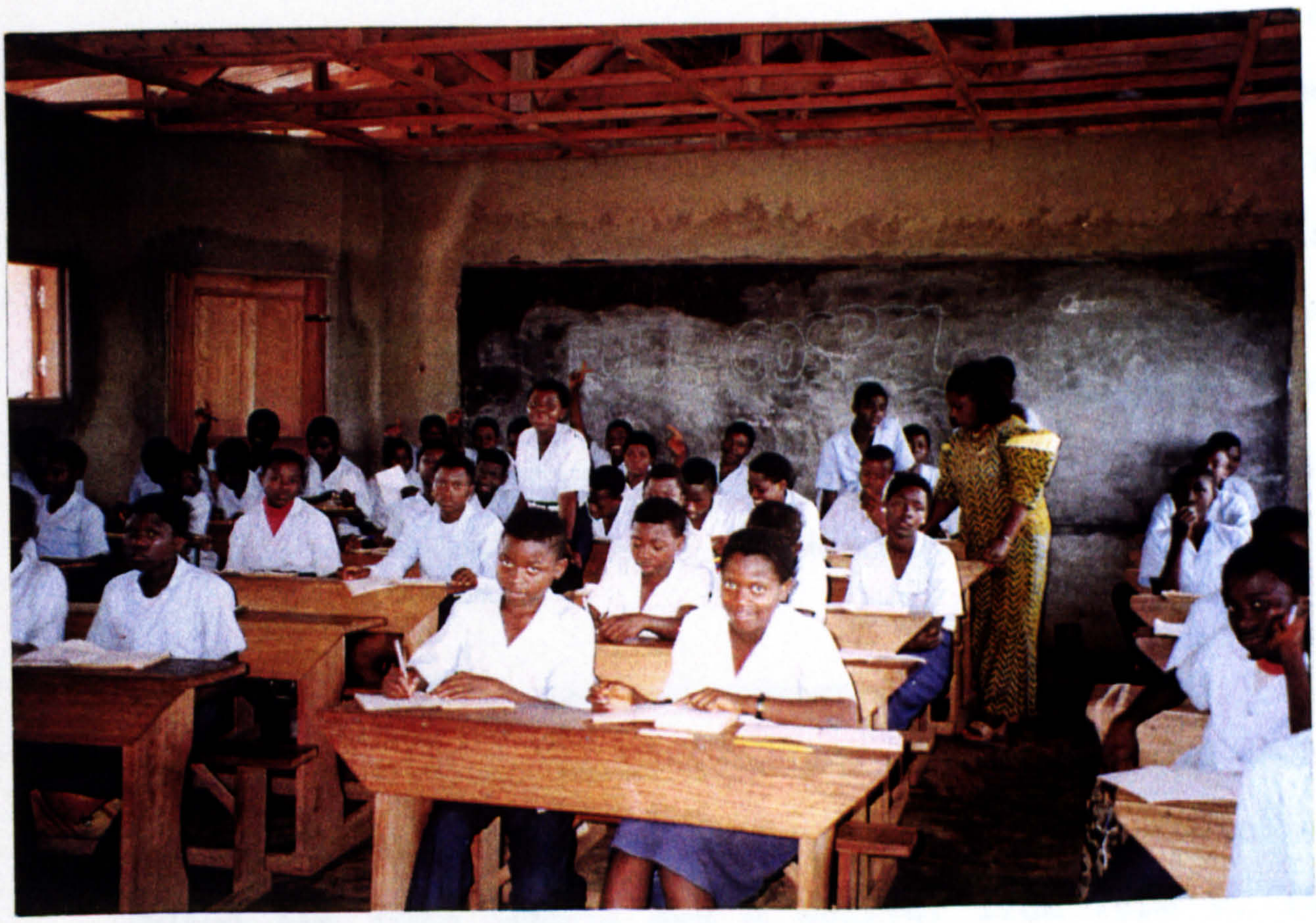


ILLUSTRATION 6 GOVERNMENT SECONDARY SCHOOL MANKON

6.3 Teacher Three

Teacher Three is the only female teacher participating in this study. Having been accepted by the University of Yaounde in 1984 she found studying Natural Sciences in French too difficult and left. She returned to her old (Mission) school to teach for one year before beginning her three year teacher training course in 1987. Just before phase one began she had been teaching at the large Government supported High School in the centre of Bamenda. During this time she attended all the INSET activities organised for maths teachers in Bamenda and became a member of the Maths Teachers' Association. In November 1990 that is about six weeks before phase one began, she was transferred to a newly opened Government secondary school about ten kilometres from Bamenda. She was observed and recorded teaching class One B. (See Illustration 6) In this class of fifty six students, thirty four were speakers of Mankon (the language spoken in the area around the school) and the remainder speakers of other languages such as Bafut and Lamso.

In the four lessons recorded during phase one of this study Teacher three made use of elicits from each of the eight types detailed in 5.4. Over half of the elicits noted are from type 1 and a quarter from type 6. There are no examples of type 2a, or type 4 b.

6.3.1. Within the elicits classified as type 1a, teacher three uses a wide range of interrogative words notably; what, which, why, how, who, where, and when. There are examples of this form prospecting a closed set of responses such as;

T3T1L97

97 T what will you do with this expression on the

98 board ...

99 ST we group them

and

T3T4L170

170 T ///// and line passing through one

171 and minus two you read x before y ///// that

172 point was what ...

It should be noted that these two forms WHAT + and + WHAT appear more often than all the other forms in this class put together.

Examples of other forms which prospect a closed response are as follows;

T3T1L192

192 T which

193 is the larger number of one and four which

194 is the larger

195 CH four four

There are very few examples of elicits of this type which prospect a more open set of responses. One example is;

T3T1L253

253 T why is this one wrong ... you

The second type of elicit in this class, type 1b, also appears in exchanges which have a closed number of acceptable responses and those with a more open set of possible responses. The auxiliaries used are do/did, have/has, is/are and can. For example;

firstly of an elicit prospecting one particular response;

T3T2L35

35 T and is a to the fourth

36 power equal to four a

and secondly of an elicit prospecting an open set of student responses.

T3T3L442

442 T //////// can you guess what x is ... ... can

443 you guess

6.3.2. Teacher three does not use any elicits of the form 2a, that is a short positive statement plus a shortened yes/no question, in this phase of the study. However there are several examples of two varieties of type 2b elicits. That is, there are numerous examples of elicits formed by the use of a positive statement plus not so, for example;

T3T2L7

7 T ////// by four a that two a /////

multiplied by

8 four a indices not so

and

T3T4L59

59 T so us one square to ////// any

one

60 unit in your book the space from here to here

61 is one square not so

62 CH yes

There are also two examples of elicits formed by the use of a negative statement plus not so. Teacher three is the only teacher participating in this study who uses elicits of this class. For example;
T3T1L72

72 T we cannot subtract unlike terms so three r and

73 r are not like terms not so

74 STS yes madam

and T3T1L270

270 T is that problem difficult

271 STS no madam no

272 T not for you to solve not so

273 STS yes

274 T um

275 ST yes madam

6.3.3. There are examples of type three elicits in each lesson of phase one but they do not appear in large numbers. Examples of those classified as type 3a are;

T3T3L468

468 T <u>two x plus five x</u>

469 STS seven x

470 T is it seven x

471 CH yes madam

Examples of type 3b elicits in the form of an incomplete statement of fact, including a specialist maths word which the students respond to by supplying missing information, are fewer than for type 3a. For example,

T3T1L203

203 T <u>one from four</u>

204 is

205 SST three

and

T3T3L415

415 T ten a plus zero is equal to ...

416 ST seventy

6.3.4. Teacher three uses elicits of types 4a and 4c in the lessons recorded in this phase. There are several examples of the former in each lesson, for example;

T3T1L100

100 T ok he says we group them as i said you look at

101 term a and you look for all the terms with a

102 you can bear it in mind you look at a take the

103 terms that have a group without leaving their

104 signs you can call them all the brothers of

a

105 are those terms with a in them ...<u>is that clear</u>

106 CH yes madam

and

T3T3L520

520 T you ... ... two a plus five a is what

521 ST seven a

522 T she says seven a <u>is she correct</u>

523 STS yes no

However it is noticeable that Teacher three only uses type 4c elicits occasionally. She does use elicits which clarify the students' understanding but as these include interrogative words and auxiliaries plus a subject/verb inversion they have been classified as type one elicits. (See above for examples) An example of a type 4c elicit appears in lesson two;

T3T2L173

173 T so you have

174 t * squared plus ... ///// is the same as

174 CH three c to the seventh power

175 T so with the division you have a problem

177 ST yes madam

6.3.5. The next class, type 5, also appears infrequently in this teacher's lessons. She uses the imperatives explain,and show. For example;
T3T1L491

491 ST i add a plus b ... equals to

492 T can you hear him

493 CH no

494 STS ... ...

495 T explain it to us

6.3.6. A large number of Teacher three's elicits fall into type 6. That is they are statements conveying a piece of information, which may or may not be left incomplete by the teacher. The students complete the statement either without the teacher's accompaniment or

in unison with the teacher. There are examples of elicits from all five sub groups of type six in these data.

The students complete type 6a elicits, by making use of words and phrases which they have heard in a previous lesson or in an utterance in the same lesson.
For example;

T3T1L33

33 T ////// have you heard of this word

34 STS terms

35 T we group them according to their [terms

36 STS [terms

and T3T3L135

135 ST because you have divide both sides by two

...

136 T because you have divided both sides by

137 SST two

There are a large number of elicits in the form of statements which the students complete by using a deictic reference in these four lessons. After the WHAT+/+WHAT elicits in type 1a (as described above) type 6b elicits

appear more often than any other type in all four lessons. The deictic terms used are; <u>that, this, these, here, there, look, next/ the next, you, we and them.</u>

For example;

T3T1L134

134 T even if b were here we will still take it *
<u>the</u>

135 next term there is b and we have *

136 CH [minus two b

137 T [minus two b

Occasionally the deictic reference is not in the teacher's elicit but in a recent utterance, for example;

T3T3L82

82 T let's try to find out ... which of them is

83 correct ... if you have a problem like <u>this</u>
...

84 i hope you are all listening

85 CH yes madam

86 T two a plus five is equal to ... [fifteen

There are also short sequences of exchanges which include a repeated deictic reference, as in

T3T4L355

355 T um minus one here

356 STS minus two

357 T and here

358 CH minus three

359 T here

360 CH minus four

There is only one example of a type 6c elicit which is in the third lesson of phase one. That is;

T3T3L28

28 SST you divide it by two so that the occasion

29 should remain [the same

30 T [the what the what

31 STS heheheheehee

32 SST equation

33 T what

34 SST oquation miss

35 T equation

36 SST equation miss

37 T ok

In contrast to this there are examples of type 6d elicits throughout each of the four lessons. The most common logical connector in these lessons is "so", but Teacher three also links a statement as a proposition to another statement with "and " and "therefore". For example;

T3T1L46

46 T ten r minus three r is what

47 CH seven r

48 T seven r so we have seven r minus [four

49 CH [four

and

T3T2L54

54 T and a times a times a times a is the same as

55 a

56 CH to the fourth power

Teacher three does not use elicits of the final sub-group in type 6 in every lesson. The type 6e elicits are in the form of statements including a cohesive tie to which the students respond. Ties seen in these data are; one side/the other side, one/two three four and a to b/b to c/and the a back to/ and x comes before/y.

for example;

T3T3L37

37 T ok because its an equation if we do

38 something to one side you must do it to the

39 * [other side

40 CH [other

6.3.7. Examples of elicits which have been classified as type 7a or 7b can be seen throughout these recordings.

Teacher three loops the discourse, following an unacceptable or poorly heard response by repeating the students words, or using one of the following forms; "say it again" "what" "eh", "any other answer" and "um".

For example;

T3T2L524

524 T what do you do about

525 that

526 CH six x

527 STS eight x

528 T eight x <u>that your answer</u>

529 STS //////////// yes madam seven x //////// six x

530 /////

531 T <u>any other answer</u>

532 ST six x

533 T um

534 ST ///// ///////

Examples of type 7b elicits, with the function of clues appear rarely. For example;

T3T2L403

403 T if you have

404 three divide by two what will it be ...

three

405 divide by two ... some of you are saying

three

406 ST one

407 CH one

408 T eh

409 ST one

410 T //////////////////////////////// you have [one

411 CH [one

and

T3T3L460

460 T let's try to find out which is

461 correct ... ... are you sure the answer is

462 among those numbers

463 STS yes madam yes

6.3.8. In summary teacher three uses all seven types of elicit as detailed in 5.4. However not all types are used regularly or in every lesson. She prefers elicits of type 1a especially those which include WHAT+ and +WHAT and type 6b elicits, that is statements which are completed as a result of the students responding to a deictic reference. Although this teacher does check on her students' understanding and redirect them if they respond in a way she cannot accept, it seems that her teaching style uses more elicits which include clear signals as to the nature of the response required ie interrogative words or deictic references.

6.3.9. There is only one example of an exchange with a mathematical message initiated by a student in the recordings of lessons taught by Teacher three during phase one. This exchange is not prefaced by any bid for attention although as it follows a pause it does not interupt the teacher in the way shown by the example in 6.2.9.

T3T4L399

399 T join a to b join it in alphabetical

400 order a to b b to c c to d and d back to a

401 ... ...

402 ST i have not understood

403 ST i have not understood

404 T /////// see how you join the points here it you

405 draw your point a

F1GURE 12 Summary of Teacher Three Elicits (Phase Three)

TYPE	PHASE ONE	PHASE TWO	PHASE THREE
1A	common mostly closed		
1B	common		
2A	none		

2B	some
3A	few
3B	some
4A	few
4B	none
4C	some
5	few
6A	common
6B	very common

6C	few
6D	some
6E	some
7A	few
7B	few
ST	few

ELICITS

6.4 TEACHER FOUR

Teachers four and five both teach at the same school and have similar educational backgrounds. The school is large, privately supported and located on the outskirts of central Bamenda. During phase one of this study, each teacher was observed teaching one class, Teacher four with a smaller class (Form One Commercial) and Teacher five with an average number of students (Form One B). (See Chapter four for details).

Teacher four completed his formal education by passing three GCE A'Levels, including Maths. He began teaching at this school in 1987. He is an active member of the Maths Teachers' Association and attends all INSET activities. He had been observed and recorded once in 1990, before this study began and had participated in discussions about the relationship between the students' level of English and their success or failure in mathematics. The class recorded between 25.01.91 and 22.02.91 was made up of twenty students who speak several different mother tongues, mainly Bafut Metta and Mankon.

Teacher four makes use of elicits classified as types 1,3,4,5,6,7, with a clear preference for types 1 and 6.

The interrogative words used in elicits classified as type 1a are; which, what, where, who, why and how,

with those including WHAT+ or +WHAT appearing more often than any other. Almost all prospect a closed set of acceptable responses often very short responses or yes/no. For example;

T4T1L70

70 T and sixty you indicate then the outer angle for

71 example if this is one hundred and twenty

72 degrees this other will be equal to what ...

73 ST two hundred and forty

and

T4T3L191

191 T ... if i measure this third side ... what

192 does it give me

193 ST four

194 T is it up to four who said four

195 STS ////////////////

Occasionally Teacher four initiates an exchange with an elicit which allows the students to give a response which is not from a closed set of predicted responses. For example;

T4T3L561

561 T thirty ... how have you converted eight

562 centimetres to decimetre to be having thirty

563 ... what have you done ... to have thirty ...

564 ...

565 ST i've times //////// times three

The second group of type 1 elicits, grouped together because they include an auxiliary and a subject verb inversion, appear regularly. The auxiliaries used are; is/was, have, can, are and do. For example;

T4T4L598

598 T do you know what is meant by four quarters

599 ST three quarters

and

T4T2L22

22 T ... is this a straight line ... ...

23 ST ////////////////////////

6.4.2 There are no examples of type 2 elicits in Teacher four's lessons recorded during phase one of this study.

6.4.3 However there are examples of him using elicits which have been classified as type 3a and 3b. Type 3a elicits are those short complete statements which include a specialist mathematical word and to which the students respond as if it were a question even though they don't include an interrogative or a subject/verb inversion. For example;

T4T3L359

359 T its isosceles triangle this an example cos

360 these two sides are equal this one is longer

361 than the other two sides

362 ST yes

Type 3b elicits are similar in that they do not include an interrogative or a subject/ verb inversion. They differ in that they are incomplete statements which are completed by the students. For example;

T4T1L65

65 T you draw

66 but the remainder that you get from after

67 subtracting that angle from one hundred and

68 from three hundred

69 ST eighty

70 T and sixty

and

T4T3L492

492 T two times five is

493 CH ten ten centimetres

494 T centimetres times centimetres will be

495 STS /////// square centimetres

496 T square centimetres

6.4.4. There are only a small number of examples of elicits which are classified as belonging to type 4. Examples of type 4a appear through out these data but there aren't any examples of type 4b elicits and one of type 4c. The form which appears most often is STATEMENT + is that true, but teacher four also uses STATEMENT + is that correct and you see what i mean. For example;

T4T1L513

513 T it is one hundred and twenty is that

514 true

515 CH yes sir

and

T4T2L248

248 T <u>five degree ... is that correct</u>

The only example of type 4c observed in this phase of the study in Teacher four's lessons appears in lesson one.

T4T1L412

412 T measure the second one

413 ////// finished with the second one

414 ST we have done it

415 T me mary ...

416 ST seventy eight degree

417 STS no twenty please sir ////////

418 T <u>you are refusing</u>

419 ST please sir

6.4.5. The next type, 5 is also used only occasionally by this teacher.He uses; <u>measure and read</u> as imperatives. For example;

T4T1L411

411 T that

412 very exercise measure the second one

413 /////// finished with the second one

414 ST we have done it

and

T4T4L316

316 T someone should read it for me ... sit down

317 and read it for me ... ... yes //////

318 indeed this means note better read this other

319 notation ... yes

6.4.6.Type 6 elicits are evident in all stages of all the lessons in this phase. Type 6b elicits appear most often but examples of types 6a, and 6d are also common.

Examples of type 6a elicits include;

T4T1L27

27 T in the previous class i asked you to ... or we

28 saw how we were able to draw angles using the

29 protractor and i told you that you cannot draw

30 angles without the use of a * [protractor

31 CH [protractor

It is noticeable that teacher four does not use incomplete statements to elicit student completions as a way of confirming a previous student response as for example Teacher one does (see 6.1).

Examples of elicits of the type 6b, that is incomplete statement which are completed by the students making use of a deictic reference within the utterance itself or one immediately preceding it, appear in each lesson analysed for the evolving model from phase one. The deictic references are; that/this/those, look/see. here, here to here, right down to, the next one and you have. For example;

T4T2L144

144 T he is correct because we said
corresponding

145 angles are equal ... a here corresponds to
*

146 CH d

147 T therefore d must also be equal to ...
thirty

sometimes a student responds incorrectly as in;

T4T3L55

55 T if this is the base ... base here is equal
to

56 [the side

57 ST [the base

58 T n o the line n o is the base indicate the

59 height

Sometimes one deictic reference directs the students to the topic and enables the teacher to elicit more than one student response. For example;

T4T2L426

426 T ... look at this two dm and dm one is with a

427 small letter and the other is with a

428 ST capital

429 T capital letter ... decimetre is with a small

430 letter and [decimetre

431 CH [decametre

432 T is with a capital letter

There are no examples of student responses being cued by the aural context cue as classified as type 6c elicits in lesson one but several in the other three lessons. There are examples of a single letter being as a cue as in;

T4T3L347

347 T what what example

348 is this what sort of triangle is this ...

349 STS /////////

350 T yes

351 ST isosceles triangle

352 T i

353 SST isosceles triangle

354 T try to pronounce it

355 SST isosceles

356 STS isosceles isosceles

357 T yes

358 ST isosceles

359 T its isosceles triangle

Another example shows Teacher four cueing the students' response with the first syllable of a word. For example;

T4T2L232

232 T where the smallest

233 ... the smallest ... ... would be the <u>milli</u>

234 * [metre

235 CH [metre

236 T why when it is being multiplied we still talk

237 of metres would be the greatest one which

238 is <u>kilo</u> * [metre

239 CH [metre

and finally there are examples of definitions being cued by the teacher saying the first part, as in;

T4T4L112

112 T as from the next class we shall make use of

113 this formula that says area n o

114 the circumference of a circle is given by

115 ST ///////

116 CH [pie radius

117 T [pie radius

Teacher four uses a wide range of linguistic forms as logical connectors. They are: so, therefore, because, if, then, and since, and, but, as, after, which means, in short and while.

For example;

T4T1L117

117 T sixteen minus seven is

118 what

119 STS nine nine

120 T nine therefore i'm going to draw angle

121 STS ninety ninety

122 T ninety degrees

and

T4T2L348

348 T ten

349 millimetre is equal to one

350 CH centimetre

351 T centimetre then ten centimetre is equal to

352 CH one decimetre

353 T decimetre

and finally

T4T3L414

414 T if you use your protractors and measure this

415 angle it must be equal to ... ninety degrees

416 and this is how we indicate angle

417 STS ninety

418 T ninety

The fifth and last sub group of type 6, 6e are those elicits in a statement form which include a cohesive tie to which the students respond. The ties used by Teacher four in phase one are; more than/less than, up/to or even more than, this/or, greater than/less than, you convert-/ or you convert --, --but not up to/--, this one to/ that one, a b c/d, d e/f, b/c, d and/e.

Occasionally the responses chosen by the teacher and the students are not identical for example;

T4T1L171

171 T either i connect this point to this point or i

172 connect but this one to * [this other one

173 CH [that one

but usually they are similar or the same as in

T4T3L289

289 T i don't have to draw it as here because if i

290 draw it <u>this other side may not be up to five</u>

291 <u>or even more than * [five</u>

292 CH [five

6.4.7. There are very few elicits of the types classified as types 7a or 7b in these data. Teacher four does not use one form repeatedly to loop the discourse but there are isolated examples as follows;

T4T2L332

332 T metric and //////

333 ST arithmetic signs

334 T no <u>i asked for the thing which is repeated</u>

335 <u>to what is on the board ...</u>

336 ST please sir

337 T yes what is the title

338 ST /////// measure

Examples of clues, that is type 7b elicits, are also few in the lessons taught by Teacher four in phase one and again there seems to be no preferred form. For example;

T4T4L555

555 T eight thousand

556 STS oooooo

557 T eh ... listen ... we are converting from

558 centimetre to decimetre ... and they are very

559 close to each other yes

560 ST thirty centimetres

and T4T1L394

394 T it is from

395 the inner scale so you have to read

396 ST forty three degrees

397 T but from the inner scale ... ... the answer

is

398 exact if you place it correctly

399 ST forty degrees

400 T the answer is forty degrees

6.4.8. In summary then Teacher four uses forms identifiable as belonging to one of the seven major types of teacher elicit as described in the evolving model. He uses many more elicits of types 1a and 6b than of the others, few elicits of types 4a or 5 and does not use any elicits from types 2a, 2b or 4b in his phase one lessons.

6.4.9. In the lessons taught by Teacher four there are three exchanges with a mathematical message which are initiated by a student elicit. The first is an interuption and includes an interogative word;

T4T1L618

618 T you have to measure then subtract ...

619 ST subtract what

620 T subtract the angle you have measured from three

621 sixty in order to have ... the angle which has

622 been indicated because those other angles are

623 greater than ... one eighty ... ...

The second example is prefaced by a non-verbal bid for the teacher's attention. The main elicit also includes an interrogative;

T4T2L656

656 T do this one

657 at home ... question yes ...

658 ST what of //////

659 T her question is ... who is that outside in

660 stop disturbing

661 ST please sir

662 T her question is what if it was fifty

663 hectometre to kilometre

The third elicit recorded in a lesson taught by Teacher four in phase one is of a form similar to that observed in Teacher two's lesson three. That is the first elicit is a verbal bid for the teacher's attention. When permission to speak has been granted the same student elicits more information from the teacher by stating their understanding of one aspect of the problem on which they are working. Their utterance is in the form of a statement although the student herself refers to her utterance as a question.

T4T3L663

663 ST please sir i have a question

664 T yes listen to her question

665 SST please sir you cannot go to ///////

666 T pardon

667 SST you cannot work in fractions

668 T how how can you not work in fractions you can

669 work with fractions but ... let me show you

670 where you'll be having a ... question

FIGURE 13 Summary of Teacher Four Elicits(Phase One)

TYPE	PHASE ONE	PHASE TWO	PHASE THREE
1A	common mostly closed		
1B	common		
2A	none		
2B	none		
3A	some		
3B	some		
4A	some		
4B	none		

4C	some
5	some
6A	common
6B	most common
6C	common
6D	some
6E	some
7A	some
7B	few

ST few

ELICITS

6.5 TEACHER FIVE

As explained above in 6.4. Teacher five works at the same school as Teacher four. He has three A'Level including maths and began teaching in 1989 at this school. He has attended all the INSET activities to which he has been invited and is a member of the Maths Teachers' Association. At the beginning of phase one he was teaching class 1B which was made up of forty six students speaking a number of different mother tongues mostly, Pinyin, Meta, and Bafut. The four lessons recorded in this phase took place between 25.01.91 and 18.02.91.

Although this teacher uses elicits which belong to each of the seven major classes definied in chapter five he uses them in different proportions to the other four teachers. There are no examples of types 2a, 2b or 6e but a large number of type 4 and type 7 elicits.

Within class 1 he uses a similar range of interrogative words as the other teachers, namely; <u>which. where. what. why. when and how</u>. Most often they require a short response from a closed set predicted by the teacher. For example;

T5T1L102

102 T you can check this too by putting ten ... in

103 place of x here ... ten minus four ... is what

104 CH six

and

T5T2L183

183 T we have to shift the decimal point

184 how many places ...

185 CH two

186 T good

On one occasion he uses elicits of this type to initiate an exchange which is more open than the examples above. That is, the response prospected is not from a closed set of possibilities. For example;

T5T2L347

347 T ah ... tell me what your problems are ...

...

348 what has made you to not understand ...

He also uses a similar range of forms for elicits which have been grouped together as type 1b, that is those which include an auxiliary and a subject/verb inversion. The auxilliaries he makes use of are, can, do and is/are.

For example;

T5T3L27

27 T is this an isosceles triangle

28 CH no

29 ST an equilateral triangle

30 T fine

6.5.2. This teacher does not use any elicits which could be classified as either type 2a or 2b .

6.5.3 There are several forms of type 3 elicits in each of the four lessons recorded during phase one. For example;

T5T1L88

88 T you add four you see you add four to this

89 negative four plus four is zero ...

90 CH yes sir

and

T5T4L417

417 T three what what and what ... ...

418 ... ... trapezium rhombus ... and a

419 kite ... they are parallelograms

420 STS yes no sir

Fewer examples of elicits of type 3b appear in these data. These incomplete statements of fact, including a specialist maths word, are completed by the students supplying the missing information. They do not include a

subject/verb inversion or an interrogative word. Examples are;

T5T2L137

137 T times one hundred ... one hundred ... ...

138 twenty times fives is

139 CH one hundred and five

140 T one hundred and five centimetres ...

Occasionally this teacher uses a number of type three elicits in a sequence of exchanges appearing to build a scaffold for the students as he leads them towards the final answer he requires. For example;

T5T3L374

374 T the units of height and //////////////

375 the height is

376 ST three metres

377 T and the base is

378 CH two metres

379 T and the base is

378 CH two metres

379 T two metres ... ...

380 STS //////////////////////////

381 T the area will be

382 STS three times eight times two times three
/////

383 T which is just

384 CH four

385 T //////

386 CH centimetres squared

387 T centimetres

6.5.4 It is in his use of elicits classified as type 4 that this teacher appears noticeably different from the previous four. He uses a wide range of forms within each of the three sub groups 4a,4b,and 4c. Within the elicits classified as 4a he uses the following forms; STATEMENT +

right, ah, ok, um, everybody is ok now, am i right, is that understood and is that clear. These appear in each of the four lessons recorded with + right and + ok being the most common. For example;

T5T3L45

45 T why

46 SST because all the sides

47 T non of the sides are equal ... ok

48 CH yes

and

T5T4L309

309 T when is the name of this figure ...

you

310 find out from your ////// ... e ... ...

um

311 ST rhombus

312 T a rhombus he says a rhombus is that correct

313 STS yes ... no

Teacher five is the only teacher recorded in this study who uses forms which have been classified as type 4b. That is a short negative statement followed by a short yes/no question as in the example;

T5T2L223

223 T ... that is ... we don't want to put this

224 decimetres and centimtres again in this number

225 ... right

226 CH yes sir

Teacher five appears to clarify his understanding of his students' understanding often via elicits from type 4c of several forms. He uses the personal pronouns you, your and I. For example;

T5T4L249

249 T do you all agree that a kite is not a

250 parallelogram

251 STS yes sir no

252 T <u>you all agree that</u>

253 CH yes

and T5T2L341

341 T six one

342 one so we have sixteen point five metres

343 ST decimetres

344 T decimetres ... ... <u>everybody is happy</u>
<u>with</u>

345 <u>this</u>

346 STS no no sir no

6.5.5 Teacher five uses six elicits which include one of the following imperatives ; <u>write, make, say it, let's change all and pronounce the word,</u>

for example;

T5T1L59

59 T say it

60 ST isosceles triangle

61 T isosceles triangle

and T5T3L6

6 T now i want somebody to pronounce that er word

7 STS //

8 T //////////

9 ST quadilat ... ral ... quadrilateral

10 T now ... quadrilaterals everybody

11 CH quadrilaterals

6.5.6.Within the class of elicits grouped together as type 6, that is those statements conveying information which may or may not be left incomplete by the teacher. The students complete the statement either without the teacher's accompaniment or in unison with the teacher.

Teacher five uses this type of elicit throughout the four lessons recorded in phase one. His use differs from

that of the other teachers in that firstly there are fewer of type 6 elicits in his lessons than those of his colleagues and there are no examples at all of elicits which are completed by the students with reference to a cohesive tie within the elicit.

Examples of type 6a elicits appear two or three times in each lesson. For example;

T5T4L163

147 T ... now a rectangle ... is a parallelogram in

148 which all the angles ... are ... right angles

149 ... ... is that clear

150 CH yes

and later

163 T ... ok but ... for a rectangle for a

164 parallelogram to be a rectangle ... all its

165 angles must be

166 ST right angle

167 T ninety degrees

and T5T2L463

463 T convert er ... one metre ... six decimetre ...

464 and five centimetres ... to ... decimetres and

465 centimetres ... ... decimetres and ...

466 [centimetres

467 CH [centimetres

468 T decimetres

There are twice as many elicits of type 6b than there were of 6a. They all appear in the first three lessons. The deictic references are; this, this one, this number, the next one, the second part, the first point, number three, the other side and are you looking. There are examples in which the deictic reference is in the previous elicit;

T5T1L67

67 T divide both sides by ... what ... divided this

68 by five ... and divide this b five ... ...

69 five will be ... five will ////////////////

70 STS seven times

71 T over x is

72 ST ten

73 T ten

and examples where the deictic reference is in the elicit in question;

T5T1L162

162 T then negative one negative two

163 negative three like that now the first point is

164 ST two three

165 T two three

In each of the lessons being described here there are examples of statements which the students complete with reference to an aural context clue. For example;

T5T3L82

82 T an obtuse angle is an angle which is more

83 than ninety degrees and

84 STS and less than

85 T less than one hundred and [eighty

86 CH [eighty

and

T5T3L108

108 T what is an acute angle triangle ... ...

109 STS //////// //////// /////////

110 SST this is an angle which is less than ninety

111 degrees

112 T an acute angle ... triangle

113 ST an acute angle triangle is an angle which is

114 less than ninety degrees

115 T are you defining an angle or a ... triangle

...

The logical connectors which Teacher five uses in these data as part of the elicits classified here as type 6d are; because, so, and, therefore, is the same as, or, since and in addition. This type of elicits appears in every lesson with a particularly large number in lesson three. For example;

T5T1L280

280 T since we are adding we

281 count now in a positive direction ... so

262 ST three

263 T continue one two

264 ST three

and

T5T2L133

133 T one and one over twenty ... one and one over

134 twenty ... is the same as twenty one over ...

135 twenty

136 ST times a hundred

137 T times one hundred

6.5.7. The final type of elicit in the evolving model included loops and clues both of which appear after an unacceptable student response. To loop the discourse back to the place where it was before this response Teacher five uses a wide range of linguistic forms including; um. ah. pardon. eh. am. that is still not clear. the next person. and the repetition of the student's unacceptable response. For example;

T5T3L52

52 T ... ... this one is scalene ... ...

53 triangle then a ... ...

54 ST isocele triangle

55 T pardon

56 ST isosceles triangle

and T5T3L221

221 T what is the height of this triangle

222 ... ...

223 ST five metres

224 T five metres the height of the triangle

225 STS no ////////////

226 ST three metres

227 T three metres

As Teacher five uses the technique of echoing a student response to indicate that the response is unacceptable as in line 224 and to indicate that one is acceptable as in line 227 it should be noted that he cues

a second attempt at the original elicit partly by echoing the response with an intonation pattern recognisable as interrogative and by following the strengthening the echo by repeating part of the original elicit.

He occasionally directs the students attention towards a more acceptable response than the one they have given or to prevent them from making a mistake. for example;

T5T4L202

202 T ... ... remember this side is ...

203 adjacent to this one ... ah

204 STS yes

205 T this side is adjacent to this one

206 CH yes sir

207 T this one is adjacent to this one this is also

208 adjacent to this ok

209 STS yes

6.5.8 Summary

In summary then teacher five uses all seven types of elicit. He differs from the other teachers in the proportions of various sub-types and is remarkable in that he doesn't use any examples of types 2b or 6e and few of the other type 6 elicits. There are also fewer elicits overall in this teacher's lessons than in those recorded when other teachers participating in the study were working.

6.5.9. Exchanges headed by a student elicit

In the lessons recorded when Teacher five was teaching there is only one example of a student eliciting mathematics related language from the teacher. The form is quite different from that in any of the teachers' lessons but similar to type seven a elicits in the model of teacher initiated patterns of interaction. The student does not preface their loop with a bid for the teacher's attention but neither do they interupt the teacher because their elicit, a loop, appears in response to Teacher five's elicit.

T5T2L311

311 T ok so

312 the five centimetres will be how many

313 ST pardon

314 T five centimetres will be how many decimetres

FIGURE 14 Summary of Teacher Five Elicits(Phase One)

TYPE	PHASE ONE	PHASE TWO	PHASE THREE
1A	common		
	mostly closed		
1B	common		
2A	none		
2B	none		
3A	some		
3B	few		
4A	common		

4B few

4C some

5 few

6A few

6B common

6C some

6D some

6E some

7A some

7B	few
ST	few
ELICITS	

6.6. SUMMARY

In this chapter the patterns of interaction observed in the lessons of each teacher have been described. Each teacher has been shown to elicit language from their students in a number of different ways all of which have been classified and defined in Chapter Five. The few exchanges which were initiated by students have also been identified so that a clear picture of the patterns of interaction in each teacher's lessons during phase one of this study has been drawn. This detailed information is now available for comparison with the patterns of interaction observed in the lessons taught by the same teachers during phase two.

In order to facilitate the clarification of the differences between each of the types as used by each teacher, this chart shows a brief cryptic definition of each type and typical forms where appropriate. It is not possible to include a typical form for type 6a as these vary. The unifying feature is the source of the students'

response which may be within the elicit or may have occurred earlier in the lesson or even in a previous lesson. Apart from that example typical forms are demonstrated.

FIGURE 15 Summary of Teacher Elicits as seen in Phase One

TYPE	CRYPTIC DEFINITION	TYPICAL FORMS
1a	includes an interrogative word and a phrase which identifies information required by teacher	what,who, why, which, where,
1b	includes an auxiliary and subject/verb inversion	is/are, do/ does,can has/have,
2a	short positive statement plus shortened yes/no question	+ isn't it
2b	positive/negative statement plus not so	+ not so
3a	includes a specialist maths word in a short complete statement responded to as	and it can continue to positive

	if a yes/no question	infinity
4a	positive statement plus short positive utterance which functions as a yes no question	+ right,+ eh, +is that clear
4b	negative statement plus short positive utterance which functions as a yes no question	its not part of the solution is that clear
4c	statements responded to as if yes no questions includes "you" and a present tense verb	so with the division you have a problem
5	includes a verb in the imperative form	read, tell me
6a	statement completed via anaphoric reference	----------
6b	statement completed via a deicitc reference	this, look,
6c	statement completed via	a triangle is

	aural context clue	a plane figure made up of ... [three sides
6d	statement completed via reference to a logical connector	so, therefore, if
6e	statement completed via reference to a cohesive tie	left hand/ right hand side opening/ closing
7a	loops;follow an unacceptable response and return discourse to where it was before response	pardon, say it aloud echo of response
7b	clues;follow silence or unacceptable response provide more information or direct attention to source of correct information	another one bodmas

CHAPTER SEVEN

ANALYSIS OF THE PHASE TWO DATA

INTRODUCTION

In this chapter the model shown in chapter five will be described in terms of the way in which it was observed during phase two of this study. Initially a general comparison will be made. This will be followed by a detailed description of the patterns of interaction as observed in each teacher's lessons. Exchanges headed by a teacher elicit with a mathematical message will be described first, followed by those headed by a student elicit with a mathematical message. A comparison will be made between the patterns of interaction observed in phase one and those observed in phase two.

As the phase two recordings were made as part of the INSET intervention, notes made during the teachers' meetings and as a result of lesson observations are included. This helps to maintain the focus on the teachers and the students and the ways in which they use language to interact rather than allowing the tape recorded language data to become the centre of attention in its own right.

7.1. OVERALL PICTURE

All the teacher elicits with a mathematical message

observed in the lessons recorded during phase two of this research can be classified as described previously and no elicit belongs to more than one class. There are some changes in the proportions of types of elicit used by each teacher and in the forms used within some of the classes although the overall model remains the same.

All five teachers use a large number of elicits which are classed as type 1. These elicits, which either contain an interrogative or an auxiliary and a subject/verb inversion, mostly prospect a student response from a closed set of possibilities. The most common forms are WHAT+ and +WHAT although there are examples of forms which elicit less predictable responses. Details of these new forms are included in the description of the interaction in the lessons of each individual teacher.

There are no examples of type 2a elicits in the phase two data and this marks a small difference in that Teacher one used one form STATEMENT+ isn't it in phase one. The use of type 2b elicits remains the same in this phase as previously although there aren't any examples of Teacher three using the unusual form of NEGATIVE STATEMENT + not so in phase two as she did in the earlier phase.

The use of elicits classified as type 3a and b remains the same in phase two as it was in phase one. That is there are a few elicits in each teacher's lessons which are of the form of a complete statement which are responded to as if they were yes/no questions although they don't contain an interrogative word or subject/verb inversion to indicate that the teacher is asking a question. The same applies to type 3b elicits. Teacher three uses more of the latter in phase two but the change is relatively small and is therefore not significant.

The ways in which type 4a elicits are used in phase two is very similar to the ways they were used in phase one with one minor change. Teacher four only used type 4a elicits occasionally during the lessons recorded as part of phase one whereas in phase two he makes use of this type of elicit often. The forms he uses are the same in both phases.

Elicits classified as type 4b were only used by one teacher in the phase one data and that was teacher five. He doesn't use any forms which would be classified as 4b in phase two,although teacher three does, just once.

It is within the forms used as type 5 elicits that there are interesting changes in all five teachers' lessons. These elicits which are in the form of a statement which include an imperative (see 5.4.5.) are used more often in phase two and are used in ways which

encourage the students to talk at greater length than was the case previously. Some of the forms used were discussed during the research group's teachers' meetings and those used show that these discussions were acted upon by the teachers over a period of time.

There are some small changes in the ways in which the five teachers used type 6 elicits during phase two. Teachers two, three, four and five used statements which are completed by the students making use of a deictic reference within the utterance itself or one immediately preceding it, in phase one, with teacher five using many elicits of this type. However in phase two, Teacher two doesn't use any at all and Teachers one and five use few.

A similar small shift in preference can be observed in the way in which Teacher one uses type 6d elicits; often in phase one and only twice in phase two. Also teacher five uses two type 6e elicits in the second phase although he hadn't previously been recorded using them at all.

There would appear to be more loops and clues (type7) in phase two than was evident in phase one although Teacher one reduces his use of loops to just one in the phase two data.

This brief summary serves to identify the overall changes made by teachers during the phase two recordings which were made after a number of teacher's meetings had

taken place. The types of elicit which will be highlighted in the next section will be types 1a, 1b and 5 as these are those which show changes in the quantity and quality of student language they prospect. The changes made by each teacher will be described in turn.

7.2. TEACHER ONE

Teacher one was recorded teaching class One E on 3.12.93. a double lesson on "Sets". In addition to the researcher, the lesson was also observed by two student teachers from ENS who were preparing for teaching practice. The teacher didn't know that the researcher or the students were going to observe this particular class and thus only had a minute or two to prepare himself. By this stage of the study I had cut down the pre-observation discussion to the bare minimum because I wanted to avoid prompting the teacher or giving them suggestions as to what I might like to see during any particular lesson. I noted in my research diary after the observation of Teacher one on 3.12.91 "He is a real performer and enjoys getting the class moving along his line of thought. The students obviously enjoy themselves and with the exception of about six, participate with great enthusiasm."

7.2.1. As in the first phase he uses a high proportion of elicits which have been classified as belonging to type 1a and 1b in the model. The form which he uses most often

is WHAT± and ±WHAT but WHICH± and WHO± also appear throughout the recording. There are elicits in forms which prospect student responses which are less predictable than those usually expected and offer opportunities for the student responding to speak at greater length, although it is clear that most students still speak as briefly as possibly when responding to a teacher elicit and the teacher maintains control of the discourse throughout the lesson. For example;

T1T5L108

106 T ok i want to write another empty set

107 STS no no

108 T it //////// why that is not an empty set ...

109 ST because we cannot say empty set empty set

110 T yeah that's alright but someone can do it in a

111 better way

112 ST when you have written are already there

113 anything inside the set means an element

...

114 T ////////

115 STS heeheeheeheeheehee

116 T that's very good

and in line 446 the teacher uses a <u>why</u> form in a similar way.

T1T5L446

441 T i want to give one again ... minus

442 ten ...

443 STS no no no //////

444 T <u>why do you think it is wrong yes</u>

445 ST because it should not be in the negative class

7.2.2. Teacher one used one form of type 2a elicit in the phase one recordings, <u>STATEMENT+isn't it</u> . This does not appear during phase two. Nor do any elicits which belong to the class labelled type 2b.

7.2.3. Type 3a and 3b elicits appear in the phase two recordings but there are no changes in either the proportions of those used or their forms. A similar comment can be made about all three sub categories of type 4 elicits. They appear in both phase one and phase two in similar proportions and forms.

7.2.4. There are several examples of type 5 elicits, that is statements which include an imperative to which the students respond verbally. In addition to the forms noted in the earlier chapter Teacher one also uses <u>say, write, give and justify.</u> For example;

T1T5L78

76 T who can come to the board ... and wrote any

77 sign that they know about sets and tell us what

78 it is ... <u>write any sign that you know what it</u>

79 <u>is</u> ////////////

80 ST please sir

81 T yes ... ...

82 ... ... good that one means what

83 ST braces

This doesn't lead to either an increase in the amount of student language or a change in the nature of the response, the student having selected his response from a closed set of possibilities.

Teacher One also uses justify in its imperative form. This form had been discussed during our teachers' meetings. It was point two on handout four as described in 4.3.6.

T1T5L446

446 T //// tell me why ////////////// justify why

447 you think i'm wrong

448 ST minus ten is not greater than two minus ten is

449 not even up to one

450 T ok very good ... go ahead

451 SST so we cannot put minus ten in set b because its

452 smaller than

453 T ok

This does seem to prospect a student response which is both longer than many and shows the student using a logical connector to link two statements of factual understanding. Student language use of this type was not previously observed during Teacher one's lessons. It is possible that Teacher one experimented with this type of elicit quite deliberately in this lesson as he was being observed by so many visitors. I noted his reluctance to experiment in earlier lessons and discussed this with him after a previous lesson observation. In my research diary I wrote;"He says that he has tried to ask the students to explain their answers but they won't talk. I jollied him along a bit and he agreed to have another go". (November 1st 1991)

7.2.5. The ways in which Teacher one uses type 6 elicits in phase two of this study changed little from the ways in which he used them in phase one. However it should be noted that he didn't elicit the completion of a statement based on a deictic reference from the class (type 6b) which he had done previously. Also within type 6d he had previously used a wide range of logical connectors whereas in this lesson he uses only so to link two statements as propositions in reasoned argument. This had

little impact on either the quality or quantity of student language use in phase two.

7.2.7. The ways in which loops and clues are used also remains very similar in these two phases of the study although loops do appear in more sequences of linked exchanges in phase two. For example;

T1T5L430

430 T now ... who wants to tell me why ...

431 STS because because

432 T yes

433 ST ////////////////// greater than two

434 T good so it must be greater than two very good

435 ////////////////// yes

436 ST three

437 T <u>three</u>

438 ST one million

439 T <u>one million</u> ...

440 STS ////////////

441 T <u>one thousand</u>

This does not lead to any significant changes in the ways in which students respond to the teacher and may appear here as the teacher demonstrated how to involve as many students as possible as active participants in his class. This is an issue which the ENS students often ask teachers about as they quite understandably worry about how to feel confident that their students are actively involved when their classes are so large.

It is worth noting that during a discussion with this teacher after the recording for phase two was finished I asked how he felt about being observed by the student teachers. In an entry to my research diary dated 10.12.91 I wrote "He said it didn't make any difference pause except that he probably thought more about what he said and the students all wanted to talk and answer questions when there were new observers in the room." !

7.2.8. Exchanges headed by a student elicit

There are no examples of exchanges headed by a student elicit in these data.

7.2.9. Summary

Many of the patterns of interaction observed in the phase one lessons in teacher one's classroom also appear in the phase two recordings. Most of the elicits he uses prospect a response from a closed set of possibilities although in the lessons being analysed here there were examples of WHY+ elicits which provided the students with opportunities for both more language in response and more personal, tentative forms within the response (see above for an example). This is an important change for the reasons discussed during the teachers' meetings described in chapter five.

FIGURE 16 Summary of Teacher One Elicits (Phase Two)

TYPE	PHASE ONE	PHASE TWO	PHASE THREE
1a	common	most common	
	mostly closed	more open eg why	
1b	common	common	
2a	some	none	
2b	none	none	

3a	some	few
3b	some	few
4a	some	some
4b	none	none
5	some all closed	many some open eg justify
6a	most common	common
6b	none	few
6c	some	few
6d	some wide range of forms	some one form so

6e	some	some
7a	some	common
7b	some	some
ST	few	none
ELICITS		

7.3. TEACHER TWO

The ways in which teacher two elicited language from the students in his class during the lesson recorded on 4.12.91 vary little from the ways already described for phase one in chapter 6. He was recorded teaching the same class as had been recorded in phase one, now in their second year of secondary education.

7.3.1. Again he uses more type 1 elicits than any other with WHAT+ and +WHAT being the most common form in this phase. Most of his elicits prospect a response from a closed set of possibilities as noted in phase one. Occasionally he does use forms which include WHY+ to follow up a student response in order to get the student to justify their opinion. For example;

T2T5L86

83 T how can we use this

84 area in order to find this side ... ...

yes

85 ST ////////////////////// by four

86 T by four ... <u>why should we divide by four ... um</u>

87 SST ///////////

88 T to have the length of one side is twenty six

89 divided by four equal to six

which may appear to be as a result of the discussion we had at teachers' meetings about possible ways of eliciting a second response from the same student in order to get them to explain the ways in which they had arrived at the first response. However according to my research diary this teacher didn't attend the meeting where this was the focus of our discussion although he did receive handout four (see 4.3.6) which includes a suggestion as to how the traditional IRF patterns might by altered.

There is another example of an exchange where the teacher appears to have experimented with a follow up elicit in line 207.

T2T5L207

204 T what is the length

205 of one side

206 STS five ... five

207 T five centimetres <u>how did you get the five</u>

208 <u>centimetres</u>

209 STS by dividing ////////// finding ///////

210 T by finding what

211 CH the square root

212 T the square root of [twenty five

213 CH [twenty five

However although this does elicit a second response from the class it seems to be more a matter of ensuring

that the class reach the end of a previously heard definition rather than giving them the opportunity to explain their procedures in more tentative or exploratory language.

7.3.2. Teacher two uses type 2 elicits in similar ways in this phase as he did previously, that is he elicits an affirmative confirmation from his class by using two forms; STATEMENT + not so and not so on its own (type 2b).Likewise he uses some type three elicits in phase two in similar ways to the patterns described in 6.2.3. such elicits appearing only occasionally in both phases.

7.3.3. Teacher two continues to use elicits classified as type 4a and 4c as he did in earlier recordings most of which prospect a response from a very small set of possible answers . In the lesson being analysed here the students always reply in the affirmative and always in chorus. For example;

T2T5L164

164 T twelve squared is what one forty four

165 ... right

166 CH yes

Elsewhere the same type of elicit is used but in two linked exchanges. For example;

T2T5L454

451 T ... ... note that this rule only holds in a

452 right [angled triangle

453 ST [angled triangle

454 T right

455 STS um

456 T when you have a triangle of this nature it rule

457 will not hold right

458 CH yes sir

7.3.4. There is a small change in the forms of type 5 elicits which Teacher two uses in phase two. Previously the imperatives he used were solve, look, see and say. and these appeared in only two of the four lessons recorded in phase one. In the data being analysed here however he makes use of a different range of forms,

namely draw, measure tell and state which clearly prospect a predetermined response.For example;

T2T5L499

499 T sit down everybody state pythagorus theorem

and

T2T5L527

526 T use this triangle use this triangle in order to

527 tell us pythagorus theorem

He uses one elicit of a different form in connection with the two above examples. Although it would be classified as a type 1b elicit, it is shown here because it is so different from the ways in which he tries to elicit the same information before and after this exchange.

T2T5L510

507 T who can state it

508 without looking at the board ... ... um ...

509 ... ...

510 can you state it in your own words

511 STS no

512 T eh ... eh ... ... can you state it in your own

513 words ... ... if i draw a triangle can you be

514 able to use it in order to state pythagorus

515 theorem ... eh

The suggestion that a student might put a mathematical idea or definition into her or his own words does not appear at all in Teacher two's phase one data. As the value of this was specifically discussed at more than one of the teachers' meetings, it is clear that Teacher two was trying to make changes in his classroom discourse.

7.3.5. There are only changes in the proportion of type 6 elicits used by this teacher in these data. Previously he uses several forms within type 6b none of which appear in phase two. Also having used a range of logical connectors in phase one such as; and, because, meaning that and so

only the latter appears in phase two. In the same way there are examples of loops and clues in the lessons taught by teacher two in both phases being discussed although they only appear once each in phase two.

7.3.6. Exchanges headed by a student elicit.

There is only one example of an exchange headed by a student elicit in this teacher's phase two data. It is of a similar type to some of those described in the previous chapter in that a student interrupts the teacher's discourse without making either a verbal or a non verbal bid for attention. It is noteworthy because more than one student tries to elicit information from teacher two. The second student (line 398) uses an IF+ form which is rare although it was used in phase one (see 6.2.8.) but she cannot complete her elicit because the teacher reclaims the leading role in the discourse by interrupting in similar ways to those used in the previous phase.

T2T5L388

386 T thirteen ... right

387 CH yes sir

388 ST //////////

389 T what

390 ST you have not ////////////

391 STS ////////////////// subtracted

392 T why should i subtract this one is a different

393 problem this is a different problem ... ...

394 STS //

395 T please you have ///////// even this example be

396 quiet ... you are solving following pythagorus

397 theorem ...

398 ST if it was a

399 T you were asked to find a c and given ab and bc

400 before you can subtract ... ...

401 right so this one you are following pythagorus

402 theorem ... so you have first to state ...

403 pythagorus theorum ...

7.3.7. Summary

Thus it can be seen that the patterns of interaction observed in teacher two's phase two recording were similar to those observed in his phase one lessons. The two changes which are important are the forms of elicits within types 1 and 5. These head exchanges which include student responses of a different kind to those previously analysed. There are fewer exchanges headed by a student elicit but those which do appear include unusual forms within the student utterances.

FIGURE 17 Summary for Teacher Two Elicits (Phase Two)

TYPE	PHASE ONE	PHASE TWO	PHASE THREE
1a	most common mostly closed	most common also open eg why	
1b	common	common	
2a	none	none	

2b	some	some
3a	some	some
3b	some	some
4a	common	common
4b	none	none
5	few	some open forms eg <u>tell us</u>
6a	some	common
6b	some	none
6c	few	some
6d	some	some

7a	some	few
7b	few	few
ST	some	some
ELICITS		

7.4. TEACHER THREE

There are very few changes in the patterns of behaviour observed in teacher three's phase two recordings. She was observed teaching the same class as had been recorded in phase one although there were a number of new students in the class due to transfers and the reorganisation of Form Two classes at her school. This teacher was absent for three weeks during the term I was meeting the teachers to discuss possible changes and thus was observed on fewer occasions. However she did collect all the handouts we used during the meetings she missed and took every opportunity to discuss the ideas raised there when I visited her during her absence and after she returned to school at the end of November 1991

She uses all the types of elicit previously noted in 6.3. with a high proportion of her elicits falling into

the type 1 class, particularly those which include the form <u>WHAT+.</u> She continues to use elicits which prospect responses from a closed set of possibilities rather than those which allow the student a wider and/or less predictable choice of response.

7.4.1 However there are one or two exchanges which are headed by a type 1a elicit which do offer the students the opportunity to use more language in their response and to use more tentative or personal forms. It reflects the discussion at the teachers' meeting on 13.10.91 as noted in my research diary. "We also discussed modifying the IRF pattern to IR why/how RF whenever possible."

T3T5L268

265 T is it greater than or less than

266 CH greater than

267 STS greater ///////// greater than ///////

268 T <u>why do you say its greater than</u> ... ...

269 STS ////////////////// greater ////// we know the

270 sign ///////// we know //////

and T3T5L566

560 T we cover it ////////////////////// our original

561 equation not so

562 CH yes

563 T ah

564 CH yes madam

565 T so we added four to this side and this side ...

566 why ...

567 STS to balance to balance the equation

Later, teacher three uses a similar form but rather than open an exchange which allows for unpredictable responses it appears to be used to cue the repeat of the response noted in line 567. In this way the teacher has used a procedure discussed as a way of increasing the opportunities for eliciting more exploratory language from the students (see 2.2.) but used it in such a way that it has become the cue for repetition of a mathematical rule.

T3T5L599

596 T and if we add four to this side of the ...

597 inequality what do we do with the other

598 STS add add

599 T <u>why</u>

600 CH to balance the equation

601 STS balance the balance the equation ////
////////

7.4.2. Exchanges headed by a student elicit

In terms of exchanges headed by a student elicit the phase two data is noticeably different from that recorded in phase one. There are five such exchanges all of which appear to involve the interruption of the teacher's discourse without a verbal or non verbal bid for the teacher's attention. There is one example of a student using a loop to elicit clarification of something the student has missed.

T3T5L403

401 T //////// times four

402 ST pardon madam

403 T that's two

404 SST two madam yes

This seems to be acceptable to the teacher who allows a long silence immediately after this and thus does not reassert her power over the discourse as has been seen with other teachers in previous examples. In another example she does respond to the student elicit with an elicit of her own but not in a way which takes the initiative away from the students completely. They go on to complete their exchange;

T3T5L11

11 STS ////////////

12 T solve what

13 STS the one //////// the open book test the problem

14 there

15 T when i give your papers we'll do that next week

16 so that you have your papers with you

There is one example of a form which was discussed in phase one, that is where the student makes a statement to indicate that they find something difficult and then allow the teacher to clarify their problem for them.

T3T5L19

19 ST we have not yet understood the question madam

20 T the

21 SST the checking

22 T the identity

23 CH yes madam

and two examples of unusual forms. In both cases a student uses a WHY+ form once when the teacher made a simple slip on the board

T3T5L604

603 T you see the ////////

604 ST i want to ask why is that ////////// to

605 that side

606 T have i changed it

607 STS yes changed ///////

and once where the WHY form elicits a response from another student as well as from the teacher who uses the elicit to publicly clarify the point.

T3T51522

521 T six is greater than x ...

522 ST why can we not find it by adding //// to both

523 sides ////// four

524 ST because they are unknown

525 T let's do it like he has said ... two greater

526 than x minus four so you want us to add two to

527 both sides

528 SST yes madam

529 T so we have ... two plus two greater than

... x

530 minus [four plus four

531 CH [four plus four

532 SST plus two

533 T plus two

7.4.3 Summary

Although the changes observed in the ways in which exchanges with a mathematical message in this teacher's lesson are small and do not require the alteration of the model suggested in chapter five, those which have been illustrated above show that the teacher was experimenting with the way she elicited language from her students and the ways in which she enabled the student to elicit language from her. This experimentation led to small changes in the amount of student language used.

FIGURE 18 Summary of Teacher Three Elicits (Phase Two)

TYPE	PHASE ONE	PHASE TWO	PHASE THREE
1a	common	most common	

	mostly closed	open forms eg why, how will you
1b	common	some
2a	none	none
2b	some	common
3a	few	few
3b	some	common
4a	few	few
4b	none	few
4c	some	some
5	few	common open forms eg support

6a	common	common
6b	very common	common
6c	few	few
6d	some	common
7a	few	common
7b	few	common
ST	few	some
ELICITS		

7.5. TEACHER FOUR

Teacher four could not be recorded teaching the same classes in phase two as he had taught the previous academic year because he was no longer teaching them. Nor was he allocated any other Form One or Form Two class. On October 5th, "He asked today whether the research was restricted to Form One - we all agreed that whatever

ideas we have should be applicable to all topics and all levels" (research diary) So in this phase he chose to be observed and recorded working with two Form Three classes, one large and one small (see 4.3.9 for details).

This teacher (see illustration 7) seemed to be very committed to the research from the start. At the beginning of phase two I noted in my research diary that "Both teachers [four and five] seem very motivated - they have both started teaching and have begun to experiment with various techniques." (October 24th 1992). At the third teachers' meeting held just before the school boycott ended on October 22nd, he reported that he had been looking through his scheme of work to see where he might experiment with some of the ideas and techniques we had discussed in earlier meetings but that "There aren't any opportunities for more language use in some topics".

ILLUSTRATION 7 INSIDE CLASS 3B AT CITY COLLEGE OF COMMERCE APRIL 1992

7.5.1 In this phase Teacher four uses all of the types of elicit he used in phase one. There are changes in the proportions he uses and in the forms with certain types. These small changes lead to some differences in the ways in which his students use language during their maths lessons.

7.5.2. He continues to use a large number of elicits which would be classified as type 1a or 1b. These mostly prospect responses from a closed set of possibilities as seen in the analysis of the phase one data. The form he uses most often includes WHAT± or ±WHAT . There are examples of new forms, however, some of which were discussed at teachers' meetings. For example;

T4T6L150

143 T is this number between one and nine point nine

144 or between ten and ninety nine ...

145 CH ten and ninety nine

146 T that is that is a choir ... i want somebody to

147 //////// the answer you say it is between ten

148 and *

149 ST ninety nine

150 T ninety nine ... ... how do you know that it is

151 between ten and ninety nine ...

152 ST because ... the decimal point is between ...

153 one point six ... so //////// between one and

154 ////// one ////// point nine

155 T ok sit down

and T4T6L455/461

455 T ////////// who can give us a reason why this

456 changes to two ... ... because somebody is

457 already saying that if it was one six ... does

458 it mean that this is supposed to be but a four

459 now

460 STS no no

461 T <u>why ... has this disappeared</u> ////////// ////

462 ok ... yes

463 ST because you have converted it into one

464 T and added two to

465 CH one

466 T one

7.5.3 There are no examples of any type 2a or 2b elicits in the phase two data and teacher four continues to use elicits classified as types 3a and 3b in a similar way as he did earlier.

7.5.4. However there is a change in the proportion of elicits which belong to type 4a in these data. Previously this teacher had used forms such as <u>STATEMENT+ is that true, STATEMENT+ is that correct,</u> and <u>STATEMENT+ is that</u>

clear but not often. In these data he uses these forms plus STATEMENT+ are you seeing what i'm saying in greater numbers. For example;

T4T5L183

179 T if i have those this piece of

180 chalk and i want to give it out to three

181 persons ... and i don't want to break it

...

182 one person will receive nothing ... and i will

183 still //////// with a piece of chalk is that

184 true

185 CH yes

and T4T6L225

223 T this is between four and

224 zero while this is between zero and four you

225 <u>understand what i'm saying</u>

226 CH yes

It is also noted that the statements which precede the short positive utterance which functions as a yes/no question, which typifies this type of elicit are much longer in the phase two lessons. It might be that this is because the teacher is working with a Form Three class who are thought able to process longer utterances in English than the students of Form One recorded in phase one.

7.5.5 There are some interesting new forms seen in the elicits used by Teacher four which fall into the type 5 class. He used statements including a verb in its imperative form only rarely in the earlier lessons, typical forms there being <u>measure</u> and <u>read</u>. Here he uses type 5 elicits more often and uses forms which require the students to use more language to respond . There are examples of the teacher trying to give the students more direction about asking their own questions although this doesn't lead to any noticeable change in their behaviour. For example; T4T5L326

323 T and if you want to put these elements together

324 the thing give us the same thing as we had here

325 putting the elements of all these four sets you

326 are going to have a set of integers ask me a

327 question relating to that ... ...

328 ... ... are you ok ... when i say

329 STS ////////////////////////////////////// ////

and T4T6L620

619 T negative will seven divided by four give a

620 remainder of two test yourself

621 ST ////////////////

7.5.6 There are no changes in the ways this teacher uses elicits classified as belonging to type 6 although he uses IF (as a typical form within type 6d) far more often in phase two than he did in phase one.

7.5.7. A similar change in the number of a particular type of elicit also appears in type 7 where there are a greater number of loops in phase two than was the case in the earlier recordings particularly those which show the teacher repeating the student's response or rewording it a little.

For example, here the student recognises that the loop has been used to indicate that the response given by another student in unacceptable so even though he doesn't seem ready to give a correct response himself he acknowledges the teacher's loop .

T4T5L237

234 T ... so when you talk of positive and negative

235 numbers

236 ST a set of natural numbers

237 T she says a set of natural numbers ... ...

238 ST no

He also uses a series of loops to maintain a sequence of linked exchanges as follows;

T4T5L378

373 T from the definition of variable what is

374 constantly changing what is or are the

375 variables in this question ... this is [our

376 question

377 ST [x

///

378 T <u>yes</u>

379 ST three m and twenty

380 T <u>pardon</u>

381 SST three m and twenty

382 T <u>no three</u>

383 STS x x

7.5.8. Exchanges headed by a student elicit

More students elicit language from teacher four during the two lessons recorded during phase two than

they did during the eight recorded in phase one. The students gain the floor using three of the four strategies classified in the model described in 5.6. There are two examples of exchanges headed by a student elicit beginning with a verbal bid for the teacher's attention. For example;

T4T6L4

4 ST please sir

5 T you have a question

6 SST ////////////////////

7 T ok i asked that's its very good because if you

8 had not reminded me we ought not to have done

9 the right thing

and T4T6L449

449 ST please sir

450 T yes

451 SST where the last eight is ... the //////

452 ST you still add

453 SST you also /////////// go down

454 T no ok sit down i've seen where you are

455 who can give a reason why this

456 changes to two ... ...

This exchange is particularly interesting because it shows a student responding to the elicit of a classmate spontaneously without the teacher trying to reclaim the initiator role immediately. The student who opens the exchange also holds the floor and elicits more information not once but twice. This is unusual in these data. This may be due to the teacher encouraging more student language use but could also be because the class includes students who are older and more confident about talking to their teacher when the rest of the class is listening.

There is an example which seems to interrupt the teacher's discourse.The teacher acknowledges the student by eliciting more information. For example;

T4T5L700

698 T test it for the rest this means remainder three

699 and so on

700 ST <u>/////// of the remainder is one how will</u>

701 T which negative one here

702 SST yes

Finally there is one example of a student stopping the teacher not by eliciting information directly but by stating that they have a problem. The teacher acknowledges the student and elicits more information from them immediately.

T4T5L169

166 T but if they are

167 numbers we are supposed to divide we know that

168 it will go zero ////////// remainder one

169 ST sir i'm not clear

170 T what ... what is your question

171 SST why is it that one one four seven are there

171 i don't know [////

172 T [there are numbers that when we

173 divide it by three the remainder is one ... ...

7.5.9. Summary

Thus it has been shown that teacher four made some changes to the ways in which he elicited language with a mathematical message from the classes he taught during phase two of this study. The changes were in the proportions of the types of elicits used and in the forms seen. There are also more exchanges headed by a student elicit although it is not possible to say that this is a result of the teacher's behaviour or because he was recorded teaching different classes in the two phases.

FIGURE 19 Summary of Teacher Four Elicits (Phase Two)

TYPE	PHASE ONE	PHASE TWO	PHASE THREE
1a	common mostly closed	common open forms eg <u>why</u>, <u>how do you know</u>	
1b	common	common	
2a	none	none	
2b	none	none	
3a	some	few	
3b	some	few	
4a	some	common	
4b	none	none	
4c	some	some	

5	some	common open forms;<u>reason it out</u>, <u>ask me a question</u>
6a	common	common
6b	most common	common
6c	common	few
6d	some	common
6e	some	some
7a	some	common
7b	few	some
ST ELICITS	few	more common

7.6. TEACHER FIVE

Teacher five was recorded teaching two new Form One classes during phase two of this study. He chose the classes to be similar to the ones he had taught in phase one, that is one large and one small. He attended all the teachers' meetings and although he often seemed very quiet during these meetings he did make suggestions and was observed to be trying out various techniques in the lessons observed prior to recording. For example on Friday 8th November I wrote in my research diary;"In One Commercial which is the small class, he started with a Guess the set game which went well-- he included a think-tell-share activity which was OK although as it was the first time he'd done it the students were a bit surprised."(See 4.3.6. for more details of Think-Tell-Share)

7.6.1. There are several changes in the proportions of various types of elicit in this teacher's phase two tapes. However he uses elicits of types 2,3,4 and seven in similar ways in this and the previous phase. The typical forms within each of these types are also the same.

7.6.2. However in the elicits which belong to type one, he uses all the forms seen previously and at least one new form. This shows that he was experimenting with ideas raised during the teachers' meetings.

For example;

T5T6L363

358 T please finish quickly and tell me ... ...
...

359 ... ... listen you cannot do it ask
your

360 friend how ... ...
tell

361 us ... ...

362 ST //////////

363 T um but how did you get it ...

364 ST ////////////////////

365 T ok

and T5T6L414

410 T this will be four

411 STS yes yes no no four

412 T this will be four

413 STS yes //////////

414 T how did you get this ....

415 STS two over two multiplied by two ///////

416 ST is two over two when you multiply two times two

417 that will be four then two times ///////

418 ST ten

419 T two times two is four

420 STS yes sir /////////// two times five is ten

and again T5T6L443

440 ST the answer is three

441 T three

442 CH yes sir

443 T now how did you get that /////

444 ST three ... three ... means here will be three

445 over three

The three examples, shown here in the order in which they appear also show the students becoming more confident about what the teacher means when he says <u>how did you get it/this</u> and that this type of elicit prospects more tentative, exploratory language than many of the forms observed in phase one.

7.6.3. There are also marked differences in the forms used to realise elicits which fall in to type 5 of the evolving model. That is elicits which are typically in the form of a statement which contains one of the following imperatives; read, say, tell, list, give, explain, draw, take, make or change. The forms seen here not only prospect a response which is appropriate to the imperative but also provide the opportunity for more student language use, more student-student interaction which the teacher facilitates but does not comment upon. In phase two there are also examples of elicits which allow the possibility of students using languages other than English to help each other understand the mathematics topic in question. The use of languages other than English is not overtly elicited but it is implied by the teacher checking that both students come from the

same village, that is that they both speak the same home language.

For example;

402 T ask you

403 friend again ... you come from the same village

404 ST ////////////

405 T ask her to explain it

406 STS //

Elsewhere the teacher requires the students to talk to each other. He allows time for this to take place and although he is monitoring the talk he does not participate nor does he ask that the students private language use be made public. For example;

T5T5L324

324 T i want those who cannot do it ... ...

325 ... ... hands down ... ... ask your friends

326 know how to do it ...

327 STS //

328 T ask your friends who know how to do it

329 STS //

and

T5T6L312

312 T ... ok ////// two of you and discuss the answer

313 ... //////// /////////// ok ... tell those who

314 don't know ... ... share out ////////// ...

315 STS ////////////////////////

316 T please make sure if you don't know ... you try

317 and find out ... //////////

318 STS //

319 T so all the hands will be up now ... ...

These innovative forms of elicit in this class are very important as they show teacher five experimenting with elicit types that we had discussed during teachers' meetings but in ways which he has chosen for himself. That is, we had considered the importance of encouraging students to ask more mathematics related questions (see Handout 4 in 4.3.6.). However the idea of encouraging students to ask their friends for further information had not been specifically raised at any of our meetings.

7.6.4. The only other differences between the ways in which Teacher five elicits language from his students in phases one and two are seen in the proportions of elicits which can be classified as type 6b and 6e. Firstly in phase one this teacher uses a large number of type 6b elicits, that is those statements which the students complete via a deictic reference. In phase two he uses few of these. Secondly he uses one or two type 6e elicits in phase two whereas it was noted that in phase one he didn't use any elicits from this class, in any of the lessons recorded.

7.6.5. Exchanges headed by a student elicit.

Finally it should be noted that there is only one example of an exchange which is headed by a student eliciting language from the teacher. This follows a pause

in the discourse so although it is not preceded by a bid, verbal or non verbal, for attention it does not seem to interrupt the teacher. However, as noted previously it is noticeable that the teacher reclaims the leading role not by initiating a new exchange himself but by directing the student to; ask your friend.

T5T6L401

400 T ... ... now sit down there ...

401 ST //////// don't understand very well

402 T you don't understand very well ... ask your

403 friend again

Again, although this seems a small change it is significant because it allows the students to elicit help from each other, by talking, with the full support of the teacher. This did not happen in this teacher's phase one data.

7.6.6. Summary

Teacher five made some important changes in the ways in which he elicited language from his students during phase two of this study. He had clearly considered some of the points raised during the teachers' meetings. He has gone

further than just trying out an idea in the ways considered by the research group, by experimenting with innovative forms of elicits within the types classified in the phase one data. In this way he has introduced practices which facilitate more student language use and more opportunities for exploratory language as well.

FIGURE 20 Summary of Teacher five Elicits (Phase Two)

TYPE	PHASE ONE	PHASE TWO	PHASE THREE
1a	common mostly closed	common open forms eg how did you get it	
1b	common	some	
2a	none	none	
2b	none	none	
3a	some	some	
3b	few	some	

4a	common	common
4b	few	none
4c	some	some
5	few	common open forms; tell me, discuss, ask your friend,
6a	few	few
6b	common	few
6c	some	none
6d	some	few
6e	none	few
7a	some	common

7b	few	few
ST	few	few
ELICITS		

7.7. CONCLUSION

In this chapter the similarities and differences in the patterns of verbal interaction as observed in phases one and two of this study have been examined. All the teacher elicits which headed exchanges with a mathematical message belonged to one of seven classes as defined in 5.4.and all the student elicits heading exchanges with a mathematical message belonged to one of four classes as defined in 5.6.

However, notable differences were identified. These mostly appeared in types 1 and 5 where teachers were seen to be experimenting with innovative forms which could elicit more student language and more language which was tentative or exploratory. Some of the forms noted had also been discussed at the meetings of the teachers participating in the study but others had not. This shows that in addition to trying out forms which the teachers had thought about during our meetings that is when they were required to concentrate only on the language used

during the teaching and learning of mathematics in their classrooms, they were also thinking about and trying out forms and strategies in their own time. Perhaps it is no coincidence that the teachers who appear to have made the most interesting changes to their own language use were both working in the same school. They often mentioned that they talked to each other about language issues almost every day (see 4.3.16.) particularly in the early stages of phase two when their school was closed and thus they had time on their hands. Perhaps it was this ongoing support from a colleague which encouraged them to be so innovative. The smallest changes would appear to be in the lessons recorded when Teacher one was teaching, one reason for this might be that this teacher was already very experienced and felt less inclined to change his obviously successful practices.

It is only possible to speculate on the reasons why some teachers change more than others as this was not the specific focus of this research. It is sufficient to note that changes did take place, some of which are clearly as a result of the INSET interventions.

In the next chapter the recordings made during phase three will be analysed to see if the changes noted here remained in place after a term without further INSET and whether there were any further changes in the ways in which teachers elicited language from their students.

CHAPTER EIGHT

ANALYSIS OF THE PHASE THREE DATA

INTRODUCTION

In this chapter the lessons recorded during phase three of the research are analysed in the same way as the data from phases one and two as described in chapters five and six. The resulting analysis is compared with that of the phase two data and differences noted in terms of both form and the number of examples of particular types of elicit.

Notes made during informal discussions with the teachers and as a result of reflection after lesson observations are included. This maintains the focus on the patterns of interaction as they occurred during mathematics lessons rather than on tapes or transcripts.

8.1. OVERALL PICTURE

All the teacher elicits with a mathematical message observed in the lessons recorded between 15.04.92 and 21.04.92 can be classified as described previously and no elicit belongs to more than one class. There are variations in the proportions of types of elicits used by each teacher in comparison with the ways in which certain elicits were used in phases one and two and there are examples of new forms within three of the classes.

As in phase two all the teachers use a large number of elicits classified as belonging to type one. WHAT+ and +WHAT are the most common forms, both prospecting responses from a closed set of possibilities. There are some examples of type one elicits which prospect responses of a less predictable nature in the lessons of three of the teachers recorded.

Teacher one makes use of one elicit from type 2a, returning to a form observed in his phase one data, STATEMENT + isn't it. This is the only example of this type of elicit in phases two or three. The use of elicits in type 2b remains the same in this phase as it was in phase two. The same can be said for type 3a elicits.

There is a slight change in the number of type 3b elicits used in relation to the overall number in the lessons of three of the teachers participating in this study. Similar changes were observed with all the remaining types, although not in every teacher's data. In other words every teacher made small changes in the proportion of types of elicit they chose to use in phase three.

There is also evidence that some of the changes made by individual teachers during phase two were maintained. This is particularly noticeable in terms of the forms prospecting open responses within types 1 and 5

specifically in the lessons of teachers one three and five.

This brief summary introduces the analysis of the phase three data. In the rest of this chapter the contrasts between the patterns of interaction observed in the lessons of individual teachers in this phase and those of the previous two phases will be examined in more detail.

8.2. TEACHER ONE

Teacher one was recorded teaching a lesson on "The collection of numerical information," on 21.04.92 There were fifty six children present. This lesson includes a few minutes during which the children were encouraged to work in groups. Due to the positioning of the tape recorder and the fact the students talked to each other in whispers none of this group work was recorded clearly enough to transcribe.

There are marked changes in the way that this teacher uses two types of elicit, types 1a and 5 in this phase model. These changes were noted in the phase two lessons and thus reappear here. There are more examples of type 1a elicits than any other type in this lesson and most prospect a response from a closed set of possibilities. However there are examples of elicits

which could be answered in less predictable ways, such as;

T1T61202

197 T which one do you think ////////////////

198 STS ////////

199 T yes

200 ST thirty eight thirty nine forty

201 T ok why do you think this is intelligent

202 SST because not everybody has the same size feet

203 T everybody has his or her own size of feet

204 T very good

205 T

and T1T6L351

346 T divided by what

347 ST five

348 CH five

349 T by what /////////// yes

350 ST five

351 T <u>how did you know it was five</u>

The latter is particularly interesting because it is a form of elicit which had been discussed during teachers' meetings but which this teacher had not used during any previous recorded lessons.

Within the elicits classified as type five there were similar, more open type of elicits which included an imperative for example;

T1T6L461

459 T let us see who

460 can come to the board ... and solve the first

461 one <u>explain</u> to us how he goes about it

462 ... ...

Thus one of the aims of the intervention activities of phase two;that of enabling the teachers to promote more student language use during their lessons would seem to be have been achieved by this teacher during phase two and maintained in phase three.

Within all other classes of the evolving model as seen in phases one and two the phase three data remains similar. The number of examples of several type of elicit has changed although all the changes are small.For example type 3b elicits, incomplete statements of fact to which the students respond by supplying a missing piece of information, are common in phase three but not in the earlier two phases. A similar increase is noted in elicits classified as type 6b that is those statements which are completed by the students making use of a deictic reference within the elicit.

There are fewer examples of certain types of elicit in the phase three data notably types 4a, 4c, and 6c but again the changes are small.

There is an interesting sequence of elicit and response exchanges in this lesson. It occurs when a student had been asked to come to the board and complete an example on the board.

T1T6L502

492 T the second on there

493 ST /////// of number two which add all the numbers

494 ... //// which are one two zero and eight

495 STS no no

496 SST //// by the total numbers of ... by the numbers

497 ////////////// //// one

498 T see he has come to the zero ... for who would

499 think that zero is an ///// number ... //////

500 ////// beautiful ... he says one two three four

501 five six good

502 SST ////////////////////////////////// one plus zero

503 //////// plus three

504 CH four

505 SST plus zero

506 CH four

507 SST plus six

508 CH ten

509 SST plus eight

510 CH eighteen

511 STS ... ////////////////// six over eighteen

512 SST then ... ... /////////

513 T very good the mean is equal to three

During this sequence of exchanges the student elicits language from the class using elicits which would be classified as type 3b if they were used by the teacher. The class, responding in chorus, behave as they would with the teacher, that is they supply the missing piece of information as if the elicit were in a question form.

8.2.1. Exchanges headed by a student elicit

There is only one example of a student eliciting language from teacher one in the phase three recording.

T1T6L411

405 T so we are going to do cross multiplication ...

406 twelve multiplied ... twelve plus x is equal to

407 what ... twenty ... twelve x is equal to *

408 [twenty

409 CH [twenty

410 T ...

411 ST ////// please sir ////// i have not

412 understood

413 T you have understood ////// cross multiply

414 ... ... we cross multiply

415 ///// ///// and then /////

416 CH yes sir

As this includes a verbal request for permission to continue it falls within type one of the classification of student elicits as described in the previous chapter. The only difference is that the student doesn't appear to wait for the teacher's verbal permission to continue. It must be assumed that as the student spoke after a pause the teacher did not react as if to an interruption and thus the student assumed that permission had been granted.

8.2.2. Summary

Teacher one continues to use newer forms of elicit in types 1a and 5 as discussed in chapter seven. The fact that he maintained these changes over a long period without any further in-service support suggests that their use has become part of his everyday teaching repertoire. The small amount of group work suggested during this lesson reflects suggestions made during the teachers meetings of phase two and suggests that the changes made to the ways of encouraging students to use English are long lasting.

FIGURE 21 Summary of Teacher One Elicits (Phase Three)

TYPE	PHASE ONE	PHASE TWO	PHASE THREE
1A	common	most common	most common

	mostly closed	more open eg why	some open eg why and how do you know
1B	common	common	common
2A	some	none	none
2B	none	none	none
3A	some	few	few
3B	some	few	common
4A	some	some	none
4B	none	none	none
5	some all closed	many some open eg justify	many some open eg explain tell us

6A	most common	common	common
6B	none	few	common
6C	some	few	none
6D	some wide range of forms	some one form so	some wide range of forms so, and, therefore
7A	some	common	common
7B	some	some	few
ST	few	few	one

ELICITS

8.3. TEACHER TWO

The lesson recorded on 15.04.92 in Teacher two's classroom began with an exodus of students. Those who had not paid all their fees were asked to leave the school,

only twenty two students of class 2G/C remained for the lesson which was about calculating compound interest.

The teacher's use of elicits differed from those observed in his phase two data in several ways. The patterns of interaction in this lesson appear closer to those noted in phase one.

This is most noticeable in terms of the number of elicits which prospect a response from within a closed set of possibilities. Whereas in phase two this teacher used some elicits which prospected less predictable responses particularly within types one and five, in phase three there are no examples of this type of elicit.

The elicits used which belong to type 1a and 1b are the most common type of elicit used and are all closed. Typical forms are similar to those seen in phase one, for example

T2T6L45

43 T you must add the ////// to four percent

44 therefore interest for first year ... ...

45 ... ... <u>is equal to what</u>

46 STS ////////////

and T2T6L69

69 T ... ... <u>how do we calculate</u>

70 <u>the interest for the second year</u>

71 ST two two eighty times

A similar change can also be seen in the way Teacher two uses type 5 elicits in phase three. In contrast to those observed in phase two some of which prospected a response which was not predictable, those in the lesson being analysed here are few in number and all prospect responses from within a restricted set of possibilities. For example;

T2T6L410

410 T ... let's <u>multiply</u> and see ... one point zero

411 three ... one point zero

412 ST three

This is similar to the elicits of this type which appear in this teacher's phase one data.

The only other change to note is that of the number of type 6b elicits appearing in phase three. Although in phase one there were some examples of this type of elicit (a statement completed by the students using a deictic reference) there weren't any in phase two. Here in phase three they are a common form of elicit and are sometimes used in the opening exchange of a sequence of linked exchanges. For example;

T3T6L568

568 T //////// cost of the sugar and <u>this</u> is the

569 number of packets ... and <u>this</u> the *

variation

570 sign ... <u>so this is c varies with ...</u> [n

571 ST [n

There are more examples of types 3b, 4b and 7a within the phase three lessons but the forms remain the same as those described in phases one and two. It would appear therefore to be merely a change in emphasis rather than anything more significant.

8.3.1. Exchanges headed by a student elicit

As in the previous phases there are examples of student elicited exchanges although few in number. For example;

T2T6L341

337 T as you move higher you will see that the

338 first ... the second one is easiest one as you

339 thought ... ////////////// because you have to

340 multiply let's say one point zero //////// ...

341 STS we had /////// we had the answer but we

342 subtracted /////// subtracted yes /////

343 T subtract what ...

This is an unusual form of student elicit in two ways. Firstly several students take part in the elicit and secondly it is not preceded by any form of bid for

the teacher's attention or for permission to speak. However the teacher doesn't behave as if the elicit is an unexpected interruption although as in previous examples he does open a new exchange by eliciting further information for the students and thus reclaims the leading role in the discourse. This unusual more informal strategy of eliciting language from their teacher may have occurred in this lesson because the small number of students present changed the context in which the discourse occurs.

8.3.2. Summary

There is no evidence of teacher two making any changes to the ways in which he elicits language from his students in this data in comparison with the ways he elicits language in phase one. It must be noted that any changes observed show teacher two reverting to his previous patterns, as described in chapter five.

FIGURE 22 Summary of Teacher Two Elicits (Phase Three)

TYPE	PHASE ONE	PHASE TWO	PHASE THREE
1A	most common mostly closed	most common also open eg why	most common all closed
1B	common	common	common

2A	none	none	none
2B	some	none	none
3A	some	some	some
3B	some	some	common
4A	common	common	common
4B	none	none	few
4C	some	few	few
5	few	some open forms eg tell us	few all closed
6A	some	common	some

6B	some	none	some
6C	few	some	none
6D	some	some	common mostly so
6E	some	some	none
7A	some	few	common
7B	few	few	few
ST ELICIT	some	some	some

8.4. TEACHER THREE

The topic of the lesson recorded on 14.04.92 was "Variation". The elicits with a mathematical message observed in this lesson are similar to those observed in Teacher three's phase two lessons although there are several changes in the numbers of various types of

elicit. There are more examples of type 4a elicits in phase three but fewer examples of types 4b, 6c and 6e. These are small changes and in the case of 6e particularly, the teacher returns to the way in which this type of elicit was used in phase one.

There are two points of note in this phase however, both showing that changes made in phase two have been incorporated into teacher three's teaching style and consolidated by the time this lesson was recorded. The first concerns elicits of type 1a which are the most common type in all three phases of this research. Teacher three continues to use many which prospect a response from a closed set of possibilities whilst increasing the number of those which prospect less predictable responses. Examples of the latter, in this lesson include;

T3T6L108

108 T <u>how did you get twelve</u> ... ...

...

109 ... ...

110 SST thirteen

111 T you've changed your mind to thirteen ... so <u>how</u>

112 did you get thirteen ... ...

113 SST four times three plus one

and T3T6L994

985 T is he correct he says he has not divided both

986 sides by two ////////////// is not a constant

987 number ... is he correct

988 STS no no madam no ///////

989 T this what you have fifteen is equal to ...

990 [three 1

991 CH [three 1

992 T and he has decided to divided both sides by

993 three ... ... but somebody's ////// number

994 fifteen and three ... his question is why

995 is that he has decided to divided it by three

996 instead of dividing by two ... ...

The second type of elicit which was realised by forms prospecting an open response in phase two and which includes similar examples in phase three are those which include an imperative, that is type 5 elicits. For example;

T3T6L1067

1067 T <u>explain</u> ... just <u>explain</u> how you arrive at that

... ...

The forms used to realise all other types of elicit remain the same in this phase as they were in phase two. The changes which occur are in the number of examples of four types of elicit. There are more examples of types 4a and 6e and fewer examples of types 4b and 6c in this lesson but the differences are small.

8.4.2. <u>Exchanges headed by a student elicit</u>

In this phase, both examples of a student eliciting language from the teacher are similar to those classified

as type three in phase two (see 5.6.3 for details) Neither are prefaced by a verbal or non verbal bid for the teacher's attention but neither seem to interrupt the teacher's discourse. In the first case the student asks for more information about a symbol which the teacher has just written on the board;

T3T61503

500 T so we say circumference varies directly with

501 that is the sign ... ... that's how you write

502 it ... ...

503 ST <u>that is what madam</u>

504 T varies directly with

The form of the student elicit is interesting in this example because it is in the form of a direct question, rather than the usual statement indicating that the student has a problem after which they wait for the teacher to find out the exact nature of the problem. The teacher does not seem to react to this elicit as if it were an unwanted interruption, she merely responds to the

elicit as if it were a loop, provides the information required and continues with her lesson.

The second example of an exchange headed by a student elicit is also interesting because it shows a student apparently correcting the teacher. This is then picked up by a number of students who call out their opinion on her apparent mistake. The teacher is writing on the board at the time this takes place.

T3T6L981

970 T now you are going

971 to solve the second part number two find the

972 value of l when m is equal to ... fifteen ...

973 ... ...

974 ST you substitute m for ///////// ... ...

975 you divided both sides by two ... ...

976 ... ...

977 ST you divide both sides by two ... ...

978 T ////// anything

979 ST l is equal to five ... ...
...

980 STS heeheeheeheeheeheehehehehe

981 ST madam you have not divided both sides by two

982 STS heheheheh

Again the teacher doesn't seem to mind being interrupted and corrected in this way although the students' utterances do halt her explanation. She picks up the main point of the student elicit and opens a new exchange thus reclaiming the leading role in the discourse. Thus this student elicit could be classified as type 4 (see 5.6.4. for details) differing only in the sense that the teacher continues without commenting on the way in which the apparent mistake was pointed out.

8.4.3. Summary

In this way it can be seen that teacher three has maintained the changes she implemented during phase two and has continued to experiment with different forms of elicit classified as types 1a and 5. She has also created or allowed an atmosphere to develop in which students feel able to elicit a response from her without first gaining her overt permission to speak. The overall aim of promoting teacher's language use which would allow or promote more student language use would appear to have been achieved by this teacher.

FIGURE 23 Summary of Teacher Three Elicits (Phase Three)

TYPE	PHASE ONE	PHASE TWO	PHASE THREE
1A	common	most common	most common
	mostly closed	more open eg	some open eg
		why	why, how did
			you know and

			how did you get
1B	common	some	some
2A	none	none	none
2B	some	common	common
3A	few	few	few
3B	some	common	common
4A	few	few	common
4B	none	few	none
5	few	common open forms eg support	some open forms eg explain and tell us
6A	common	common	common

6B	very common	common	common
6C	few	few	none
6D	some	common	common
6E	some	common	some
7A	few	common	common
7B	few	common	few
ST	few	few	few

ELICITS

8.5. TEACHER FOUR

In the two lessons recorded in phase three teacher four made some changes to the ways in which he had elicited language from his class in phase two. Most of these changes were small and most showed him reverting to

patterns of interaction which had been noted in the phase one lessons.

He used fewer elicits of types 4a, 6c and 6e but the forms used to realise these three types were the same as those used previously. The most common type of elicit in these data was type 1a, the difference here being that all the forms used prospected a response from a closed set of possibilities. The questions words used, that is WHO, WHICH, HOW and WHAT also appeared in phases one and two with WHAT+ and +WHAT being the most common forms. For example;

T4T7L70

70 T what

71 is wrong with this diagram ... ... yes

and T4T7L305

305 T ... and what will it be equal to ... ...

...

306 STS ////////// //// ////// ////

307 T nine squared is what

308 STS eighteen eighty one one

309 T who is talking about eighteen

These changes would suggest that the INSET meetings held during phase two only affected the ways in which this teacher elicited language from his students, temporarily. By phase three, which was three months later he has returned to his original patterns of interacting with his class. However there is an example of a type 5 elicit which seems to indicate that this teacher is still trying to find ways of eliciting language from his students. Or having given the researcher permission to observe this lesson he felt he should try to put something he remembered from the teachers' meetings into practice. One of the aims discussed during the teachers' meetings was how to get students to ask more maths related questions (see 4.3.6. for details) and in this lesson there is an example of Teacher four doing this successfully.

T4T7L314

314 T ... <u>if you have any questions concerning this</u>

315 <u>particular /////// ask</u> ... ... yes

316 ST //// ////

317 T what is your question again

318 SST ////////////

319 T ok you follow up the way we did this one

8.5.1. Exchanges headed by a student elicit

Apart from the example shown above where a student elicited language from the teacher as a result of an invitation to do so there is only one example of a student elicit;

T4T7L93

90 T conditions for similar triangles ... ... if

91 these two triangles are supposed to be similar

92 ... and a x y is equal to this other angle ...

93 STS pardon pardon we have not heard //////

94 T conditions for a similar figure a //// triangle

This is similar in form to one of the student elicits described in 7.5.8.in that the elicit is not prefaced with a bid for the teacher's attention or a request for permission to speak. It differs in that several students speak at the same time. Perhaps this is why the teacher responds to the elicit as if it were a loop. That is he doesn't appear to be upset by the interruption, he doesn't acknowledge or comment on the elicit rather he responds to it by going back in his explanation and repeating his original statement .

8.5.2. Summary

It is disappointing to note that teacher four did not maintain all the changes made to his range of eliciting language from his class in phase two. However in this phase students do elicit language from him as they did before and respond immediately to his invitation to ask questions which was one of the aims agreed during the teachers' meetings of phase two.

FIGURE 24 Summary of Teacher Four Elicits (Phase Three)

TYPE	PHASE ONE	PHASE TWO	PHASE THREE
1A	common mostly closed	common open forms eg why, how do you know	most common all closed

1B	common	common	some
2A	none	none	none
2B	none	none	none
3A	some	few	few
3B	some	few	few
4A	some	common	few
4B	none	none	none
4C	some	some	some
5	some	common open forms;<u>reason it out</u> <u>ask me a question</u>	some open forms eg <u>ask</u>
6A	common	common	common

6B	most common	common	common
6C	common	few	none
6D	some	common	common
6E	some	some	few
7A	some	common	common
7B	few	common	some
ST	few	more common	few

ELICITS

8.6. TEACHER FIVE

The two lessons recorded in phase three covered two different topics. In the first the teacher reviewed an assignment on "Pictograms" and the second a review of the

terminology of statistics. The second class 1 COMMERCIAL was smaller than usual because on the day of the recording 20,04.92 students who had not paid their school fees had been sent home. Only twenty eight students remained.

Teacher five had made numerous changes to the ways in which he elicited language from his students during phase two of this research. The newer ways of eliciting language appear again in the lessons recorded in phase three with a wide range of forms being used to elicit more student language in general and more exploratory language (see 2.2.3.) in particular.

As was the case in the lessons taught by the other teachers participating in this study the most noticeable changes occurred in the forms used to realise elicits of types 1a/b and 5. Type 1a elicits are common in these two lessons with a large number of <u>WHAT+</u> and <u>+WHAT</u> forms. In addition to these however there are a number of forms which prospect responses of a less predictable nature. For example;

T5T8L309

308 STS three three please sir please sir

309 T now how did you get <u>how did you get that</u>
first

310 three ... ...

In the same way there are a number of new forms used to realise type 1B elicits in the phase three lessons. Those of particular interest include examples which prospect a response from a wide range of possibilities.For example

T5T7L136

134 T he says the number with the highest
frequency

135 ... ... the number with the highest
frequency

136 <u>any other way of putting it</u> ...

137 ST no sir

Perhaps the most noticeable changes occur in the forms used to realise type 5 elicits that is those which include a verb in the imperative form. In the phase three lessons there are several forms used which were not seen in either phase two or phase one. Elicits within this

class appear when the teacher organises his class to work with each other in co-operative groups for example;

T5T8L175

175 T if you cannot do it ... work with your

176 neighbours um ... i will call any //////

as well as when he is trying to give his students greater opportunities to use English to talk about mathematics by asking more questions, for example;

T5T7L286/292

285 T this what you can do for me i've not given any

286 definition on the board yet ... now ... ... ask

287 me your questions because the next thing will

288 be to the next thing will be that i will ask

289 all of you to write the definitions

290 of these words on a piece ////////////////

291 STS hah ////

292 T so <u>ask your questions</u> where you have problems

343 T fully ... what any of these words ... mean you

344 choose one right

345 STS yes sir ////// heh

or by explaining their understanding of mathematical vocabulary, as in this example;

T5T7L354

354 T so ... ... you will stand up and <u>explain</u> ////

355 the meaning of ... any of these words ...

These changes increase the possibility of students using English to talk about maths to each other in an exploratory way as well as the opportunity for the teacher to monitor the effectiveness of his own teaching

orally and as such mark a change in this teacher's classroom practice .

The only other changes between the way teacher five elicits student responses in phase three is in small changes in the number of elicits from four types;3b,6b,6d and 6e. In the case of the last three types mentioned here the teacher reverts to a pattern of usage seen in phase one. Only in the case of type 3b is there an increase rather than a decrease. That is, in phase one there were few examples of elicits which are realised as an incomplete statement of fact which the students complete as if it were in a question form, in phase two there are more examples and in phase three there are even more.

8.6.1. Exchanges headed by a student elicit

There are a small number of exchanges in which a student elicits language from the teacher, in the two lessons taught by teacher five in phase three of the research. There were also exchanges between students but these could not be recorded clearly due to the positioning of the tape recorder and the large number of people speaking simultaneously.

There is an example of a student requesting permission to take the floor

T5T7L200

199 T after this i will /////// see my

200 ST please sir

201 T who ////////

202 SST i have question ... //////////

which is an student elicit of type one (see 5.6.1.) to which the teacher responds by repeating his explanation in different words.

There is also an example of a student interrupting the teacher with an elicit which is picked up by the rest of the class and expanded.

T5T7L217

216 T my median will be six plus four over two

217 ST why is it so

218 STS ////// please sir ///// why ///// there are two

219 figures

The teacher responds to this interruption (a type three elicit) by going back in his explanation and rewording what he wants the students to understand.

There is one example of the students trying to elicit a response from the teacher who apparently ignores them.

T5T7L196

194 T then i will say that ... ... this ... ...
...

195 ... ...

196 STS //////// <u>you have made a mistake</u>

197 T if i want to find the median ... of this number

198 this is what i will have to do

8.6.2. <u>Summary</u>

Teacher five continued to make changes to the forms of the elicits he uses to promote language use with his student in this phase of the research. The students were given more opportunities to use English and also to use it whilst talking to each other in small groups.

FIGURE 25 Summary of Teacher Five Elicits (Phase Three)

TYPE	PHASE ONE	PHASE TWO	PHASE THREE
1A	common mostly closed	common open forms eg how did you	common open forms how can we, how did you get that, what did you do
1B	common	some	some open forms any other way
2A	none	none	few
2B	none	none	none
3A	some	some	some
3B	few	some	common
4A	common	common	common

4B	few	none	none
4C	some	some	some
5	few	common open forms eg tell me, discuss explain to me, ask your friend ask me, work with your neighbours	common open forms
6A	few	few	few
6B	common	few	common
6C	some	none	none
6D	some	few	some

6E	none	few	none
7A	some	common	common
7B	few	few	few
ST	few	few	few
ELICITS			

8.7. CONCLUSION

In this chapter the differences between the ways in which individual teachers elicited language from their students in phase three have been compared with their strategies in phases one and two. All the elicits in the lessons being analysed in this phase can be classified in terms of their type and are similar to those analysed in phase one but as in phase two there are examples of new forms being used within various types. The most common changes are within the forms used to realise types 1 and 5.

The data collected while teacher two was teaching stands out here because it contains no new forms of any type of elicit. Where there are differences between his use of elicits in phases two and three the later lessons

show a return to those patterns observed in the earliest lessons of phase one. Teacher four also shows signs of reverting to previous patterns of interaction although he maintains some of the changes made during phase two.

Thus whilst all the teachers have clearly made changes to the ways in which they promoted student language use during their lessons mostly by using forms of elicit which prospect responses which are not from a closed set of possibilities, two teachers made changes only during the period of intense in-service support.

The phase three data shows that three of the five teachers either maintained the changes in forms of elicit as observed in phase two but that two of the teachers returned to the patterns of interaction they had demonstrated in phase one.

There are a number of interesting points which arise from these conclusions, these will be examined in detail in the next chapter.

CHAPTER NINE

CONCLUSIONS AND INSIGHTS

INTRODUCTION

In this chapter, this study into the verbal interaction in mathematics lessons in Anglophone Cameroon will be concluded. The difficulties encountered during each of the three stages of research will be discussed as will unexpected points of interest which emerged. It will be shown that the three research questions with which I began the research have been answered. As a result of this study a way of enabling mathematics teachers to make changes to the ways in which they use English to interact with their students during their lessons has been identified.

9.1. THE RESEARCH QUESTIONS ANSWERED

This study grew out of my work as an English Teaching Adviser, work which had included discussions of the learning of mathematics in English, with Cameroonian teachers and students who used languages other than English outside their lessons. The difficulties faced by such students and teachers especially in Anglophone Cameroon seemed enormous, for the reasons stated in chapter one. Thus the first aim of this study was to illuminate the language used whilst mathematics was being

taught and learnt. The second aim was to do this in such a way that the teachers would feel able to use the insights so gained to experiment with new ways of interacting with their learners in English. It seemed at the outset that narrowing the gap between classroom practice and theoretical research would be insightful from a theoretical point of view and valuable from a practical point of view. This view has been strengthened over the last three years.

The answers to the three research questions have been shown in detail in this thesis. The first, how do teachers and learners interact in English as they seek to teach and learn mathematics at the secondary level in Anglophone Cameroon, has been answered by analysing data collected from the participating teachers in chapters five and six. The model raised from these data answers question three.

The intervention phase of the study answering question three, described in detail in chapter four, shows how this analysis was used as part of intensive INSET activities to enable the teachers to be aware of this aspect of their teaching methodology and to use this heightened awareness to facilitate their own professional development.

9.2. DIFFICULTIES

Many of the difficulties faced during this study came about as a result of the time and context in which

the data collection took place, as explained in chapter four. However there were four issues which had to be resolved as the study progressed which were not connected to the wider political and cultural changes taking place in Cameroon.

9.2.1. Non-Judgemental Observation

As noted in 4.2.5. I had to learn how to observe teaching and learning in a new way. As an Adviser I had observed teachers to evaluate their teaching and had devised many culturally appropriate strategies to facilitate this type of observation, all of which involved making judgements about classroom procedures on the spot. In this study I wanted to observe the teachers without evaluating their procedures. The observation notes were to supplement the audio recordings being made and thus needed to be of a different kind to those I had made previously.

Had I been observing teachers of English, that is teachers within my own field, this type of non-judgemental observation would have been extremely difficult. An observer who has experience of teaching the subject being observed would naturally have opinions about the ways in which items or skills should be taught. These opinions would influence what the observer noticed and what they ignored. However, as I was an observer watching a subject with which I had no experience as a teacher I was more able to observe without judging

because I had few pre-conceived ideas about "good" and "bad" mathematics methodology. From the experience gained during this study whilst seeking ways of enabling teachers to understand the patterns of interaction in their own classes, the possible role of teacher observation by teachers of other subjects, as part of a cycle of INSET would seem to be well worth further exploration.

9.2.2. Audio Recording Classroom Language

The practicalities of audio recording in classrooms, filled often to bursting point with students, gave much food for thought as noted in 4.2.4. Many issues were resolved by trial and error, for example by finding a location for the microphone which was as unobtrusive as possible and yet which captured as much of the verbal interaction as possible at the same time. This became a much greater problem in the later stages of the research when teachers began to encourage their learners to work in pairs or small groups (see 4.2.13). However as these instances were short lived and did not occur in every lesson it was possible to record the greater part of verbal interaction in all the lessons in all three phases.

9.2.3. Using a Linguistic Model with Non-Linguists

Two difficulties occurred during phase two. Planning how to use a descriptive analytical model written in

linguistic terms with teachers of mathematics who had no previous experience of linguistics was a major concern. However, by limiting the scope and the terminology of the analysis to that which seemed appropriate to the participating teachers and by linking the new terms such as "exchange" and "elicit" to examples from transcripts of their own lessons this barrier proved to be much smaller than had been imagined. The teachers said they were attracted to the systematic nature of discourse analysis in the form it was presented to them, and as this description of their patterns of interaction didn't refer to grammar, vocabulary or pronunciation, the teachers were required to discuss their lessons in innovative ways. This they did, so that an aspect of the intervention process which had been seen as a potential weakness turned out to be a strength.

9.2.4. Supporting Teachers during INSET

The final difficulty also seemed greater before the teachers' meetings in phase two began than it did once the teachers were experimenting in their own classrooms. As I wanted to find ways of describing the patterns of interaction in theoretically acceptable ways and which would enable the teacher-participants to feel confident about experimenting and making changes to their own ways of working, I was concerned about how directive I ought to be during the teachers' meetings and before and after lesson observations.

As it turned out this was not as problematic as had been anticipated. If I had a suggestion to make I made it quite clear that it was either something I had observed one teacher in the group doing and I thought the others might be interested or that the idea came from my experience as an Adviser to teachers of English. As noted in 4.3.7. I wrote in my research diary after the third teachers' meeting that, for fruitful discussions to take place all I needed to do was to keep the focus of attention on the ways in which language was and could be used in class . As was the case in 9.2.1., not being a mathematician was advantageous in this respect. Whenever a discussion about ways of teaching eg "sets" or "angles" took place, the teachers were the experts. However I was able to build on their discussions by asking language related questions thus maintaining our focus. As the teachers weren't able to teach at the beginning of this phase because of "Operation Ghost Town", they had more time to reflect upon and prepare for our meetings than had been expected. They also had more time to look at resources in the Maths' Teachers Centre and collect ideas from these;another example of a difficulty which turned out to be a blessing.

9.3. SUCCESSES

This study has been successful in several ways. It has illuminated the patterns of interaction used by

teachers and students in the lessons observed and recorded in four schools in the Bamenda area in 1991 and 1992. The research method selected to collect the first data of prolonged observation, and audio recording enabled a description of the verbal interaction to be raised from the data which is culturally appropriate, theoretically acceptable and accessible to the teachers concerned. It thus adds to the current understanding of the ways in which English is used in the specific context described and also offers insights into classroom language and verbal interaction in other contexts (see 9.4.6.)

The second and third phases of the study made use of the analysis to enable the teachers to use it to increase their awareness of the ways in which they elicited language from their students. As this self awareness became established the teachers became more confident about experimenting with new ways of eliciting language, some of which encouraged longer student responses and some of which increased the opportunities for the students to use exploratory language as part of the learning process. As all but one of the teachers were able to use these new strategies repeatedly, over a period of time, it would seem that they have become part of their repertoire of procedures from which they make a selection as they teach.

However, they have not only been able to make changes in the short term. They also now have a way of thinking about their own lessons which has student

language use and its implications for learning as a central focus. This is a point of great importance and marks a highly successful outcome for the INSET activities. The intervention process and the observed results add to the theoretical understanding of INSET not only in Cameroon but also in other contexts. This is particularly the case where it is important to design INSET which will not foster a culture of dependency on an expert but which will equip teachers with the skills to monitor their own professional development and thus empower them to implement the changes they deemed necessary.

9.4. FURTHER RESEARCH

There are many points arising from this study which would provide an interesting starting point for further research. Within Cameroon itself numerous possibilities emerged, particularly during phase three.

9.4.1. Class size

The classes chosen at the beginning of this study, that is those in the first year of secondary education in January 1991, varied in size from quite small by Cameroonian standards to very large by any standards. In phase three the three private schools were excluding children who had not paid their fees, thus creating small classes for short periods of time. It would be

interesting to take the data collected in the lessons taught by one teacher to both a large and a small class to see how the patterns of interaction compared. It would also be interesting to conduct a similar research study with classes of different sizes, perhaps in a range of subjects with a view to contrasting the patterns of interaction observed in both the smaller and the larger classes.

9.4.2. The Length of Time a Teacher and a Class Work Together

It would be interesting to focus more intensively on the number of lessons and the overall length of time a teacher and a class spent together and to establish whether or not this was linked to any noticeable changes in the patterns of interaction observed in their lessons. For example, in phase three it was felt that the lessons taught by teacher three, to a class she had known for almost two academic years, took place in a more relaxed atmosphere than did other phase three lessons and that this facilitated more spontaneous student initiated exchanges. However as this took place in the only class taught by a female teacher, after the school had settled into its new buildings which were in a very quiet rural area. There are a number of factors involved so it is not possible to isolate the reasons for this atmosphere.

9.4.3. Backwash Effect of External Exams

One of the participating teachers who had seemed very innovative and committed to change in phases one and two and who had also taken part in discussions about maths and language before this research began (whilst the researcher was still working in Cameroon as an Adviser) seemed to return to his original patterns of interaction in phase three. The only explanation for this as seen in the data available from this study is that he was teaching form one classes in phase one and form three classes in phase two. By the time the phase three recordings were made in April 1992, the form three classes were very close to an examination which would determine whether or not they would be able to move up into form four and begin their "O'"level courses. Perhaps the backwash effect of the external examinations was becoming more evident in this class. As it was not possible to record this teacher with any form one classes nor any of the other teachers with form three classes the answers to this question will have to wait for future research.

9.4.5. Other possibilities

The teacher language which was not classified in the model which evolved during phase one could provide valuable data for a study of how the participating teachers explain (inform) their students. Likewise all

the exchanges which have a managerial purpose would provide a rich source of data about the ways in which these teachers organise their often very large classes in order to be able to teach.

A similar research method could be applied to lessons of other subjects in Anglophone Cameroon so that the models raised from each study could be compared. Apart from the intrinsic value of such comparisons and the value of enabling all teachers to monitor their own teaching, it could also inform those teaching English in such contexts about the ways in which students use the medium of instruction in other subjects. This could enable these teachers to adapt their own schemes of works and teaching methods so as to make their lessons as relevant to their learners' day to day needs as possible.

It would be also interesting to conduct a similar study in maths lessons, in Africa, where the medium of instruction is French and thus be able to make a comparison between verbal interaction in Anglophone and Francophone classrooms. Cameroon would provide an ideal setting for such a comparison.

9.4.6. Looking out from Cameroon

The research method used in this study could be used again in other contexts. Intuitions based on personal experience with English teachers in many countries lead me to suggest that raising a model from data collected in this way could be a valuable mode of research in other

educational contexts within Anglophone Africa and indeed throughout the world.

The same process could also be used successfully to illuminate the verbal interactions of doctors and patients, receptionists and clients, counsellors and clients. A particularly interesting use would be with those working in the field of conflict resolution. To enable participants to become more aware of the ways in which the antagonists were interacting and to enable them to feel able to change these patterns could lead to more fruitful and efficient negotiations.

Within school based INSET, discussing the emerging analysis with the participants also offers opportunities for beginning a cycle of teacher monitored action research which could be an integral part of future INSET projects anywhere in the world, that is not only in English as a second language context. It has a major role to play in narrowing the gap between those who plan INSET and those who are supposed to benefit from it. By fostering a spirit of joint ownership it contributes to the empowerment of teachers as agents of change.

Although the cultural contexts might be different, this study should be of interest to mathematics educators internationally both in terms of its insights into English as a second language medium classes in any country and into verbal interaction in mathematics lessons in general. There is ample room for more research in both areas.

9.5. CONCLUSION

In this thesis the questions which began the study have been asked, discussed and answered in the light of data collected in four schools in and around Bamenda in Cameroon. The five teachers who participated in the study all reported that working with the researcher and with each other had been a positive, strengthening experience and that as a result of our discussions they had become more aware of the role played by language during the teaching and learning of mathematics.

The data collected and the analysis which grew from it have proved to be a valuable resource for the in-service training of the participants and have gone some way to filling the huge gap in current understanding of what happens during maths lessons when everyone involved is using English as one of their many languages. It also went some way towards making it possible for the teachers to feel that they were able to play a major role in their own professional development by giving them the opportunity to look at their taken for granted classroom practices in a new non-alienating way.

As the starting point for the study was the needs of the teachers and learners in schools in Anglophone Cameroon it is hoped that this will be seen as only the first step in a longer research journey undertaken by many of those involved in such schools so that little by little a more detailed and useful picture of the complex

relationship between mathematics and studying in a second language can be drawn.

BIBLIOGRAPHY

Afolayan A. (1984) "The English Language in Nigerian Education As An Agent of Proper Multilingual and Multicultural Development" Journal of Multilingual and Multicultural Development 5,1,1-22

Aitken L.R. (1972) "Language Factors in Learning Mathematics" Review of Education Research 42,3,359-385

Alladina S. (1985) "Second Language Teaching Through Maths-Learning Maths Through a Second Language" In Educational Studies in Mathematics 16 215-219

Allwright D. (1988) Observation in the Language Classroom Harlow:Longman

Association of Teachers of Mathematics (1980) Language and Mathematics Derby:Association of Teachers of Mathematics

Atkinson P. (1992) Understanding Ethnographic Texts London: Sage

Austin J. and Howson A. (1979) "Language and Mathematical Education" Educational Studies in Mathematics 10,161-197

Bain R. (1988) "Let's Talk Maths!" Mathematics in School 36-39

Baker C. (1993) Foundations of Bilingual Education Cleveldon:Multilingual Matters

Barnes D. Britton J. and Rosen H. (1969) Language the Learner and the School Harmondsworth:Penguin

Barnes D. (1973) Language in the Classroom E262 Block 4 Buckingham:Open University

Barnes D. (1976) From Communication to Curriculum Harmondsworth:Penguin

Barnes D. and Todd F. (1977) Communication and Learning in Small Groups London:Routledge and Kegan Paul

Bell A.W. (1970) cited in Bell A.W. (1983)

Bell A.W. Costello J. and Kuchemann D.E. (1983) "Research on Teaching and Learning" in Part A of A Review of Research in Mathematics Education Windsor:NFER-Nelson

Bellack A.A. et al (1966) The Language of the Classroom New York: Teachers' College Press, Teachers' College Columbia

Bennett N. (1973) (for the Open University course team) E341 Block 2 Research Design.Methods of Educational Enquiry Buckingham:Open University

Berry J. (1985) "Learning Mathematics in a Second Language Some Cross Cultural Issues" For The Learning of Mathematics 5,2,18-23

Beveridge M. (1982) Children Thinking Through Language London: Edward Arnold

Biggs A.P. and Edwards V. (1991) "I Treat Them All The Same. Pupil Talk in Multi-Ethnic Classrooms" Language and Education 5,3 161-176 Clevedon: Multilingual Matters

Bishop A. (1979) "Visualising and Mathematics in a Pre-Technological Culture" Educational Studies in Mathematics 10,136-146

Bishop A. (1988) "Mathematics Education in its Cultural Context " Educational Studies in Mathematics 179-191

Brissenden T. (1988) Talking about Mathematics Oxford: Basil Blackwell

Brock C.A. (1986) "The Effects of Referential Questions on English as a Second Language Classroom Discourse" TESOL Quarterly 20,1,47-59

Brodie K. (1989) Learning Mathematics In A Second Language unpublished manuscript Department of Education University of Cambridge

Brophy J. (1986) "Teaching and Learning Mathematics: Where Research Should Be Going " Journal for Research in Mathematics Education 323-346

Brown G. Anderson A. Shillcock R and Yule G (1984) Teaching Talk Cambridge:Cambridge University Press

Brown G. and Armstrong S. (1984) "Explaining and Explanations" In Wragg E.C.(ed) (1984)

Brown G. and Yule G. (1989) Discourse Analysis Cambridge: Cambridge University Press

Bruner J. (1985) Towards a Theory of Instruction Cambridge Mass. Harvard Paperbacks

Bullock A. (1975) Language for Life (The Bullock Report) London:HMSO

Burgess R.(ed) (1985) Field Methods in the Study of Education Basingstoke:Falmer

Brumfit C..and Mitchell R. (1989) Research in the Language Classroom ELT Documents 133 London:The British Council and Modern English Publications

Caillods F. and Postlewaite T. (1989) "Teaching and Learning conditions in developing countries" Prospects: Quarterly Review of Education 169-190 Paris:UNESCO

Cambridge Seminar (1982) Teaching Maths Through English as a Second Language Unpublished summary Department of Education University of Cambridge.

Carter R. (1990) Language in the National Curriculum Notes from a Seminar given 16.10.90 School of Education, University of Durham

Caulfield S. (1989) "Problems with Problems" Junior Education 30-31

Cazden C.B. (1985) "Classroom Discourse" In Wittrock M (ed) (1985)

Chaudron C. (1990) Second Language Classrooms Cambridge: Cambridge University Press

Chia E. (1992) The Languages of North West Province Unpublished lecture notes University of Buea Cameroon

Chilver P.and Gould G. (1982) Learning and Language in the Classroom Oxford:Pergamon

Clarkson D. (1973) "A Bit of Research" Mathematics Teaching 65,26-31

Clements M.A. (1982) "Language Factors in School Mathematics" Australian Journal of Applied Linguistics 9-24

Cockcroft W.H. (1982) Mathematics Counts London:HMSO

Cocking R.C. and Mestre J.P. (1988) Linguistic and Cultural Influences on Learning Mathematics New Jersey:Lawrence Erlbaum Ass.

Cohen L. and Manion L. (1989 edition) Research Methods in Education London:Routledge

Commonwealth Secretariat (1968) Mathematics in Commonwealth Schools Report of a Conference held at the University of the West Indies St Augustine Trinidad.

Corson D. (1987) Oral Language Across the Curriculum Clevedon:Multilingual Matters

Corson D. (1989) Language Policy Across the Curriculum Clevedon:Multilingual Matters

Coulthard M. and Montgomery M. (1981) Studies in Discourse Analysis London:Routledge and Kegan Paul

Coulthard M. (1985) An Introduction to Discourse Analysis Harlow:Longman

Coulthard M. (ed)(1987) Discussing Discourse Birmingham:University of Birmingham English Language Research Unit

Cowie H. and Ruddick J. (1990) "Learning Through Discussion" In Entwistle N (ed) (1990)

Cuevas G.J. (1991) "Developing Communication Skills in Mathematics for Students with Limited English Proficiency" Mathematics Teacher USA 84,3,186-189

Dawe L. (1983) "Bilingualism and Mathematical Reasoning in English as a Second Language" Educational Studies in Mathematics 14, 325-352

Delamont S. (ed) (1985) Readings on Interaction in the Classroom London:Methuen

Derrick J. (1977) Language Needs of Minority Group Children Windsor:NFER

Desforges C. and Cockburn A. (1987) Understanding the Mathematics Teacher Basingstoke:Falmer

Dillon J.T. (1988) Questioning and Teaching Beckenham: Croom Helm

Dockerell W. and Hamilton D. (eds)(1980) Rethinking Educational Research Sevenoaks:Hodder and Stoughton

Duffin J.M. (1989) "Maths Through Classroom Talk" Mathematics in School 15,2, 10-13

Durkin K. and Shire B. (1991) Language and Mathematical Education Buckingham:Open University Press

Edwards D. and Furlong D. (1985) "Reflections on the Language of Teaching" in Burgess R (1985)

Edwards D. and Mercer N. (1987) Common Knowledge London:Methuen

Eisner E. (1979) "The Use of Qualitative Forms of Evaluation For Improving Educational Practice" Educational Evaluation and Policy Analysis 1,6,11-17

Entwhistle N. (1973) (for the Open University course team) E341 Block 1 The Nature of Educational Research Buckingham:Open University Press

Entwistle N. (ed) (1990) Handbook of Educational Ideas and Practice London:Routledge

Eyongetah T. and Braine R. (1985 edition) A History of The Cameroon Harlow:Longman

Fey J.T. (1968) Patterns of Verbal Communication in Mathematics Classes PhD Thesis Columbia

Fletcher (1960/1970) cited in Bell A.W. (ed) (1983)

Floyd A. (ed)(1981) Developing Mathematical Thinking Wokingham:Addison-Wesley for The Open University

Galton M. and Delamont S. (1985) "Speaking with Forked Tongues? Two styles of Observation in the ORACLE Project" in R. Burgess (ed) 1985

Gay J. (1974) Language and Effective Mathematics Teaching report of the Nairobi Conference Paris:UNESCO

Gay J.and Cole G. (1967) The New Mathematics and the Old Culture New York:Reinhart and Winston

Gerdes P. (1988) "On Culture, Geometrical Thinking and Mathematics Education" Educational Studies in Mathematics 19 137-162

Glaser B. and Strauss A. (1978) The Discovery of Grounded Theory Chicago:Aldine

Gillham B. (1986) The Language of School Subjects London:Heinemann

Goetz J. and LeCompte M. (1984) Ethnographic and Qualitative Design and Educational Research London: Academic Press

Goetz J. and LeCompte M. (1984) Ethnographic and Qualitative Design and Educational Research London: Academic Press

Graham A. (1990) "An Imaginary Conversation" Mathematics Teaching 132, 48-49

Graham A. (1991)"Maths Talk" In In-service pack for Oracy for Teachers Buckingham:Open University

Gwanfogbe M. and Melingui A. (1988) Geography of Cameroon Basingstoke:Macmillan

Hakkansson G. and Lindberg I. (1987) "What's the Question? Investigating Questions in Second Language classrooms." In Copenhagen Studies in Bilingualism Clevedon:Multilingual Matters

Hart K.M. (1981) Children's Understanding of Mathematics London:John Murray

Harvey R. Kerslake D. Shuard H. and Torbe M. (1982) Language,Teaching and Learning 6, Maths London:Warde Lock

Hatch E. (1992) Discourse and Language Education Cambridge:Cambridge University Press

Henderson K. (1967) "A Model For Teaching Mathematical Concepts" The Mathematics Teacher USA 573-577

Howe A. (1992) Making Talk Work Sevenoaks:Hodder and Stoughton

Howson A.G. (ed) (1973) Developments in Mathematical Education Cambridge:Cambridge University Press

Hoyle C. and Sutherland R. (1989) Logo Mathematics in the Classroom London:Routledge

HMI Report (1987) Mathematics from 5 to 16 Curriculum Matters 3 London:HMSO

Hull R. (1985) The Language Gap. How Classroom Dialogue Fails. London:Methuen

Jones P. (1982) "Learning Mathematics in a Second Language: A Problem with More and Less" Educational Studies in Mathematics 13 269-287

Joseph G. (1990) "The Politics of Anti Racist Mathematics" Multicultural Teaching 9,1,31-33

Kane R. (1967) "The Readability of Mathematical English" Journal of Research in Science Teaching 5,296-298

Keddie N. (1971) "Classroom Knowledge" In Young M. (1971)

Kelly M. (1990) "A Script for a Maths Lesson" Arithmetic Teacher 38,4,36-39

Kerslake D. (1982) cited in Harvey et al (1982)

Kramsch C. (1981) Discourse Analysis and Second Language Teaching Washington:Centre for Applied Linguistics

Kyriacou C. and Newson G. (1991) "Small Group Work in Secondary School Mathematics" Mathematics in School 20,3,44-47

Land F. (ed) (1963) New Approaches to Mathematics Teaching London:Macmillan

Larsen-Freeman D. (1980) Discourse Analysis in Second Language Research Newberry House:Sage

Lemke J. (1982) Classroom Communication of Science Final Report for City University Of New York Washington DC: National Science Foundation

Lemke J. (1989) Using Language in the Classroom Oxford:Oxford University Press

Lincoln Y.S.and Guba E.G. (1985) Naturalistic Inquiry Newbury Park:Sage

Lopez Real F. and Roberts I. (1988) Basic Words in Mathematics and Science unpublished paper written for the Overseas Development Administration

Lorenz J.H. (1980) "Teacher Student Interaction in the Maths Classroom" For the Learning of Mathematics 1,2,14-19

Luboobi L.S. (1990) "Methods and Techniques for Learning Mathematics" Uganda Mathematics Bulletin 3,1,21-26

Luthuli D.V. (1992) Language and the Teaching of Euclidean Geometry "Riders" unpublished paper written for the Centre of Advancement of Science and Mathematics Education Durban

Lynch J.(ed) (1981) Teaching in the Multicultural School London:Ward Lock

Marshall C. and Rossman G. (1989) Designing Qualitative Research Newbury Park:Sage

Mathematical Association (1987) Maths Talk Cheltenham:Stanley Thorne

McLeese R. and Hamilton D. (1978) Understanding Classroom Life Windsor:NFER

McCarthy M. (1991) Discourse Analysis for Language Teachers Cambridge:Cambridge University Press

McGowan E. (1981) "Mathematics and Numeracy" In Lynch J.(ed) (1981)

McIntyre D. (1978) "The Characteristics and Uses of Systematic Classroom Observation " in McAleese R. 1978

McTighe J. Lyman F.T. (1988) "Cueing Thinking in the Classroom:the Promise of Theory Embedded Tools" Educational Leadership 18-24

Mercer N. (1985) (for the Open University course team) P534 Book 1 Every Child's Language Buckingham:Open University

Meek M. and Miller J. (1984) Changing English Essays for Harold Rosen London:Heinemann

Mehan H. (1979) "What Time is it Denise?" Theory into Practice 18 285-294

Mehan H. (1982) "The Structure of Classroom Events and their Consequences for Student Performance" in Gilmore P and Glatthorn A (eds) (1982)

Mehan H. (1985) "The Structure of Classroom Discourse" in Teun Van Dijk (ed)(1985)

Merriam S.B (1988) Case Study Research in Education A Qualitative Approach San Francisco:Jossey-Bas Ltd

Mikhail F.I. and Mina M.M. (1985) "The In-Service Education of Secondary School Mathematics Teachers" In Morris R (1985)

Mmari G. (1980) "Secondary Mathematics in the United Republic of Tanzania" Studies in Mathematics Education 106-126 Paris:UNESCO

Mousley J. and Marks G. (1991) Discourses in Mathematics Geelong:Deakin University Press

Morris R. (1978) "The Role of Language in Learning Mathematics" Prospects Quarterly Review of Education 8,1,73-81

Morris R. (ed) (1984) Studies in Mathematics Education Volume 3 The Mathematical Education of Primary School Teachers Paris:UNESCO

Morris R. (ed) (1985) The Education of Secondary School Teachers of Mathematics Paris:UNESCO

Muller J. (1985) "Out of their Minds: An Analysis of Discourse in Two South African Science Classrooms" Research Applications 312-337

Murray J. (1985) "Maths and Exploratory Talk" Mathematics in School 14,15-16

National University of Lesotho (1980) Report of the workshop Language in the Mathematics and Science Lesson Lesotho:National University

Nunan D. (1989) Understanding Language Classrooms Hemel Hempstead:Prentice Hall

Orton A. (1987) Learning Mathematics,Issues,Theory and Classroom Practice London:Cassell

Peck A. (1988) Language Teachers at Work Hemel Hempstead: Prentice Hall

Piaget J. (1954) The Construction of Reality in the Child New York:Basic Books

Philp A. (1973) Article in Exeter Congress Proceedings in Howson A. et al (1973)

Pimm D. (1987) Speaking Mathematically Communication in Mathematics Classrooms London:Routledge and Kegan Paul

Potter J. and Wetherell M. (1987) Discourse and Social Psychology Newbury Park:Sage Publications

Prabhu N.S. (1987) Second Language Pedagogy Oxford:Oxford University Press

Quilter D. and Harper E. (1988) "Why we didn't like Mathematics and why we can't do it" Educational Research 30,2,121-134

Reed M.B. (1984) "The Influence of Linguistic Factors upon Mathematics Achievement Among Second Language Learners" In Journal of Maths Education Science and Technology 15,4 437-446

Richards J. (1979) Classroom Language. What Sort? London:Allen and Unwin

Richards H. (1985) The Evaluation of Cultural Action London:Macmillan

Rounds P.L. (1987) "Characterizing Successful Classroom Discourse for NNS Teaching Assistants" TESOL Quarterly 21, 643-671

Rothery A. (1980) cited in Shuard H and Rothery A. (1984)

Rowe Budd M. (1986) "Wait Time:Slowing Down May be A Way of Speeding Up" Journal of Teacher Education 31,1, 43-50

Selinger H.W. and Shohamy E. (1989) Second Language Research Methods Oxford:Oxford University Press

Servais W. and Varga T. (1971) Teaching School Maths A UNESCO source book Paris:UNESCO

Seychelles Government (1978) The Evaluation Of Integrated Science and Mathematics Curriculum Projects in Africa Unpublished Report of the workshop held in the Seychelles February 1978

Shuard H. and Rothery A. (1984) Children Reading Mathematics London:John Murray

Simons H. (1980) Towards a Science of the Singular Care Publications Number 10 Centre for Applied Research in Education

Sinclair J. and Coulthard M. (1975) Towards and Analysis of Discourse The English Used by Teachers and Pupils Oxford:Oxford University Press

Sinclair J. and Brazil D. (1982) Teacher Talk Oxford:Oxford University Press

Skemp R. (1963) "A Three Part Theory For Learning Mathematics" In Land F. (1963)

Skemp R. (1970) "Concept Formation and its significance in Mathematics Teaching and Syllabus Reform" In Stones E (ed)(1970)

SMILE Project (1985) see Alladina S. (1985)

Smith L.R. (1977)"Aspects of Teacher Discourse and Student Achievement in Mathematics " Journal for Research in Mathematics Education 8, 195-204

Strevens P. (1969) The Medium of Instruction (Mother Tongue/Second Language) and the Formation of Scientific Concepts Paper presented at the Nairobi Conference 1974 Paris:UNESCO

Stones E. (ed) (1970) Readings in Educational Psychology London:Methuen

Stubbs M. and Delamont S. (1976) Explorations in Classroom Observation London:John Wiley

Stubbs M. (1979) Language Schools and Classrooms London:Methuen

Stubbs M. (1983) Discourse Analysis The Sociolinguistic Analysis of Natural Language Oxford:Blackwell

Sutton C. (1981) Communicating in the Classroom Basingstoke:Hodder and Stoughton

Swaziland Ministry of Education (1979) The Development of Teaching Materials for School Mathematics unpublished report of the International Seminar held March 1979

Swaziland Science Teachers' Association Newsletter November 1987 Number 3 Published by the University of Swaziland

Sweet A. (1972) "Children Need Talk" Mathematics Teaching 58, 40-43

Taiwo S. (1968) Primary School Mathematics London:Commonwealth Secretariat

Teun A Van Dijk (ed)(1985) Handbook of Discourse Analysis Volume 3 Discourse and Dialogue London:Academic Press

Torbe M. and Shuard H. (1982) "Mathematics and Language" In Harvey R. et al (1982)

Thornton E. (1967) "The Power of Words" Mathematics Teaching 38,6-7

Thornton C.A. (1991) "Think,Tell,Share" Arithmetic Teacher 38,6 22-23

Tsui A. (1987) "Elicitations" In Coulthard M.(ed) 1987

Uganda Mathematical Society (1990) Uganda Mathematical Bulletin 3,1,Makerere University Uganda

Van Lier L. (1988) The Classroom and the Language Learner: Ethnography and Second Language Research Harlow:Longman

Van Lier L. (1989) "Ethnography: Bandaid, Bandwagon or Contraband" In Brumfit C. (1989)

Vuilliamm G. Lewin K. and Stephens D. (1990) Doing Educational Research in Developing Countries Basingstoke:Falmer

Vygotsky L. (1962) Thought and Language Cambridge Mass: The M.I.T.Press

Walker R. and Adelman C. (1976) "Strawberries, Strawberries" In Stubbs M and Delamont S. (1976)

Walker R. (1980) "The Conduct of Educational Case Studies:Ethics,Theory and Procedures." in Dockerell W. and Hamilton D. (eds) (1980)

Watson H. (1988) "Language and Mathematics Education for Aboriginal Australian Children" Language and Education 2,4,255-273

Watson-Gegeo K. (1988) "Ethnography in ESL:Defining the Essentials" TESOL Quarterly 22,4,575-592

Wells G. and Nicholls J. (1985) Language and Learning An Interactional Perspective Lewes:Falmer

Westgate D. Batey J.Brownlee J. and Butler M. (1987) "Some Characteristics of Interaction in F.L classrooms" British Educational Research Journal 11,3, 271-283

Westgate D. and Edwards A. (1987) Investigating Classroom Talk Lewes:Falmer

Williams P. (1971) "What is Language Across the Curriculum" English In Education 5,2,18-31

Willis J. (1981) Spoken Discourse in the ELT Classroom: A System of Analysis and a Description. unpublished M.A. thesis University of Birmingham

Willis J. (1987) "Inner and Outer: Spoken Discourse in the Language Classroom" In Coulthard M. (1987)

Wilson B (1981) Cultural Contexts of Science and Mathematics Education Centre for Studies in Science Education

Wilson B (1991) Mathematics Education in Africa unpublished paper/personal communication

Wittrock M. (ed) (1985) Handbook of Research in Teaching New York:Macmillan

Wood D. (1988) How Children Think and Learn Oxford:Blackwell

Woods P. (1985) "Ethnography and Theory Construction in Educational Research " in Burgess R. (1985)

Wragg E. (1984) Classroom Teaching Skills New York:Nichols

Wright E.M. (1959) "Development of an Instrument for Studying Verbal Behaviour in A Secondary School Mathematics Classroom" Journal of Experimental Education 28,2,103-121

Yin R.K. (1984) Case Study Research London:Sage Publications

Young M. (1971) Knowledge and Control London:Collier-Macmillan

Young R.E. (1984) "Teaching Equals Indoctrination: The Dominant Epistemic Practices of Our Schools " British Journal of Educational Studies 32,3,220-238

Yu V.W. and Atkinson P. (1988) "An Investigation of the Language Difficulties Experienced by Hong Kong Secondary School Students in English Medium Schools" Journal of Multilingual and Multicultural Development 9,3,267-28

Zepp R. (1981)"Relationship Between Maths Achievement and Various English Language proficiencies" Educational Studies in Mathematics 12,1,59-70

Zepp R. (1989) Language and Mathematics Education Hong Kong:API Press

UNIV DUNELM