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A CASE STUDY INVESTIGATION OF THE USE OF A TEXTBOOK IN A SECONDARY MATHEMATICS CLASSROOM: ISSUES OF REGULATION AND CONTROL

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DISCLAIMER STATEMENT

I, Diana Leonie Mulcahy, hereby declare that the work contained in this minor dissertation is my own work, that it has not been submitted to any other institution before for assessment purposes, and that all sources, references and peer, tutor and other assistance have been acknowledged.

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ABSTRACT.

This dissertation is concerned with aspects of the role of the textbook in school mathematics. An attempt is made to uncover control strategies used by the teacher in textbook use in the classroom, and those implicit in a mathematics textbook. It is argued that these forms of regulation place constraints on the transformative role sometimes attributed to textbooks. The following research question is addressed: how does the teacher recruit the textbook in the classroom, how is he/she 'recruited' by it and how are both recruited by school mathematics?

A case study methodology is described, involving a video-recording of a fifty minute mathematics lesson and a follow-up interview with the teacher. Transcriptions are used and a fine-grained analysis of data is attempted. A literature survey examines other research in the areas of content selection, content control and content expression. Content selection refers to choices and omissions, content control refers to sequencing, pacing and authority in the pedagogic relationship, and content expression includes verbal and textual modes of expressing content.

Theoretical ideas are drawn from Bernstein (1976, 1991, 1993) and Dowling (1993). Although these works are methodologically different, they both describe aspects of regulation and control. Of particular interest are Bernstein's notions of classification and framing, and Dowling's ideas on discourse and procedure. The hypothesis is put forward here that there is a dialectical relationship involving the positioning of teacher and textbook. The teacher recruits the textbook to regulate pupils and knowledge, but s/he is at the same time constrained by strategies implicit in the textbook. In other words the teacher both positions and is positioned by the textbook. Both in turn are positioned by school mathematics.

The data analysis examines the 'how', 'what' and 'who' of control. It considers the regulation of speech, silence, working and listening, as well as the sequencing, pacing, selecting, presenting and authorising of content. It argues that the teacher both recruits and is 'recruited' by the textbook, and that although the framing is strong and the teacher has a high degree of control in the pedagogic relationship, the classification is also strong and the teacher lacks control over what she can teach and the relationship between contents.

The research concludes by suggesting that the transformative role sometimes attributed to the textbook is problematic. The strategies of regulation and control operating in the classroom, implicit in the textbook and in school mathematics, limit the possibilities of how textbooks can be used by the teacher and constrain transformation to a significant degree.

CONTENTS.

CHAPTER 1. INTRODUCTION

1.1 Locating the study....1

1.2 The NEPI documents....2

1.3 The research question....4

1.4 The study....4

CHAPTER 2. LITERATURE SURVEY....6

2.1 Content expression....9

2.2 Content control....14

2.3 Content selection....19

CHAPTER 3. THEORETICAL FRAMEWORK

3.1 Classification and framing....29

3.2 Discourse and procedure....31

3.3 Discussion....32

CHAPTER 4. METHODOLOGY AND DATA COLLECTION

4.1 Case study....35

4.2 Qualitative analysis....38

4.3 Generalisability....39

4.4 Discussion....40

CHAPTER 5. ANALYSIS AND DISCUSSION OF DATA

5.1 The textbook....42

5.2 The classroom organisation....49

5.3 The lesson....51

5.4 Concluding remarks....74

CHAPTER 6. CONCLUSION....76

BIBLIOGRAPHY....82

CHAPTER 1. INTRODUCTION.

1.1 Locating the study.

This dissertation is set against the development of a new educational dispensation in South Africa; a time characterised by contestation between educators, politicians, manpower developers, authors, publishers and ideologues. It is a time of curriculum innovation and policy making, with interested parties raising new questions and attempting to accommodate new ideas. Against this backdrop of activity, excitement and hope are the realities of educational crisis, student strikes, lack of resources, poor qualifications of teachers, overcrowding and the inertia of traditional classroom practice.

Textbook authors and materials developers have, some would argue, an important role to play in curriculum development. Textbooks have at times been given the awesome responsibility of passing down "the authorised version of society's valid knowledge" (Olson 1989:238). This research seeks to explore ways in which the textbook is negotiated in the context of the classroom, and suggests that any transformative role (in pedagogy) attributed to textbook production and use, is by no means unproblematic. Conventional classroom discourse has been described as being "about the text, based on the text, or directed by it" (pg.250). This study will be concerned with the 'about', 'based on', and 'directed by'. It will attempt to uncover control strategies used by the teacher and implicit in the textbook and will explore some of the limitations of the textbook as an instructional tool in the classroom. The textbook considered will be 'traditional' rather than 'innovative', in an attempt to identify commonly-used, traditional practices that may place constraints on the transformative role of new materials.

1.2 The NEPI documents.

The Curriculum Materials Model Group of the Curriculum Research Group of NEPI (National Education Policy Investigation) (Greybe and Woolley:1992) were given a specific brief to address the question "how do texts operate to trigger, realise, sustain, develop and institutionalise change in the curriculum" (pg.1). They used Gopinathan's definition of textbooks as educational tools: "Textbooks may be defined as organisations of selected, ordered and simplified content capable of being taught" (Gopinathan, cited in Greybe and Woolley, 1992:1). This definition points to the following questions: how is the content organised and why? How are content selections made and how are they ordered? How is the content simplified and why? What characterises "capable of being taught"? This research seeks to explore what the teacher does in the classroom with this 'organised, selected, ordered and simplified content', to what extent he/she does the organising, selecting and simplifying and to what extent he/she is directed by the organisation, order, selection and simplifications shown in the book.

The Curriculum Materials Model Group argued that teacher productivity is enhanced "since in large classes textbooks free the teacher to do a variety of education-related and non-related tasks" (Greybe and Woolley 1992:2). The statement here referred to textbooks in general rather than those incorporating a different type of pedagogy. The question of whether texts "free" the teacher or in fact constrain or even direct him/her will also be addressed.

The same group, in summarising interventions made by the textbook, state that "(t)extbook content has offered one way of introducing students everywhere in the nation to common socialising experiences, thus giving textbooks a vital integrative function" (Greybe and Woolley 1992:3). The question will be raised to what extent the textbook performs a socialising, that is, integrating function and to what extent the teacher's own construction of the textbook does the socialising. Is it in fact 'common'?

Fuller and Snyder (cited in Greybe and Woolley 1992) conducted a study in Botswana to investigate activities of teachers and pupils in the classroom. They argue that little is known about how "teachers mobilize and apply instructional materials" (pg.17). According to them, few studies have investigated how often teachers use textbooks in their lessons. They suggest that "textbooks and written exercises appear to be mobilized less frequently than one might assume,...where basic materials are in ample supply relative to African norms" (pg. 17). They conclude also that the textbook's presence tended to make the classroom less teacher-centered and allowed more learner participation, even if it was "only reciting material chorally"! (pg.17) . They note that although textbooks allowed teachers to ask questions based on the text, most questions were "closed-ended", that is, demanding simple recall only (pg.17).

Another study conducted in Botswana by Rowell during the National Development Plan 6, shows that patterns in classroom interaction do not change automatically

with the provision of new curriculum and new texts (Rowell cited in Greybe and Woolley 1992:18).

1.3 The Research Question.

These statements, quoted in the NEPI working papers, make assumptions and generalisations about textbooks and how they function in the classroom. Textbooks in general have been credited with the reproductive role of passing down society's valid knowledge, and with 'freeing' the teacher. They have been credited with the transformative role of allowing pupil participation in class and so altering teaching practice, and have been described as giving pupils common socialising experiences. In this study I will investigate to what extent these claims made about the role of the textbook are problematic. I am interested in traditional texts rather than those incorporating new kinds of pedagogy. I will attempt to throw light on the following research question: how does the teacher recruit the textbook in the classroom and how is he/she 'recruited' by it, how are both recruited by school mathematics? I will understand "recruit" to mean "influence the positioning of".

1.4 The Study.

To address this question, I will describe a case study of a lesson demonstrating the use of a textbook in a mathematics classroom. This will entail an uncovering of control strategies evident in the text, in the classroom and in school mathematics. Other research articles and discussions will be described in the areas of content control (that is, sequencing and pacing), content selection and mode of expression of content. I will draw theoretical ideas from Bernstein's work on 'classification and

framing' and from Dowling's work on 'discourse and procedure'. Both these works, although methodologically different, describe aspects of regulation and control.

Classification and framing describe strategies of control over contents, while procedure and discourse, in Dowling's model, describe modes of expression of contents and the regulation associated with these. I will argue that there is a dialectical relationship involving the positioning of teacher and text. The teacher both positions and is positioned by the text, both are positioned by school mathematics. These positioning strategies include strategies where the teacher uses the text as object of classroom control, as well as those of knowledge regulation involving selection, sequencing, pacing and what counts as legitimate knowledge. The directing of classroom language and strategies implicit in the text are also identified as regulative. This positioning of both teacher and text result, I will argue, in the limiting of possibilities for ways in which the textbook can be used.

In the light of the data collected, questions will be raised about some of the claims and generalisations made on behalf of textbooks. The analysis of data describes regulation and control found in the classroom, in the textbook and in school mathematics and I will argue that the teacher recruits the text to regulate pupils and knowledge, but that he/she is at the same time constrained by strategies implicit in the text. Therefore the transformative role sometimes attributed to the textbook is problematic and is limited by these forms of regulation.

CHAPTER 2. LITERATURE SURVEY.

The focus of this research has been identified as the uncovering of regulating strategies, with particular reference to a mathematics textbook as it is negotiated in the context of a lesson in the classroom. I will refer to this as mathematics text-in-use. This study will describe how the teacher recruits the textbook as an object of classroom control, and how the textbook in turn positions the teacher and 'recruits' him/her. In other words, it will describe mediation in a particular way, involving the dialectical relationship between the positioning of the teacher and the positioning of the textbook. I will refer also to how each is affected by institutional norms, social expectations, the education system and school mathematics. To inform this argument I identified three areas of literature search, finding material on ERIC and in journal articles covering the past 10 years. (For The Learning of Mathematics, Educational Studies in Mathematics, Journal for Research in Mathematics Education, South African Journal of Education, Curriculum Inquiry). Key words used on ERIC included different combinations of: research, sociology, classrooms, mathematics and textbooks.

The first area identified was previous research articles involving **sociological analyses of classroom interaction**. This was in order to explore some of the ways of describing interaction between teachers and pupils in a classroom. I was interested in the terms and vocabulary used by other researchers doing sociological research. The areas of study, the patterns, and the analogies used by

them would, I thought, be useful to inform my own descriptions. This proved to be a very large body of research which I then limited to research involving regulating strategies of interaction, determining who could say what to whom under what conditions. Also, who had access to what, what content was selected and what was left out. Adding 'mathematics' to this classroom search resulted in very few relevant articles, so I looked more broadly across the subjects, in particular, research involving language usage, and the language classroom. I took as axiomatic that all teaching practice includes a significant language dimension.

The second area of reading involved the **textbook and the control of content**. I was interested in issues of authority and regulation and how these might be linked to textbook use. This led to readings on the ongoing debate regarding the language and authority of the textbook. Do authority and meaning lie within the text? (Olson 1989). What authority does the teacher have and how does the institution affect this 'authority'? (Luke et al, 1989). Although little empirical work will be discussed, I will refer at some length to issues arising from this debate. I have taken as peripheral to this study, research involving content evaluation (Freeman 1983, Kim 1993), bias (Anyon 1981a), gendering (Northam 1982, MacBride 1989), readability, textual cohesion, production and distribution of textbooks (Apple 1986).

The third area of reading was other research which examined **content selection of text-in-use**. Sociological description of mathematics text-in-use reveals very few research articles directly relevant to the present study. Research by Anyon (1981) involving a study of five elementary schools and their use of the same curriculum,

is perhaps the most closely related. Although her object was to study the effect of social class on the nature and distribution of school knowledge and went beyond the teacher and beyond mathematics, her study resonates with the present research in that it describes how content is selected in a classroom. She contrasts curriculum with curriculum-in-use and highlights how the same given content can be realised in very different ways. Research done by Jules (1991), in Grenada, involving the restructuring of the curriculum during the time of revolution, draws interesting conclusions regarding textbooks and the restructuring of classrooms. Although his work cannot be described as sociological it has useful implications for this study, as it describes the reorganising of a class around new content. Freeman and Porter's (1989) work involving analyses of mathematics textbooks in comparison with analyses of lessons and standardised tests is also relevant though not sociological in nature. These three works will be discussed in more detail later in this section.

Dowling (1993), in his sociological analysis of mathematics textbooks, discusses 'closed' text, that is, he does not discuss classroom interaction. In his own literature survey, Dowling discusses in detail, analyses of mathematics textbooks, sociologically-oriented analyses of textbooks in other curriculum areas and lists a number of items indirectly related to his work (pg.38,393). His work on texts will not be repeated here although I will refer to issues arising from it. I have concentrated, rather, on classroom interactions and how the text is negotiated in the classroom.

The literature search will be discussed under the following headings: 1) content expression, that is, language use and modes of expression 2) content control, that is, pacing, sequencing and elements of authority in the pedagogic relationship 3) content selection. These three themes point to a particular way of understanding teacher mediation, and will later be developed into a theoretical understanding of the forms of regulation acting upon teachers and pupils.

2.1 Content expression.

The following readings attempt to bring together *patterns of teacher control in classroom interactions*, *using mode of expression of content*. This includes verbal patterns, negotiation of meaning, shifting of goals and reference to shared background of pupils. The use of language, the way the contents are expressed and the teacher-talk are of interest in how they may contribute to regulation and control.

Cobb, Wood and Yackel (1991) conducted cognitive research investigating how individual student knowledge is constructed in a mathematics classroom. Their research project involved observing and video-recording the mathematics instruction of a second grade class over a period of a year. They found philosophy and sociology of science a rich source of analogies to describe how a group of 7-year-olds constructed meanings to make intelligible what happened in the classroom. They found a resonance between the negotiating of norms and the scientific practice of refutations (pg.24). For example in learning a new idea, pupils

measured it against old ideas, asked questions, tested it, tried something different and then either accepted or rejected it. The teacher made use of shared background to help her explain concepts, and interactions took place against a background of "frequently tacit, taken-to-be shared assumptions about one's own and others' obligations and expectations about the theme of the discourse" (pg.24). The focus of the analysis was processes by which shared meanings are negotiated and accepted.

These tacit background assumptions and verbal negotiations of meaning are of interest to the present research in the way they affect language use, mode of expression and control over knowledge. Localised speech, shared knowledge of past procedures and background assumptions result in practices that are highly dependent on context. Data supporting this will be discussed in a later chapter, but one example will be mentioned now. As the teacher, in the classroom being studied, introduced a new word to her class she said softly (so that someone who was not familiar with her teaching method may miss it): "Say the word", the class responded without missing a beat "Inequalities". This was clearly a local practice that everyone was familiar with and it was taken for granted that the class would respond with one voice. Construction of meaning in a context-dependent situation has implications for power relationships and hence control of knowledge. These issues will be taken up in the data analysis.

Cobb, in an earlier investigation (1987), attempted to analyse the meanings that first grade children gave to the equality sign. His research involved analysis of

video-taped interviews conducted with 34 children drawn from 5 different classrooms. Interviews were also undertaken with 5 teachers and it was possible to relate the students' interpretation of the equals sign to social interaction patterns that typified classroom life during arithmetic instruction (pg.109). This highlighting of the impact of social interaction on meaning is relevant to this study in its possible contribution to regulation of knowledge. Cobb concludes that "people in interactive situations (eg. the elementary school classroom) continually modify their own goals as they attempt to give meaning to each other's actions..." (pg.117). He describes a hierarchy of goals, the more general corresponding to the level of beliefs. He describes the goals of the children as trying to find ways of giving the impression that they are acting in line with the teacher's expectations, rather than trying to make sense of the arithmetic. Cobb thus describes how even in a situation where pupils appear to have some control, regulative patterns can be identified as pupils attempt to act in line with the teacher's expectations.

Heap (1985) discusses the social organisation of lessons with reference to the presentation of lesson knowledge. He raises the question of the relation between knowledge and discourse formats. He describes literature on classroom discourse and refers to a basic normative structure of teacher-student interaction, namely, initiation-response-feedback. The 'elicitation' component of initiation is of particular interest to Heap and can be interrogative, statement or command. An elicitation demands a verbal response which obliges feedback. This feedback can be reinitiatory or evaluative. A teacher can reformulate, reinterpret or reshape the response, "but all expansions are governed by the 'rule' that the sequence will

close by an overt or covert positive evaluation by the teacher in the Feedback slot" (pg.248). This evaluation is often effected by consulting the text. This "adjacency triple" (Griffen and Humphrey cited in Heap 1987:248) clearly contributes to positioning of authority and control. In the feedback position, the teacher controls pacing, sequencing, acceptable content, expression and so forth.

Young (1984), conducted research in Australian classrooms attempting to identify the dominant epistemic practices and to answer the question whether the most common teaching patterns are a form of indoctrination or not. In his study of teaching and learning patterns in classrooms he identifies 'validity-forming practices' commonly used by teachers. He also uses the IRF (interaction, response, feedback) as a unit of analysis and quotes figures that "60% of all public talk across large samples of classrooms" involves this pattern of interaction (pg.229). He describes teacher practices of channelling, correcting, shaping, reformulating, re-cycling and appeal to common sense formulations of a "common and unproblematic context of background knowledge" (pg.232). He concludes by describing the ways that teachers shape the lesson as "explicit control of topic through near monopoly of questions; direct controlling talk regarding pupil rights to speak (...) by formulation of gist which summarises the talk or introduces definitive material into it in the form of monologue or short interspersed statements" (pg.235). He refers to this teacher-talk as meta-language.

Apple and Christian-Smith (1991:14) identify three ways in which people can potentially respond to a text, namely dominated, negotiated or oppositional.

Dominated response is accepting at face value, negotiated response is accepting of overall interpretations with dispute of claims, oppositional response 'repositions' in relation to the text and takes on the position of the oppressed. Meanings are described as multiple and contradictory:

> We cannot assume that what is "in" the text is actually taught. Nor can we assume that what is taught is actually learned. Teachers have a long history of mediating and transforming text material when they employ it in classrooms. Students bring their own classed, raced, gendered and sexual biographies with them as well. They, too, selectively accept, reinterpret and reject what counts as legitimate knowledge. (Apple 1991:14).

Apple and Christian-Smith thus describe the interactions of classrooms as mediated by more than the text. The teachers and pupils with their complex backgrounds also impact on the contents and interpretation of what is taught.

These readings have attempted to describe verbal patterns of content expression in classroom interaction and the control associated with this. Regulation has been identified in mode of expression and language use, including patterns of elicitation, response and feedback. Negotiation of meaning, shifting of goals and appeal to common background are seen to have regulative potential. These verbal patterns are mediated by the type of response of the pupils, who respond from a complex range of social backgrounds. Verbal interactions, use of language and mode of expression form one of the themes in this study and will be used to inform the research question which is an attempt to uncover control strategies in the classroom.

2.2 Content control.

The following readings relate to *ways in which content may be regulated.* This refers to the sequencing and pacing of content as well as the authority of that content. How it is decided by the teacher that content is reliable and 'correct' is of interest, in other words, how the textbook develops 'authority' and how much 'authority' the teacher has. Authority here refers to what is accepted as correct and non-negotiable.

The language and authority of the textbook itself is discussed by Olson (1989). He argues, controversially, that the authority that is created and maintained through texts, is dependent on the separation of the speaker from the speech. This separation gives the speech an authority "it would not have if it originated in the mind of the current speaker" (pg.239). He describes the social relations maintained by the text by noting that the text is taken as "the authorised version of society's valid knowledge" (pg.238). Children are required to master this knowledge and do not have the right to disagree with these texts. Olson likens the status difference between writer and reader to that of teacher and child in the oral language of the classroom (pg.239). He describes strategies that are used by teachers to maintain this speaker/speech authoritative distance. These are the use of indirect speech forms for example, 'I hear talking' and the seldom used modal auxiliaries (may, might, could) or other expressions of uncertainty (pg.240). He mentions also that in order for someone to disagree or make an assertion, s/he must have the right to

speak within the relevant social group. This implies that in order to disagree with the textbook, you must belong to the relevant group of authors.

Luke et al (1989) add to Olson's argument the dimensions of institutional context and social situations particular to schooling. They argue that the authority of the text has less to do with authorial absence and more to do with the social relations governing the production and use of texts (pg.253). They argue that the text-in-use in a rule-bound class is very different from the text read in some other context: "... the student reader is constrained by a variety of contextual factors extrinsic to the text but intrinsic to the social structure of the school" (pg.250). Students rely on previous courses, readings and teacher explanations. They go on to say that "if we are concerned with the actual sources of text authority, we must consider the extratextual and interactional practices which mediate its educational use" (pg.250). The student's negotiation of the textual content and form is influenced by instructional and administrative objectives, institutional constraints, cultural/linguistic concerns and the teacher's metatextual commentary. The present study resonates strongly with these ideas and will attempt to describe data where this notion of mediation is in evidence.

> Thus the school text is always the object of teacher mediation. One instructs with and through the text; a student confronts textual knowledge via teacher mediation (...) the student assumes an acquiescent, non-authoritative status in relation to both the text and the teacher (...) Conventional classroom discourse is about the text, based on the text, or directed by it (...) In this context of use, then, the text is necessarily reconstituted in an operational sense by a prior pedagogical reading, which may or may not 'preserve the very words' of the authored text. (Luke et al 1989:250).

Luke et al (1989) describe the textbook as 'icon' and object of student resistance. The text has a material presence, it can be ritually cared for and covered, it can be slammed against a locker, it can be hidden from friends, it can be scribbled in and pictures can be defaced with moustaches. There are clear institutional rules that protect the authority of the text (report card may be withheld until text is returned intact), but it is more open to learner criticism (in the form of graffiti for example) than is the teacher, who embodies the rules. In this way the text can become "a transferred object of student resistance to institutional constraints" (pg.256/7). Luke et al conclude by saying that the curriculum is not 'in the text':

> We have argued for a more interactive and pragmatic explanation of text apprehension whereby meaning is contingent on the interaction between the reader's prior knowledge, the institutional setting within which the reading task is situated, the teacher who teaches the text and the distinctive features of the textbook per se. This relationship, we have noted, is delimited and constrained by the rules of schooling which position teacher, text and student in hierarchical levels of power and authority (1989:258).

The present research concurs with this idea and will present data illustrating, supporting and discussing in a fine-grained way, strategies in the text and strategies used by the teacher that play a part in this positioning.

Baker and Freebody (1989) formulate this debate around the authority of the school text as "whether the authority of school texts lies 'in' the structure of the text, or whether this authority derives from the broader institutional context in which such texts are used" (pg.263). Their interest is text-authorising practice which may be

observed in the classroom, especially in the utterances of teachers. Their studies involved reading lessons in the early years of schooling, from an ethnomethodological perspective. The link with the present study lies in the teacher's metatextual commentary and the 'talk around the text' that establishes the social organisation of authority relations between students and teachers. Baker and Freebody (1989) point to teacher utterances where the teacher provides interpretations, acceptable responses, and clues which "penetrate and shape the text" (pg.267) and provide a commentary of the social relations. The teacher's 'questioning' and 'wondering' provide a commentary on the text. They point to the absence of a "principled way of determining the meaning" (pg.268) by students, as the determining principles are only made available to them retrospectively, after they have tried to guess what answer the teacher was looking for. They point also to the teacher's self-legitimation, by using a correct answer to support and legitimize the text as source of knowledge: "The correctness of the answer via reference to the text also legitimates the question itself: the question is shown to have been a competent one by having an answer available to it in the text. It is a form of self-authorisation using the text as resource" (pg.268). The text is thus recruited by the teacher to assert her own authority. The present study identifies instances of this self-authorisation and legitimating of questions using the textbook.

Teachers may draw also on their own cultural knowledge rather than the text to answer a question: "This method of relating the text to everyday life through consult-the-text questions alongside consult-your-commonsense-knowledge questions also displays the teacher as arbiter in both realms of knowledge, able to

cross the boundaries with ease" (pg.267). Teachers may ask students to guess, imagine, hypothesize, but suspend resolution until the text is consulted to find the answer (pg.273). In this way the teacher could subordinate the student's knowledge to the text. S/he also pretends not to know the answer until everyone refers to the text. Baker and Freebody (1989) conclude that "how a teacher designs questioning is always a product of the teacher's own reading of the story, to which the organisation of the text would certainly contribute. (...) As any text provides for multiple readings, the teacher's running commentary cannot be seen to reflect the text's structure, but to construct it for all practical purposes" (pg.281). In this way the text is recruited to regulate knowledge boundaries.

Cazden (1989) points out that in expository books (eg. science and mathematics) "it is not just beliefs and attitudes toward the nature of reading that are at stake, but beliefs about and attitudes toward the nature of our knowledge of the world" (pg.285). Cazden expresses unease with ethnomethodological work which implies that practices uncovered are universal and do not allow for variation.

The debate discussed above, highlights important considerations for the research question of the present study : how does this authority of the text affect the teacher's recruitment of it as a resource? If it is seen as a legitimate record of society's knowledge, can it be successfully used as an object of control and self-validation by the teacher? Also, if the teacher regards it as legitimate, is s/he more likely to be 'recruited' by the text and follow contents, methods, and sequences? To

what extent are both teacher and text positioned by schooling? These issues will be discussed later in light of the data analysis.

2.3 Content selection.

The following readings are concerned with *content selection, describing its possible involvement in regulating strategies.* Content selection is described in terms of classroom organisation and is related to social class, to teachers' philosophies, to likes and dislikes and to teacher expertise. The criteria used for selection are of interest to the present study in how they may contribute to regulation and control.

Jules (1991) examines the evaluation and reconstruction of texts during a revolution in Grenada. He argues that in a political context of revolution, the intense ideological contestation is made explicit. This study relates to the present research in that Jules describes how the social interactions of the classroom changed with the introduction of new content. New desk arrangements, teaching styles and expectations were introduced. He identifies the organisation of classroom social relations around the text as follows: "(t)he texts legitimated the learners' knowledge through use of the learner's own experience and the acceptance of his or her language" (pg.284). The knowledge of the texts was linked to the social reality and the learner's reality formed part of the organisational structure of the lesson. The classroom structuring involved new styles of teacher-pupil interactions, democratic forms of exchange of knowledge and the cultivation of expression rather than memorisation (pg.284). In these ways the text constructed, or reconstructed, the

interactions and social relations of the classroom. This research contrasts with Rowell's study in Botswana (cited in Greybe and Woolley 1992), mentioned earlier, where it was found that classroom patterns of interaction do not change automatically with the provision of new texts. This contradiction feeds into the argument of this study which suggests that there is a dialectical relationship where the teacher both positions the text and is positioned by it.

Anyon's curriculum research (1981) involving a case study of five elementary schools in contrasting social settings in New Jersey, highlights the "subtle as well as dramatic differences in the curriculum and the curriculum-in-use among the schools" (pg.3). Data was collected on the nature and distribution of school knowledge by classroom observation and interview. Formal and informal interviews were conducted with students, teachers, principles and administrative staff. Assessment of materials and curriculum was also used. Anyon organises a social stratification hierarchy and names the categories as follows: working-class, middle-class, affluent professional and executive elite. Of interest to the present research are the results obtained pertaining to ways in which teachers structure the curriculum. Anyon argues that even when the curriculum is fairly 'standardised,' social stratification of knowledge is possible. For example in the school classified as 'working class', mathematical knowledge was restricted to procedures and steps to be followed. The pages calling for mathematical reasoning and inference were "left out because they're too hard" (pg.8). The teacher concentrated on "the basics" and believed that "the students feel secure in doing routine tasks" (pg.8).

Anyon also identifies student resistance as a dominant characteristic of teacher-pupil interaction (pg.11). Higher up the 'social stratification' in the affluent professional school, the mathematics teacher believed in discovery and direct experience. Using geoboards and empirical investigations the class did 'all' the pages involving patterns. Evidence from the executive elite school finds a teacher whose goal is mathematical reasoning, who "doesn't have time to explore with the geoboard " (pg.21) as the curriculum demands are too great. Lessons stress decision-making and manipulation of hypothetical variables.

Anyon thus highlights that what counts as knowledge in the schools differs along dimensions of structure and content and that although the curriculum topics and materials are similar, there are profound differences in the curriculum and the curriculum-in-use in her sample of schools (pg.31). Anyon points, then, to the relationship between different 'contents' taught to different social groups. Although their curriculum was the same, what was considered to be legitimate knowledge was different in each group. She has identified content selection and choice of teaching style as factors regulating social and knowledge boundaries and has shown the teacher's role in this regulation of knowledge. The present study resonates with these ideas and also distinguishes between 'procedural' content selections and selections involving mathematical reasoning and inference. Where Anyon compares curriculum with curriculum-in-use, this research attempts to compare text with text-in-use, in the more limited, more detailed, context of one lesson.

The distinction between curriculum and curriculum-in-use has also been described by Jackson (cited in Goodson 1988:130), who identifies "preactive" and "interactive" curriculum, preactive referring to definition of curriculum and interactive referring to realisation of curriculum. Young (cited in Goodson 1988:130) refers to "curriculum as fact" and "curriculum in practice". Goodson stresses that both of these dimensions are crucially important. He maintains that there is not a direct or easily discernible link between the preactive and the interactive. The interactive may on occasion subvert or transcend the preactive, the preactive construction may also "set important and significant parameters for interactive realisation in the classroom" (pg.19). These comments on curriculum resonate with the idea that the text 'recruits' the teacher in some way, likewise that the teacher can subvert and transcend the text.

Flanders (1993) describes research investigating the relationships between intended, implemented, and tested curricula of 84 classes of US eighth-grade mathematics students. It was based on data from the SIMS (Second International Mathematics Study) and consisted of 180 multiple-choice items. The implementation phase of this study is of interest to the present study, especially the selection of content by teachers. This selection is a 'restructuring' of the given text and resonates with 'recruiting' the text. Flanders identifies OTL (opportunity to learn) and EXP (teacher expectation of success). OTL and EXP responses were compared by regression analyses to see if variation in responses in one variable was accounted for by variation in the other. Conclusions drawn included the following, "improved expectations meant higher motivation to teach the items (...)

whether items were covered in the book or not did not make a statistically significant difference in motivation (...) coverage of items in books correlated with better expectations" (pg.274). Teacher claims are interesting in how this impacts on what curriculum is available to students:

> This study is instructive in its look at the teacher-textbook relationship as compared to classroom observations or teacher surveys. Teachers expected students to succeed on SIMS items found in the textbook, not to succeed on items missing from textbooks, and they claimed that items not in the textbook were taught anyway. But because only 51% of the teachers in this study reported using materials other than the textbook many of these teachers seem to be sources of the nontextbook mathematics, albeit not confident ones. (Flanders 1993:275).

Therefore although teacher motivation was strong, confidence was very much tied to the book. The teacher's perception of what the students are able to succeed in,is seen as directly related to choice of content. In this way the teacher gives access to mathematics and creates knowledge boundaries by her own choices. She recruits the aspects of the textbook that she feels are best suited to her needs.

Freeman et al (1983) conducted research examining critically "the claim that in elementary school mathematics there is a national curriculum defined by textbooks and texts" (pg.509). The analyses of texts were guided by a classification manual using a three dimensional taxonomy of elementary school mathematics and two independent raters. Any discrepancies were resolved by a third rater. The texts were described in terms of general intent of items, nature of material and operation that the student should perform. Results were presented as tables describing topics covered by texts and by tests. Tables of percentages of topics covered were also

recorded. Results indicated that the claim that there is a national curriculum defined by textbooks and tests is "valid only when content is described at a relatively high level of generality" (pg.508). The results suggest that "diversity rather than consensus is likely to characterise the mathematics curricula of elementary schools" (pg.510). This study thus further informs the theme of 'contents' and the relationship between the contents of the textbook and a national curriculum.

Freeman et al (1983) discuss the influence of different styles of textbook use on instructional validity of standardized tests. They describe styles of textbook use as: textbook-bound, selective omission, the basics, and management by objectives. The object of the research was to investigate "the degree to which the match in textbook-test content varies as a function of how a teacher uses the book" (pg.259). Although Freeman et al do not go into the fine detail of textbook use, and only considered one textbook, their study points to different styles of teaching from the same book resulting in functional differences in the curriculum. They quote Berliner (cited in Freeman et al 1983:259) as saying that "different philosophies of education yield different beliefs about what is important for students to learn. These beliefs, along with the teacher's likes and dislikes for teaching certain areas, result in some interesting differences in the functional curriculum of a class".

In a later study, Freeman and Porter (1989) investigated to what extent textbooks dictate the content of mathematics instruction in elementary schools. This was a four-teacher case study involving description of style of textbook use and an examination of the overlap between content taught and textbook content. Raters

generated classifications of all problems presented in books and all content presented to students over the course of a year. Daily teacher logs and a three-dimensional classification system were used (pg.403). Results point to differences between the curriculum of the text and the teachers' topic selection, content emphasis and teaching sequence. Once again, Freeman and Porter do not detail teaching style, but some results are of interest to this study. One table of results maps style of textbook use onto Content authority of the text and Strength of convictions. Data was collected 10 years previously and only 4 teachers were considered. However, results indicated that teachers do not always defer to the text when deciding what topics to teach, how much time to allocate to a topic, or the order in which topics are taught. Also, it was not clear from the study whether teachers who used additional materials served their students better or not. In this particular case study:

> the teachers who followed their textbooks most closely were the teachers who placed most emphasis on applications and conceptual understanding. The teachers who deviated most from their textbooks did so in order to augment an already heavy emphasis on drill and practice of computational skills. (Freeman and Porter 1989:419).

Apple (1986) in his work on texts, attempts to "illuminate the relationship between the curriculum, pedagogy, and forms of evaluation in schools and the structures of inequality in the larger society" (pg.7). His discussion involves the ideology and politics of the textbook, as well as production and distribution of textbooks. Although Apple does not discuss details of classroom interaction, he mentions that the textbook has an immense impact on the social relations of the classroom: "(i)t is

estimated, for example, that 75 per cent of the time elementary and secondary students are in classrooms and 90 per cent of their time on homework is spent with text materials" (pg.85). Apple cautions educational researchers not to take people as isolated objects of study, rather to see pupils as classed, raced, and gendered subjects in a context of economic, political and cultural conflict (pg.5). Apple examines the process by which the curriculum gets to teachers rather than what the teacher does with it. He looks at processes by which knowledge, "usually the knowledge of the dominant groups, gets to be legitimate for use by teachers in their classrooms" (pg.12). He stresses that an education system can only be understood relationally: in relation to culture, politics and economics.

Elbaz (1991) carried out research examining classroom interaction among teachers, students and texts. Her research involved a case study of reading and reading comprehension in Israeli elementary schools (pg.301). She adopts the view that the text is a material embodiment of the knowledge of the culture, that teachers are responsible for socialising children to the culture and that this task is is carried out primarily through the interrelated media of language and text (pg.299). Conclusions drawn include the teacher's own interactions with the text modelling the behaviours of critical reading that they wish the pupils to adopt (pg.316). Teachers also interact with the mandated curriculum in complex ways. In some cases they followed the compulsory and non-compulsory syllabus exactly, attempting to tie these materials to pupils' experience using classroom conversation, but otherwise using traditional transmission techniques. In other cases they use compulsory materials with a pedagogy that incorporates pupils'

choice and interest (pg.317). The teachers' own interest and background was found to have a bearing on the way they translated the curricula into use. "The lesson to be learned is that attention to structural arrangements alone does not allow us to understand the ways in which teachers bring to bear their knowledge in the curricular process played out in the classroom" (pg.318).

These readings around text-in-use highlight various issues of 'content' selection. Content selection has been related to classroom organisation, it has been related to social class and to teacher background. Teachers' philosophies, expertise, likes and dislikes have been linked to choices about what counts as knowledge and teachers' own cultures and beliefs have been related to the socialising of pupils through language and texts. Curriculum has been described as being significantly different from curriculum-in-use. The present study is in line with many of these ideas, but will describe them somewhat differently, attempting to use data to suggest and describe how these types of regulation operate in a mathematics lesson.

To sum up then, the themes I have drawn out of this literature survey are **content selection**, **content control**, **and content expression**. Each of these themes has been identified and discussed in previous research and each describes some form of regulation. None of this previous research has, however, described in a fine-grained way how this regulation can be identified in a lesson and how it may affect the transformative potential of new textbooks. Pupils are regulated by teachers' selection of contents and verbal modes of expression and teachers are 'regulated'

by institutional demands, instructional as well as disciplinary demands and by strategies implicit in the textbook. These themes thus throw light on the research question: how does the teacher recruit the text and how is she 'recruited' by it; what are the institutional controls affecting each? The following section will attempt to understand these themes in terms of existing educational theories.

CHAPTER 3. THEORETICAL FRAMEWORK.

The previous section examined arguments and research articles in the areas of content expression, content control and content selection. Content control included sequencing, pacing and authority in the pedagogic relationship, while content expression referred to verbal modes and patterns in classroom interactions. Content selection referred to choices, inclusions and omissions. The focus was on regulating strategies involving the positioning of the teacher by the text, and the positioning of the text by the teacher. To understand these themes and the way the teacher and the textbook organised and were organised in the lesson observed, I have drawn theoretical ideas mainly from from Bernstein (1973, 1990, 1993) and from Dowling (1993, 1994). Although these theoretical ideas come from different methodological positions, each theory throws light on the research question.

3.1 Classification and framing.

The aspects of Bernstein's work that I am interested in are his ideas on classification and framing. Classification "refers to the degree of boundary maintenance between contents" (Bernstein 1973:68), framing refers to the "degree of control teacher and pupil possess over the selection, organisation, and pacing of the knowledge transmitted and received in the pedagogical relationship" (Bernstein 1973:68). Both classification and framing provide a theoretical way of understanding text-in-use.

Classification will be used to describe the relationships and boundaries between the contents of the textbook and the contents of the lesson and how each of these 'contents' relate to mathematical knowledge. Framing will be used to describe the nature of the control that pupils and teacher possess over selection, pacing, sequencing and organisation during the lesson.

Classification refers to the relationships between, or the nature of the differentiation between, contents. Strong classification means that the "contents are well insulated from each other by strong boundaries" (Bernstein 1973:68). Classification determines the structure of 'curriculum'. Mathematics is strongly classified since it has strong boundaries and is well insulated from other disciplines by its specialised terms, language and so forth. Framing describes the structuring of pedagogy, it refers to the pedagogical relationship of teacher and taught ie. to the context in which knowledge is transmitted and received (pg.68). Framing can be defined as follows:

> Framing refers to the principle regulating the communicative practices of the social relations within the reproduction of discursive resources, that is, between transmitters and acquirers. Where framing is strong, the transmitter explicitly regulates the distinguishing features of the interactional and locational principles, which constitute the communicative context. Where framing is weak, the acquirer has a greater degree of regulation over the distinguishing features of the interactional and locational principles that constitute the communicative context. (Bernstein 1990:36).

The concept of framing thus describes the location and nature of control in the pedagogic interactions of the classroom, which is central to this description of text-in-use. In the present study, transmitter/acquirer refers primarily to teacher/pupil

although it could be used more broadly, for example, textbook/pupil. Framing thus occurs within the broader context of classification: the degree of boundary maintainance between contents.

This idea of bounding knowledge suggests that Bernstein has a "notion of knowledge as contents" (Dowling 1994:5). In contrast Dowling resists the notion of 'boundary' within his methodology. He describes 'contents' as "specific articulations of a notional Global Semantic Universe" (pg.6). Knowledge is thus 'articulations' of meaning, rather than 'contents'. The same signifier can participate in more than one system, but its signification will be transformed. Dowling (1993) describes the esoteric domain of practice as that region of an activity where both form and content are highly specialised. Ambiguity is minimised and it is "only within this domain that the principles which regulate an activity can attain their full expression" (pg.95). Public domain, on the other hand, exhibits relatively weak specialisation in terms of form of expression and content and has the appearance of non-specialised practice (pg.95). The principles regulating activities cannot be adequately expressed in this domain.

3.2 Discourse and Procedure.

Dowling's study is concerned with " the production of a language for the systematic sociological description of pedagogic texts and with the application of this mechanism to two series of textbooks within the secondary mathematics scheme" (Dowling 1993:2). He examines the modes of expression of a school mathematics

textbook and describes how meaning is articulated. I will use his concepts of "discourse" and "procedure" as a theoretical resource to describe the modes of expression of both textbook and teacher. Discourse and procedure are textual strategies which reproduce the esoteric domain of mathematics. Discourse is associated with abstract, context-independent, generalising practices, while procedure is associated with concrete, context-dependent, localising practices. Dowling's study of pedagogic texts excludes interactions in the classroom and he considers both transmitter and acquirer as textual categories. He describes the construction of the ideal reader by the text, rather than the empirical pupil who is affected by the complex, polythetic practices of the classroom. My own study's interests are the teacher and the text as 'transmitters' within the classroom. The pupil as acquirer will be backgrounded. Dowling describes the transmitter as being "in possession of the regulative rules of the practices of the activity which the acquirer is to acquire" (Dowling 1993:90).

3.3 Discussion.

This study will thus understand the relationship between contents, and the control over the pedagogic relationship in terms of Bernstein's concepts of classification and framing. Articulation of meaning, form of expression and language will be understood in terms of Dowling's concepts of discourse and procedure.

Dowling's map of contexts of mathematical practices (Dowling 1993:37) illustrates the empirical space in which the present study is located. Dowling's own research

is in cell F, the recontextualising field of school mathematics, which generates the official pedagogic practices of school mathematics represented in textbooks (Dowling 1993:37). This study will be located in cell G, the reproduction of school mathematics. Here mathematics is transmitted as local pedagogic practice. The classroom can be "resolved into two contexts for the elaboration of mathematical practices. These contexts are the fields of 'reproduction', where the practices are produced for or on behalf of the teacher, and 'operationalisation' where they are produced by the students" (pg.36). This study will focus on the teacher rather than the pupil and hence will be located in the field of reproduction.

Dowling's distinction of discourse versus procedure will be used to describe language and meaning sequences in the classroom. A similar dichotomy in modes of practice has been identified by various people in the social sciences (Dowling 1993:53-66) and related to language use, namely thinking, reasoning and so forth. Bernstein has identified elaborated/restricted speech codes which are "abstract, underlying principles which regulate communication and generate speech" (Stubbs 1976:44). A restricted code implies localised speech, highly dependent on the context, while elaborated speech draws from a larger repetoire of possibilities of expression. It is generalised rather than context-dependent. Walkerdine identifies a dichotomy in types of reasoning, namely, formal or practical. Practical reasoning determines the truth of a statement in terms of its correspondence to the rules of a practice, that is, it is rule-governed. Formal reasoning determines the truth of a statement in terms of the internal relations of the statement itself (Dowling 1993:58). Luria's abstract/situational thinking and Vygotsky's conceptual/complex

thinking identify a similar dichotomy associated with modes of thinking. In the present study, I will use Dowling's discourse/procedure dichotomy to describe how the use of a textbook shapes the teacher's speech pattern and how both discourse and procedure are identified in the classroom. I believe that it is possible to identify discursively-elaborated meaning sequences and speech patterns, which may or may not mirror the patterns evident in the textbook. Discursive elaboration includes making explicit the regulating principles of school mathematics, while procedural elaboration obscures the regulating principles. In other words, discursive elaboration makes principled connections between and within topics thus providing access to the discourse, while procedural elaboration hides the relationships and teaches algorithms and procedures, thus, in Dowling's terms, alienating pupils from the discourse. Strategies which alienate and construct pupils in a subordinate position are referred to as localising strategies, while strategies which apprentice pupils to the esoteric domain of mathematics as a relatively dominant voice, are referred to as generalising strategies (Dowling 1993:105).

These theoretical ideas described above will inform the ideas put forward, and the interpretations made, when analysing the data from the classroom. The theme of content expression, that is, verbal mode and textual mode will be described using Dowling's language. The themes of content selection and content control will be understood in terms of Bernstein's theories on classification and framing.

CHAPTER 4. METHODOLOGY AND DATA COLLECTION.

This section of the dissertation describes the research design and the methodology chosen to collect data that seemed best suited to the nature of the research question. Also discussed in this section are issues of reliability, validity and generalisability.

The research question involves text-in-use and the uncovering of strategies. This will include strategies used by the teacher, strategies implicit in the text and strategies involving content selection, content control and content expression. The focus is on the teacher's recruiting of the textbook as object of classroom control, as well as the 'recruiting' of the teacher by the textbook as agent of knowledge control. The ways in which the teacher positions and is positioned by the text are of particular interest. My hypothesis is that the teacher recruits the text to regulate pupils and knowledge, but that s/he is at the same time constrained by strategies implicit in the text. Both teacher-strategies and textual-strategies are in turn positioned by institutional and social demands.

4.1 Case study.

In order to uncover these two strands, namely the teacher's recruitment of the text and the text's 'recruitment' of the teacher, I chose a single case study method. Firstly, the practical necessity of gathering data before the September school examinations in order to complete a limited research project in a limited space of

time, suggested that a case study would be a suitable approach. Secondly, I felt a close examination of a small amount of empirical data would reveal a more fine-grained account of a teacher's strategies than could be achieved by a more extensive study, given the time constraints.

I therefore chose to analyse one 50 minute lesson, together with a teacher interview, as a suitable methodology to examine the research question. The limitations of this are that this is only one class, one teacher and one textbook, so no generalisations can be made except insofar as the reader can clearly recognise strategies, phrases and structures from experience. I am attempting to describe a situation familiar to anyone who has been to school and am thus attempting to analyse "in a fine-grain way, one-off representative instances of what are unmistakably commonplace phenomena" (Potter 1990:161). I believe that unmistakably commonplace and familiar situations are clearly recognisable in the lesson under discussion.

Data was collected by video-recording this lesson, and taking field notes. The multiple viewing possibilities of a video recording allow for greater accuracy and attention to a greater range of details. An informal unstructured interview was conducted with the teacher to gain background information and follow up on a number of issues arising from the lesson. Transcriptions of the lesson and interview were made. The teacher was informed that the reasearch involved studying the use of the textbook in the classroom. She was asked to describe how textbooks were chosen at her school, how she judged a good textbook and whether her lessons

were based on the textbook. She was also asked to comment on how often textbooks were used and whether the camera changed her organisation of the class. She mentioned evaluation as an important factor affecting her use of the textbook. The teacher had many years of experience and repeatedly commented to me that she was not disturbed by a camera. She had taken part in an inservice project course a year previously so felt confident and willing to participate in this textbook study. The class had been filmed before, so she felt they would also not be constrained by the camera equipment.

As the lesson progressed it was clear that the pupils were in fact constrained by the camera equipment. They often glanced up at it, giggled when it was focused on them and were extremely quiet and reticent for most of the lesson. The only time that some of them relaxed, was when the camera and microphone were quite clearly not directed at them. Then a few pencils were thrown across to friends, and a bit of light-hearted noise was heard. Another possible reason for the quietness and lack of pupil response was the structure of the lesson which was largely teacher exposition from the blackboard with one-phrase responses demanded by the questioning style. The course of the lesson may have inadvertently been disrupted by the camera operator when he gave a portable microphone to the teacher, saying that she should put it on the pupils' desks as she went from group to group. (The teacher, shortly before, had instructed pupils to bring their books to her to correct when they had finished the allocated examples). This was followed by shuffling and giggling on the part of the pupils, and stilted questions addressed by the teacher to groups, which led me to believe that this may not be the usual

course that the lesson followed. In the follow-up interview, data gathered at this part of the lesson was found to be idiosyncratic, since the teacher, when asked whether this had in fact disturbed her lesson, answered:

> Oh no! not at all, I never usually walk around the class so much, but I don't mind at all, I thought you might need it for your purposes.. a bit of group work. (Interview Transcript lines 43-45).

Thus, although she attempted to move from group to group, this was not planned and the desks were not grouped for this. Pupils had their backs to one another and it was somewhat artificial. Data from this part of the lesson has therefore not been considered representative and is only referred to anecdotally in the analysis.

4.2 Qualitative Analysis.

I have analysed the data qualitatively, with a few quantitative details added. I have focused on the words and actions of the teacher rather than those of the pupils, as this research is limited to the teacher's construction of, and construction by, the text. Patterns identified in the transcribed data include patterns of language use and expression, content selection, pedagogic interactions, control strategies and so forth. These patterns have been examined in the light of the functions and consequences they might have. The qualitative nature of the analysis limits the research, since any qualitative description is subjective and could be understood and read in many other ways. Other selections could be made and what one researcher judges to be data worthy of note, may be glossed over by another.

> regardless of how faithful you attempt to be in describing what you have observed, you are creating something that has never existed before. At best it can be similar, never exactly the same as you observed (Wolcott 1994:15).

Conclusions drawn and descriptions attempted, cannot be scientifically evaluated or quantitatively supported. They can however, be linked to existing theoretical propositions. Although the study of a single case cannot report authoritative correlations, its contribution lies in its potential for understanding something beyond itself and serving as a restraint on overgeneralisations made by others (Wolcott 1994:33). As Hitchcock suggests, classroom research can alert teachers to some of the "subtle and complex processes of interaction that directly shape and influence learning" (1989:134).

4.3 Generalisability.

The theoretical ideas of "classification and framing" and "discourse and procedure" are well suited to a detailed analysis of a small amount of empirical data and some generalisation of this case to theoretical propositions may be appropriate, rather than generalisations to populations or universes (Yin 1984, cited in Bryman 1993:90). This case study is not viewed as a sample drawn from a wider universe of such cases, but seeks to integrate classroom data with a theoretical context (Bryman 1993:91).

This case study is also not attempting to show a situation that is representative, but focuses rather "on social processes that occur within a social situation" (Burgess 1987:5). The complexity of the social context of the classroom is a limiting factor. It is impossible to adequately describe the history, social context and identity of the participants of this classroom in such limited research, but it is also not possible to explain and adequately describe what is happening in the classroom without paying attention to this context. "By a concentration upon observable behaviour and in effect taking it at 'face value', interaction analysis can become involved in by-passing the viewpoints and intentions of the teachers and pupils themselves" (Hitchcock 1989:137). Although I have made no attempt to describe the social context and intentions of the teacher, I have analysed the pedagogic relationship within this context and attempted to integrate it with a theoretical context. The impact of the social context is acknowledged and referred to, though not discussed in any detail.

4.4 Discussion.

The data has not been arranged chronologically, rather, themes have been identified and followed through the text to highlight more than one instance of the same theme. Analysis has been in the areas of content, conversation, discourse and interaction, but particular attention has been paid to teacher-talk. Classroom talk can be easily identified as distinct from other kinds of talk. It is typically organised around the completion of tasks or activities and one category of speaker, the teacher, attempts to control and direct most of that talk (Hitchcock 1989:149).

Some reference has been made to this 'classroom talk' approach to understanding the classroom in analysing the data. Also informing the analysis has been an ethnographic understanding. The boundaries between linguistic and ethnographic approaches have become increasingly blurred and there are a number of points of contact between them: "(b)oth are concerned with what participants are doing in making sense of each others' utterances and both approaches look at patterns and regularities in classroom talk" (Hitchcock 1989:150). Ethnographic approaches, however, include a broader range of factors that influence what goes on between the participants in the classroom.

To summarise then, a case study has been chosen as a suitable method to analyse in a fine-grained way, regulative strategies in the classroom. For reliablity and validity it relies on recognition of the unmistakably common-place, on recognition of existing theories, and on transparency of detail given to the reader about the origin of statements to allow him/her to make independent evaluations. This study does not claim to be generalisable or representative, it does however, attempt to throw light on over-generalisations made by other researchers.

CHAPTER 5. ANALYSIS AND DISCUSSION OF DATA.

As mentioned previously, this data analysis has been informed primarily by Bernstein's categories of classification and framing, and Dowling's categories of procedure and discourse. The data will be analysed in three parts. Firstly, I will discuss the textbook itself, how it was chosen and what strategies are evident in the text. Secondly, I will provide a description of the classroom and how its arrangement participates in the regulation of pupils, and thirdly, I will describe the events of the lesson and the strategies used by the teacher. The emphasis will be on the regulative role of the teacher while the instructional role will be backgrounded. This is an analytic separation as these two roles are, in practice, embedded within each other.

5.1 The Textbook.

a) Choice of text.

The prescribed textbook in the classroom under consideration is "New Modern Mathematics 8 " by Dreyer and Dreyer. It was first published in 1985 and reprinted in 1993. It was chosen a few years ago by the head of the mathematics department in the school chosen for this study, who had asked her department for suggestions and comments. The staff have access to samples from booksellers and representatives, and are fairly free to buy copies for their own use. However "once

we have a set of books we are really stuck with them for a number of years, until they (the pupils) can't use them any more" (IT:I 24-26) (for easy reference IT:I.. will refer to interview transcript and a line reference). The teacher was asked to describe how she judged a good textbook and how she chose a book from the available range. She answered that she liked graded examples, from easy to difficult. She felt it was very important to have a large number of examples to choose from and a variety of different types. She liked books with explanations and worked examples to which pupils and teachers could refer. She felt that she should be able to use the book as a basis on which to set examinations and she liked to use examples directly from the book. She stressed 'variety', saying that it gave her a better choice. The teacher thus expressed the criteria she used to select the book.

The authors of the textbook also attempt to make clear the criteria upon which they made selections of examples to include in the text. According to them, the book:

> continues the attempt to break away completely from the traditional presentation of algebra, which tended to the acquisition of manipulative skills rather than to an understanding of the processes involved (...) The book also continues the features of numerous exercises in separate groups, carefully graded in ascending order of difficulty, thereby providing practice for pupils of varying degrees of attainment. (Dreyer and Dreyer 1985: preface).

The authors, however, do not elaborate how they hope to achieve this, nor do they suggest what role they expect the teacher to play.

The criteria set out by the authors describe selection, sequencing and organisation of the content of the textbook. The teacher's criteria included the practical details of finding enough suitable examples for examination purposes, as well as grading of examples and worked examples from which to teach. The criteria used for the production of this textbook and by the teacher to reproduce the text, are of interest to this data analysis in their contribution to regulating strategies. The textbook constitutes a selection of what counts as knowledge and the teacher selects still further and thus strengthens control.

In Bernstein's language, the mathematics content is strongly classified. The boundaries between what can and what cannot be included in the lesson are made clear by syllabus requirements and by what is understood to be school mathematics. In other words, syllabus and examination requirements limit and often define the contents which are selected. On the other hand, the selection made by the teacher, within the selection made by the text, can be said to contribute to the strength of framing with respect to selection, in the lesson. The teacher, within the pedagogic relationship, maintains a high degree of control over selection.

Achievement in school is usually measured by examination results so selections are often made with performance as a criterion.

b) Textual mode of expression.

The section of text being considered (see included extract) is consistent with the layout of the book as a whole. Sections are introduced with a topic title and a few words of introduction, either referring back to a previous section or defining terms. For example, in the section being considered, inequalities are introduced by referring back to the section on equations: "(p)rocesses similar to those used for finding the solution of equations can also be used with inequalities" (TB:I 1-2) (for easy reference TB:I.. will refer to the textbook with a line reference, in this case Dreyer and Dreyer 1985:50). An exposition of laws with some explanation is followed by a few worked examples, graded in difficulty and each demonstrating a new aspect of the topic. This is followed by exercises of graded examples and ending with an enrichment exercise in a few cases. Enrichment exercises involve problem solving related to the section being learned.

"Boxes" are used to emphasise laws and definitions. Language use is formal and precise, there is no colloquial usage, no cartoons, drawings or other devices to increase "user friendliness" common in modern textbooks. There are no pictures or photographs, all diagrams are accurately printed, all numbers, letters and angles are typed, rather than hand-drawn. Very few "everyday" examples used as metaphors appear in the book. Some however, are found in the 'problems' at the end of a section. Using Dowling's terms, the presentation of the textbook thus displays the symbolic mode of signification, associated with generalising strategies. Dowling (1993:107) describes three signifying modes: the iconic (pictures,

Extract from: New Modern Mathematics. Dreyer and Dreyer (1985) pp 50 - 51

7.6 Inequalities

Processes similar to those used for finding the solution of equations can also be used with inequalities. The following laws form the basis for operations on inequalities:

1. **For all real numbers** a, b **and** c,
   if $a > b$, **and** $b > c$, **then** $a > c$.
   This law states that if $5 > 3$, and $3 > 1$, then $5 > 1$.

2. **For all real numbers** a, b **and** c,
   if $a > b$, **then** $a + c > b + c$.
   This law permits you to add the same number to both sides of an inequality.

3. **For all real numbers** a, b **and** c.
   if $a > b$, **then** $ac > bc$, **if** c **is positive.**
   This law states that if you multiply both sides of an inequality by a **positive** number, the order remains unchanged.

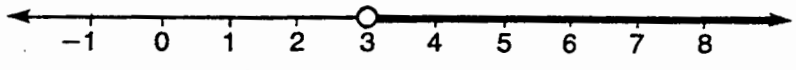
4. **For all real numbers** a, b **and** c,
   if $a > b$, **then** $ac < bc$, **if** c **is negative.**
   This law states that if you multiply both sides of an inequality by a **negative** number, the order is reversed.

The following examples will show how solutions are found.

Examples

(1) Find the solution of the inequality $7x - 6 > 4x + 3$, $x \in \mathbb{R}$ and draw its graph.
The procedure is similar to that used for finding the solution set of an equality.

$$
\begin{aligned}
& 7x - 6 > 4x + 3 \\
\Leftrightarrow\ & 7x - 6 + (+\mathbf{6}) > 4x + 3 + (+\mathbf{6}) \\
\Leftrightarrow\ & 7x > 4x + 9 \\
\Leftrightarrow\ & 7x + (-\mathbf{4}x) > 4x + (-\mathbf{4}x) + 9 \\
\Leftrightarrow\ & 3x > 9 \\
\Leftrightarrow\ & (\tfrac{1}{3})3x > 9(\tfrac{1}{3}) \\
\Leftrightarrow\ & x > 3
\end{aligned}
$$



(2) Find the solution of the inequality $2x - 16 \leq 2 - x$, $x \in \mathbb{N}$.

Solution: We have $2x - 16 \leq 2 - x$.
Add $x + 16$ to both sides:
Then $3x \leq 18$
Divide both sides by 3:
So that $x \leq 6$

Thus the solution is $x = 1; 2; 3; 4; 5; 6$

(3) Find the solution of the inequality $2x - 7 \geq 4x - 10$, $x \in \mathbb{R}$.

Solution: We have $2x - 7 \geq 4x - 10$.

$\Leftrightarrow 2x - 4x \geq -10 + 7$

$\Leftrightarrow -2x \geq -3$

In the next step we multiply both sides of the inequality by the negative number $-\frac{1}{2}$. The order is now **reversed**.

$\Leftrightarrow x \leq \frac{3}{2}$

> The sense of an inequality is **not changed** if both sides are multiplied by the same **positive** number. The sense of an inequality **is reversed** if both sides are multiplied by the same **negative** number.

Exercise 7.10

Find the solution of each of the following inequalities. Draw the graphs of the solutions in 1, 2 and 3.

1. $5x + 7 \geq 73 - 6x$, $x \in \mathbb{N}$
2. $2x - 5 < 5x + 4$, $x \in \mathbb{R}$
3. $5(x - 3) \geq 2(2x - 7)$, $x \in \mathbb{N}$
4. $2(x - 1) < 7(3x - 4) + 64$, $x \in \mathbb{Z}$
5. $\frac{3x-1}{4} + \frac{3x-3}{8} \geq \frac{19}{8}$, $x \in \mathbb{R}$
6. $3 - (3x + 4) < -2(1 + x)$, $x \in \mathbb{R}$
7. $-2(x - 3) \leq 5x + \frac{4}{3}$, $x \in \mathbb{R}$.
8. $5 - (x + 7) \leq 3x - 2(x - 4)$, $x \in \mathbb{R}$
9. $4(x - 3) + 3x > x + 6$, $x \in \mathbb{R}$
10. $x + \frac{3}{2} \geq 7x + 2(3 - 2x)$, $x \in \mathbb{R}$

7.7 Problems involving inequalities (Enrichment)

Examples

(1) The sum of two consecutive odd numbers is less than 96. Find the largest possible values of two such numbers.

Solution: Let the consecutive odd numbers be $2x + 1$ and $2x + 3$.

We have $(2x + 1) + (2x + 3) < 96$.

$\Leftrightarrow 4x + 4 < 96$

$\Leftrightarrow 4x < 92$

$\Leftrightarrow x < 23$

If $x = 23$, the numbers are 47 and 49 and their sum 96. Therefore, the required numbers are 45 and 47.

photographs and so forth), the indexical (diagrams, graphs) and the symbolic (mathematical signs, variables). These modes describe the form of the relationship between content and expression. In the textbook under consideration the symbolic mode is strongly in evidence with some indexical material also present, for example, the number line (TB:I 29) belongs to the indexical mode of expression.

c) Algebra

The topic taught by the teacher in the lesson under consideration was 'inequalities'. She had taught 'equations' a week earlier and was planning to spend a few weeks doing algebra. Dowling (1993) describes algebra as "that topic of school mathematics which is concerned with the structure of systems which is explored and described through the introduction of variables" (pg.156). Algebra is concerned primarily with unknowns, with variables and with the solution of equations. One would expect, therefore, to find a predominance of the symbolic mode. Algebra is concerned also, with the structure of systems and with generalising. This is very similar to Dowling's description of discourse as the description of systems in terms of the principles that regulate them. The principle regulating algebra is essentially generalisation and the construction of systems. Using these ideas then, algebra is largely discursive and we would expect it to be involved with generalising strategies (Dowling 1993:156). On reading this particular text concerning inequalities, however, non-discursive strategies can also be identified.

d) Localising and Generalising Strategies.

Inequalities are introduced in the text by stating the four laws of operation accurately, using variables and generalised to the set of real numbers, for example: "(f)or all real numbers a, b, and c, if a>b, and b>c, then a>c." (TB:I 4-5).

The laws are thus produced as general principles, applying to generalised cases, and involve discourse (Dowling 1993:160). However, each law is then explained with a sentence which 'translates' the mathematical language into something which is easier to understand, for example, "(t)his law permits you to add the same number to both sides of an inequality" (TB:I 9). These explanatory sentences are understood to be localising strategies where the discursive mathematics is translated into everyday language in the form of a procedure. (In Bernstein's terms they could also be understood as a weakening in classification.) In Dowling's language a localising strategy constructs a relatively subordinate position, while a generalising strategy constructs a relatively dominant position (1993:105). In the first law (TB:I 4-6), the explanatory sentence is mathematically inaccurate since one example has been given as the whole law: "(t)his law states that" would more accurately read "an example of this law is". One example has thus been given the status of a law without an attempt at generalisation. The statement " (t)his law states that if 5>3, and 3>1, then 5>1" suggests that the law does not say anything further about other numbers. This inaccuracy is associated with localising strategies and procedure. Instead of an example being generalised to a law, the example is equated with the law. This same strategy will be discussed further in relation to the teacher.

The use of the pronoun "you" in the explanatory sentences is also associated with localising strategies. The reader recognises him/herself in the text, and is thus objectified by it. An apprentice to the discourse would recognise mathematics in the text, rather than self, and his/her individuality would remain exterior and irrelevant to it (Dowling 1993:164). A little later in the text, the pronoun becomes "we", elevating the pupils to the level of the textbook author and allowing pupils to recognise themselves as apprentice mathematicians working with people who are within the discourse. The strategies, then, are mainly generalising and the specialisation of contents is strong, although some localising can be identified.

e) Procedure and Discourse.

The three worked examples demonstrate operating procedures, in a hierarchy of ascending difficulty. They demonstrate the use of, first the real numbers, second the natural numbers and third the rule of the negative. The law of the negative is stated as a general principle without exposition of any kind, it is presented as a procedure the pupils should follow. Thus the esoteric domain text is procedurally produced. The exercise following the worked examples, is a rehearsal of the rules and is organised in ascending order of difficulty. Rehearsal of rules is also understood to be procedural. A few examples require the pupils to extend these rules and apply them to fractions. This extension of principles is associated with discourse. The section concludes with a problem solving enrichment exercise, catering for the "pleasure" of the "more advanced" pupils (TB: preface).

f) Summary

In this section I have discussed dimensions of the textbook that may have a bearing on strategies of control and regulation in the classroom. I have discussed the choice of text and the criteria used for selection by the teacher and the author. The strong classification of school mathematics is seen to contribute towards control of knowledge while the syllabus and examination demands affect the sequencing and pacing of that knowledge. I have discussed, also, the language and expression of the text which is identified as predominantly esoteric domain content, procedurally produced in the symbolic mode. This expression of the text is associated with control over who gets access to the discourse of mathematics and who is placed in a subordinate position.

5.2 The Classroom Organisation.

The classroom was organised with a teacher desk and cupboard in front, the pupils (17 boys, 18 girls) sitting in three triple rows. The middle row was facing forward towards the blackboard, the side rows were facing each other towards the middle of the room. Most boys sat to the teacher's right in a side row, three sat on the teacher's left with the girls, four sat in the centre row. All the girls sat together in the row to the teacher's left. The establishment of the "teacher space" was very clear, her desk acted as a boundary between herself and the class and she only stepped out of her 'space' once during the exposition section of the lesson. The organisation of space thus contributes to the teacher's construction of her own

authority and can be considered to be a control strategy. Bernstein describes the classroom context in terms of a transmitter, an acquirer and a locational principle involving organisation of space; this locational principle regulates physical location and the form of its realisation (Bernstein 1990:34).

The scene is thus set for the lesson to begin. Before the teacher starts teaching, we notice that the classification and framing of teacher's and pupil's practices is strong: "strong classification reduces the power of the teacher over what he(she) transmits" (Bernstein 1975:90). In this case, the teacher has a prescribed text, a prescribed number of pupils, a given time allocation for the mathematics lesson, an examinable syllabus, and a time-table constraining what she transmits. Strong boundaries are maintained, bells ring, pupils move to other rooms, the contents of the mathematics lesson are in no way related to other subjects or to everyday experiences. Framing, on the other hand, refers to the degree of control teacher and pupils have over the pedagogic relationship: "strong frames reduce the power of the pupil over what, when and how he receives knowledge, and increases the teacher's power in the pedagogical relationship" (Bernstein 1975:90). In the classroom being studied, the teacher assumed full control over the pedagogic relationship prior to the beginning of the lesson. The pupils had previously been allocated seats to sit in, she had organised the spatial arrangement of the desks in a specialised way in advance of the lesson, thus providing evidence of strong internal classification regulated by the locational principle. Internal classification refers to "the arrangements of the space and the objects in it" (Bernstein 1993:125). The lesson plan included exposition from the board, worked examples,

pupil's practice examples, signing of books and completion of exercises at home. The form of realisation of the lesson, that is, the way in which the meanings were put together, was thus tightly regulated and was decided in advance of the lesson. The external classification is also strong since there is little opportunity for the everyday to enter the classroom.

5.3 The Lesson.

In analysing the data from the classroom, I will understand the teacher to fill both a regulative and an instructional role (cf. Bernstein). Although the regulative role of the teacher and the use of the textbook as mechanism of control is of particular interest, the instructional role is embedded within the regulative and will also be discussed. Bernstein describes framing as a function of the instructional and regulative discourses and he suggests that the regulative is the dominant discourse (Bernstein 1993:124). This data analysis will examine the 'how', 'what' and 'who' of control. I will consider the regulation of speech, silence, working and listening, as well as sequencing, pacing, selecting, presenting and authorising. I will argue that the teacher positions and is positioned by the textbook and that although the framing is strong and the teacher has a high degree of control in the pedagogic relationship, the classification is also strong and the teacher lacks control over what she can teach and the relationship between contents.

a) Description of the lesson as a whole.

The lesson commenced with the teacher walking into a classroom where most pupils were milling around, chatting and showing great interest in the camera equipment. Without greeting the class, or explaining the presence of the visitors (one assumes the pupils were informed previously), she began the lesson by saying loudly: "Okay, open your books". This clear control mechanism will be discussed in the next section. Twenty minutes were spent with the teacher teaching from the blackboard. She started with revision of an equation from the previous section, this equation was transformed into an inequality by erasing the equals sign and replacing it with an inequality sign. In this way she introduced the topic of the lesson, inequalities. The teacher proceeded to discuss three examples from the textbook, sequencing the examples so that a new dimension was added with each one. The first example was a straightforward inequality, the next involved a fraction, the last involved division by a negative value. After introducing the law of the negative, the teacher gave the class examples to do from the textbook exercise, which they were to complete for homework. The pupils then worked, comparing answers with their neighbour, for the last twenty minutes of the lesson. As they completed the examples, pupils were expected to go to the teacher to have their books signed. Contrary to the normal course of her lessons, the teacher also walked around the class participating in the 'groups'. As discussed in the previous chapter, the teacher commented in the follow-up interview that this was done for the benefit of the researchers and was not the usual course of events.

b) Classroom control - the recruiting of the textbook.

This section will briefly describe how the textbook is used as a resource to regulate relationships between pupils and teacher, who does what, when. I will show how the teacher's use of the textbook as object of control participates in 'framing'.

As the teacher enters the classroom, we see the first example of her recruitment of the textbook as object of control. There is a general friendly, noisy atmosphere as she walks in, she opens the lesson with these words:

(for easy reference VT:l.. will refer to video transcript and a line number).

> Okay,open your books to that last exercise, the equations on page 43....but we'll take one of the easier ones. Well anyway I'll take another example. Leave your books open by the last exercise and your textbooks closed. I'll give you the page later. I want you to have a look at the board (VT:l 1-4).

The teacher gains the attention of the pupils by giving them something to do that requires them to physically open their books. She never again refers to page 43 nor does she choose her examples from the section on equations. Her control strategy is aimed at gaining attention, stopping the talking and getting pupils to pay attention to their books. She uses a second control strategy by not telling pupils what the current topic is, she does not direct them to the page number of the current lesson. In this way she regulates what can be known in advance of her lesson. The pupils have been denied access to advance knowledge of what topic they are to learn and do not yet know that inequalities is the subject of the lesson. The teacher uses this withholding of information as a pedagogic strategy, as, later in the lesson, she erases the equals sign from an equation and replaces it with an inequality sign and

so empirically introduces the new topic. Dowling considers the empirical approach to be highly local and generalisation depends upon making the move from the particular case to the general case (Dowling 1993:165).

Another example where the textbook is used purely as an object of control is evident later in the lesson when the teacher stops working on the board for a minute while she searches in her own notebook which contains preparation notes for a particular example she has in mind. The potential break in teaching could lead to talking, loss of focus and so forth, and the teacher deals with the hiatus in this way:

> ...let me just find an example. I just want to point this out quickly. We'll use textbooks in a minute. I just want to show you an example where we have a negative (VT:I 167-169).

The teacher is still suspending access to where in the textbook the pupils will be expected to work, but she invokes it as something that 'we are aspiring towards', we are still getting there, we have just got one more thing to learn (negatives) before we know enough to use it. She does so at a point in the lesson where there could possibly be a break in control.

The pupils then open their books:

> Now open your books to page 50 I think...exercise 7 point 10. Now right at the top of page 50. Check in your books, right at the top of page 50. 'John' do you have a book? Didn't I say you must bring your book today. Oh you don't have one (giving 'John' her book and taking someone else's on the way), right, top of page 50 (VT:I 205-209).

The repetition of the textbook reference can be seen as a strategy of control, while waiting for everyone to find the place (another possible control break). The exchange with 'John' suggests that the teacher regulates when pupils bring their books to lessons, she also controls who gets one (John gets hers) and who does not (pupil whose book she took).

These examples show the teacher using the tightly framed context of the classroom, with textbook as a resource, to maintain discipline and control of the classroom. In these examples the textbook was not used as instructional tool, but as regulative device.

c) Control over the pedagogic relationship - the recruiting of the textbook.

This section deals with the control over the pedagogic relationship and the regulating of knowledge, what counts as legitimate and who has access to it. It describes the ways the teacher recruits the text to control selection, sequencing and pacing. It describes also how she recruits the text both to authorise herself and to authorise her own knowledge.

The teacher's 'I think' of the previous example is the only occasion in the lesson where she expresses uncertainty. This is significant in that the message she transmits is possibly one that knowledge is certain and uncontested - teachers may be uncertain about a page number, but not the knowledge itself.

i) Pacing

The teacher's recruiting of the textbook as a mechanism of knowledge control can be seen as she regulates how many examples may be done and how long pupils can take to do them:

> Now in your books, you put the date, the heading will be inequalities and...page 50 exercise 7 point 10...you do the first four for me. When you've done them you can bring your books to me...Now we're not going to take the whole period, hey, about 3 minutes..each, no that's too long, about 2 minutes, 10 past. By 10 past we must be done with 4, the first 4. Rule a line under the previous equation exercise (VT:I 273-278).

The teacher has assumed control over the setting out of pupil's classbooks, the examples chosen and the speed with which they must be done (selection, pacing). She has recruited the textbook to assist her, by repeating the reference (although no-one asked) and by referring to the printed examples. Framing is strong since the teacher (transmitter) has control over selections from the textbook, she also controls sequencing of examples and decides on an appropriate pace. The classification is also strong, however, and the teacher has made her selections from a text which is already a selection of content. Her power over what she teaches is limited by the institutional factors mentioned above: time-table, syllabus and so forth.

ii) Knowledge as uncontested.

The idea that knowledge is uncontested, is suggested by the organisation of the text and by the teacher's organisation of space. The pupils sit at their desks and although they sit close enough to communicate with one another, they do not face

one another and have to turn around should they want to speak to anyone other than their immediate neighbour. Although the two halves of the class face one another, the large space in between renders communication impossible without shouting. Thus, although a first impression of the class layout may be one of friendly interaction and sitting in a cluster with one's friends, communication is difficult and pupils remain in a 'cell' formation. They work alone except for comparing answers with their neighbour. This is mirrored in the organisation of the textbook, in that there is no opportunity for discussion. No scope is given to try a different example, to explore an idea or to interact with the examples in any way. There are no questions addressed to the pupils in the text, only examples that should be practised. The organisation of the textbook and the lesson thus both seem to support the notion that knowledge is uncontested and is a set of facts to be understood and mastered. Strong framing is once again evident, pupils (the acquirers) are given no opportunity to discuss or to take control in any way.

iii) Space

The teacher's use of space control is consistent with this organisation of knowledge as uncontested and not requiring negotiation. She maintains a large teacher space while teaching at the board and only enters the pupil-space to give a student her book, and take another book for herself. She invites the pupils to enter her space near the board when they have finished their work and she can evaluate it. Although she moves into the pupil space to ask a few questions and make suggestions, the usual course of the lesson is for pupils to bring their books to her to be marked. Her use of space is thus not oriented towards discussion.

iv) Self-validation

The teacher's use of the textbook as a means of self validation, can also be seen as a pedagogic control strategy and a construction of her own authority. The strategy she uses is to withhold knowledge, giving carefully selected portions, one at a time, until she finally reaches the target, which is the rule of the negative. She builds up to this point and concludes by reading the rule printed in the box on page 51. This validates her lesson, her strategy, her questions and at last the students are sure what it is that they have been building towards. Her questions are seen to be legitimate since there is an answer to them in the text. The teacher has thus used the text to establish her own authority and the authority of her knowledge.

Thus from a body of mathematical knowledge, a number of selections have been made. The author of the textbook has made a selection about what counts as school mathematics, the school mathematics department teachers have selected a book based on the criteria mentioned above and the teacher in the classroom makes a further selection, based on what the pupils "can cope with" and "depending on time" (IT:I 126-128). The degree of control the pupils possess over the selection of what they are to learn is thus very low. We notice that although the teacher assumes a large degree of control in the pedagogic relationship (strong framing), she is also constrained by factors such as the examinable syllabus (strong classification). There is a dialectic relationship regarding the positioning of the text, the teacher recruits the text as a resource and thus positions it, but she is at the same time positioned by it.

v) Selection and Omission.

Omissions from the text constitute a strengthening in framing. As the teacher selectively omits examples from the text she makes a selection within a selection and increases the degree of her control over the pedagogic relationship. This is illustrated by the teacher's omission of the theoretical introduction of the laws of inequalities quoted in the textbook. She stresses rather, the fact that there is really only one operating difference between equations and inequalities and that is the rule of the negative sign. She thus makes a further selection of content by stressing the procedural differences between equations and inequalities, relating them to one another but to no larger regulating principles of mathematics. That is, she does not make connections within the topic, she omits any mention of the Real Numbers (although she signals that she will be covering graphical representation on a number line in the following lesson). The textbook, on the other hand, shows the number line, distinguishing real and natural numbers (open dot, solid line and so forth). The teacher's procedural selection is pursued thus:

> How many values here? (x is) more than 6. How many values? More than one? Somebody said...who said more than one? There's not only one answer. Greater than 6, so we can have any number greater than 6. Greater than 6 and up to 10. What are the possible answers? (...) 7,8,9,10. Okay so there's more than one (VT:I 87-91).

She makes a content selection assuming that 'any number' refers to any natural number, omitting mention of the regulating principle that different number systems would yield different answers. She thus makes a procedural choice against the textbook's more discursive explanation. She controls the pacing by dividing the

given section into two parts, signalling that her target for the lesson is to let pupils "play around with inequalities" (VT:I 203; IT:I 79) and that she will leave number lines for another lesson. Pupils are instructed to ignore reference to real numbers, natural numbers and integers in the exercise, thus practising the procedure only. The words 'play around' are used three times during the course of the lesson, suggesting that she has not yet reached the 'real' mathematics. She does however, repeatedly signal her intention to explain the graphical representation later. She finds a time and content scheme that she feels is better suited to her needs than those in the textbook. When asked whether pupils did the enrichment exercises (IT:I 81-84), she answered that they did not. She added that time was a problem, the class was so big with 35 pupils, that it was difficult to get to everyone, but that perhaps sometime in the fourth quarter she would find time to give "the bright ones a chance."

The teacher has thus selected what she feels counts as legitimate knowledge and adapted it to suit what she perceives to be the realities of the class. She constructs ability as being able to do the enrichment exercises (which involve problem solving) in the same way as the textbook. Solving problems is seen to be the preserve of the 'bright ones' by the teacher, it is seen as 'enrichment' by the textbook. Knowledge and access to knowledge is strongly controlled.

vi) Sequencing

The teacher's sequencing of the lesson follows the textbook sequence in part, with the content omissions already mentioned. Both teacher and text introduce

inequalities by linking them procedurally with equations. The textbook includes an introduction involving the laws of inequalities, while the teacher leaves this out and introduces inequalities empirically by erasing an equals sign and replacing it with an inequality sign. Both teacher and text follow the same pattern of worked examples: a straight forward example followed by one involving a fraction, and ending with an example involving division by a negative. Pupils follow the exercise sequence exactly and end there. The text goes on to a conclusion linking inequalities with problem solving and real life examples.

The examples above demonstrate the strong framing evident in the classroom. The relations within the pedagogic relationship are strongly controlled. This is clearly seen in the high degree of control the teacher (transmitter) has over the selection, sequencing, pacing and criteria. The teacher recruits the text as a resource to select, sequence and pace examples. Although she makes her own selections and chooses her own pace, she has only selected within this given selection and has relied on the text significantly.

d) Verbal Interaction Control - the recruiting of language and expression.

This section describes strategies of control used by the teacher where her running contextual commentary, her mode of expression, her questioning, and her teaching style closely direct the events of the class. This section does not comment on the teacher's use of the textbook but comments on her use of language to redirect, rephrase, evaluate and so forth and shows how this is used as a control strategy.

This will link to the following section where I will argue that what appear to be simply teacher-directed exchanges are also often directed by the text.

i) Elicitation- feedback- response.

The teaching style adopted by the teacher is exposition from the blackboard, involving the eliciting of mostly one phrase answers from the pupils by a series of teacher-directed questions. In the first five minutes of the lesson seventeen instances can be identified where one-phrase responses were given by pupils; in the second five minutes, eighteen instances can be identified, and in the third five minutes, fourteen instances. These questions were addressed to the class as a whole and answered in chorus. Four instances can be identified in the lesson where a question was directed to a specific pupil which demanded an answer of approximately three sentences. The teacher directs the order of the lesson and uses strategies of repeating, rephrasing, giving clues, evaluating and correcting to achieve the sequencing and responses she clearly has in mind. We can identify some of these strategies in the following examples. The teacher is solving on the board the equation $5x+7 = 73-6x$:

> Okay, we want to solve for x. So what will be the procedure...anybody. (Response: put x's on the other side). Okay, this is x on the left hand side, numbers on the right hand side, so we're going to try and get it like that. So how am I going to get 6x on this side? (Response: change the sign). Okay you say I must change the sign of the 6x..bring it over to this side, becomes plus 6x. Okay, can anybody tell me why? (VT:I 17-22).

In this example, the teacher regulates the direction of the task (we want to solve for x). She then elicits part of the response she is working towards (put x on the other

side), she rephrases the pupil's response to include the words left-hand-side, which she then extends to include right-hand-side, and the idea of 'numbers' being different from x's. She then elicits another response. She has thus directed students towards her goal which she clearly reaches and evaluates a few moments later when she says with a note of finality in her voice:

> Right, correct. We must add the 6x there so that we can get rid of it on that side. What we do on the right hand side, we do on the left hand side (VT:I 31-32).

She then proceeds with a change of direction, so the pupils know that they have reached the conclusion of that exchange. This pedagogic style of directing responses through questions does not appear in the textbook, but there is a consistency in the demand made on the pupils. In each case, the pupil is directed towards a particular pre-arranged solution, using a particular pre-arranged method. Neither the eliciting of short responses nor the expository style of the textbook require the pupils to explain, justify, discuss or find their own method. In each case there is a set of given procedures to practice.

Later in the lesson we can see another example, where the teacher elicits, evaluates, rephrases and extends the pupil's response in order to direct the attention of the pupils in a pre-prepared sequence:

> Okay, what does this equals sign tell you in the linear equation? (Response: left-hand-side equals right-hand-side). That the left hand side equals the right hand side for a particular value of x and when we solve the equation we find in that case x must equal 6, then the left hand side will be equal to

> the right hand side. Okay? Now just remember that for the time being (VT:I 125-129).

The teacher evaluates the response as correct, but rephrases and elaborates to express a mathematically accurate argument. She then signals that she is still going to do something with that idea: "just remember that for the time being", and the pupils are not let into the game until the teacher judges that she should call upon that idea again. (She does this later when she explains the difference between an equals sign and an inequality sign.) The examples quoted above point to the strong control the teacher maintains in regard not only to the content, order and sequence of events in the lesson, but also the strong control over what the pupils are allowed to think about, how far ahead they are allowed to think and how much they are allowed to know in advance. In this way, she controls not only behaviour, but thought processes to a significant degree, also access to knowledge and type of knowledge. The teacher thus has "explicit control of topic through near monopoly of questions; direct controlling talk regarding pupil's right to speak" (Young 1984:235).

ii) Context-dependency.

The form and style of the lesson are context dependent in a way that the text is not:

> Can anyone tell me what the middle one is? (...) A more than sign, greater than, more than. Obviously this one's going to be smaller than or less than, okay. Sometimes we say it's wide here, so it's bigger than, it's narrow there so less than.. you can just remember the way you want to, you have your own ways of remembering that okay. Now I'm going to take this equation and put that there. Okay? the rest remains the same. We're still going to solve for x, so we're going to use exactly the same method or procedure, but instead of the equals sign we have a more than sign (VT:I 139-146).

In this example, the teacher depends on the context for the exposition to make sense - pupils can only know what 'the middle one' refers to if they can see the three signs she has drawn one below the other on the black board (equality sign, greater than, less than). "Put that there" only makes sense in the context of the strategy she is using. She erases all working and the equality sign from the equation on the board and replaces it with an inequality sign, thus drawing out the link between equations and inequalities. This link is seen to be procedural ("we're going to use exactly the same method or procedure") rather than discursive. Dowling associates context-dependence with public domain. The teacher has thus presented esoteric domain content from the textbook using localising strategies in a public domain setting. Dowling associates the context-dependent, non-discursive, polythetic practices of the classroom with the public domain (Dowling 1993:62). The teacher uses the textbook as a resource to help her select, order, organise and evaluate. She uses a style and form that, although matching the expository style of the text to some extent, also goes outside of the text to refer to public domain (for example, "did you show this work to your mother yesterday") and metaphorical domain (for example, "you have your own ways of remembering"). She is referring to metaphors commonly used to remember the direction of the inequality sign (for example the crocodile's mouth used in so many classrooms).

This context-dependent speech of the classroom, however, is related to the more context-independent expressions in the textbook and this relationship will now be described.

e) Control and textbooks - the 'recruiting' of the teacher.

Following from the previous section, this section describes how the language and mode of expression that were recruited by the teacher to direct the lesson, shift, and culminate in language and mode that in part take their direction from the textbook. This language shift will be described as one of the ways in which the textbook 'recruits' the teacher.

As has been mentioned before, the expository style of the textbook does not allow for discussion, questioning, refuting, generalising and so forth. It is largely esoteric domain text, with strongly classified form and content. The expository teaching style matches this, although the polythetic practices of the classroom weaken the classification of form and content and the message in the classroom is given largely through the public domain.

Language shifts.

The vocabulary and precision of statements in the text is largely lacking in the colloquial conversational style of the classroom. However one can identify precise statements made by the teacher in a number of instances, particularly at the conclusion of a verbal exchange. The pattern of teacher-pupil exchange relies on the teacher asking questions, eliciting a response, editing that response and then asking another question. After a number of such exchanges, the teacher judges that she has achieved the goal of the exchange and concludes with a positive evaluation (for example, "right, correct"). At this point on a number of occasions

her concluding statement is mathematically precise and regulated by the textbook. In two cases she uses identical wording, in one case she reads from the book. Consider the following example:

> So we're going to add a 6x here, so it'll be 5x+6x, 73 is on its right place, we want the 7 to go over, so we add there and get rid of it there.. add 7 on that side. Now we know what is happening, so we don't really have to show it, as long as you know what is happening, you can use a short cut and then just move it across (...) then x=6 , okay. What do we call this kind of example? (Response: equation) Okay, a linear equation and we have added the additive inverse.. the equals sign in a linear equation tells us that the left-hand-side equals the right-hand-side for a particular value of x (VT:I 95-102).

This example demonstrates a shift in language between the context-dependent, conversational teaching style ("73 is on its right place, we want the 7 to go over") to an evaluation ("okay"), then to a more precise conclusion using correct terms ("the equals sign in a linear equation tells us that the left-hand-side equals the right-hand-side for a particular value of x"). The concluding statement is always true, it is not dependent on the particular example of the blackboard for its validity. It is thus context-independent, and uses the vocabulary of the textbook.

Another occasion where we see this shift from colloquial conversational language to more precise language possibly regulated by the textbook comes later in the lesson where the teacher says:

> Okay so if I divide by -3 on both sides the rule is that that sign must change direction. When you are multiplying or dividing by a negative the inequality sign changes direction (VT:I 227-229).

She concludes the rule by directing her own and the pupils attention to the textbook and reads directly from the text (TB:l 44-46) (VT:l 231-234). Her teaching is clearly directly supported by the text at this point. She makes use of it firstly as a way of legitimating herself and secondly as a demonstration to the pupils that this is where the authority is located. The point of everything that went before is thus legitimated and the pupils know they have reached the goal. The language has shifted at the conclusion of an idea or concept. The teacher uses vocabulary that is non-specialised, context-dependent and restricted most of the time, but in these concluding sentences we see her use more specialised terms, context-independent statements and greater precision. However, the conclusions remain procedurally-based and neither teacher nor textbook give a discursively-elaborated argument. Rules are stated without further exposition and thus do not go beyond procedure.

f) Matches and Disruptions - the role of the textbook.

In this section I will describe strategies used in the text and by the teacher, where one can identify matching methods or mismatches and disruptions. I will examine ways in which the teacher is positioned by the text and how some of her ideas are disrupted as she attempts in turn to position the text. I will also describe apparent imitation of strategies. Bernstein (1993) comments that the "text itself under certain conditions can change the interactional practice" (pg.129). Bernstein is referring to a broader idea of text than textbook: "(t)he definition of a text is anything which attracts evaluation, and this can be no more than a slight movement" (pg.129).

However this comment applies to the textbook as well and refers to a change in the classification and framing values. The text can be said to challenge the interactional practice and the classification and framing values upon which it is based (pg.129).

i) Strategy

The first example I would like to discuss does not challenge interactional practice, rather, a matching strategy can be identified where the text feeds back to the interactional practice. This strategy used by the textbook and the teacher in two different contexts supports the idea that the teacher either imitates or is authorised by the text to use certain strategies. In this way she is 'recruited' or positioned by the text. Consider the following example from the textbook:

> 1. For all real numbers a, b, and c, if a>b, and b>c, then a>c. This law states that if 5>3, and 3>1, then 5>1 (TB:I 4-6).

This statement in the textbook uses a strategy where one example is used to demonstrate a law pertaining to all the real numbers. While this may be pedagogically helpful to pupils attempting to understand the law, it is mathematically inaccurate to say "this law states that..etc". As mentioned earlier, it would be more accurate to say that 'this law is demonstrated by the following example'. This strategy of using one example to describe a rule which is more generally applicable is used by the teacher in the following way. She is trying to explain why the inequality sign changes direction when dividing by a negative:

> Now that is sometimes difficult to understand but maybe if we take an example like this..say -2 greater than -6, okay and we leave out the x. Is -2 greater than -6? (Response: No...yes). Is -2 greater than -6? (Response: Yes) Okay? Yes. Now divide by -2. Then what am I going to get here? (Response: one). One.. Three.. is one greater than three? No, so for some reason like that if we divide by a negative that happens. So that will be x greater than -3. Okay? For some reason like this, that is the rule in inequalities that you must apply when you divide or multiply by a negative VT:I 231-238).

The teacher has also used one example to cover a rule that is applicable to all real numbers. She does mention that she is choosing an example, but moves directly from the example to the rule without discussing any generalising strategies. Thus we see a match between teacher strategy and textual strategy in that both omit to mention that a rule cannot be based upon one example, that generalising strategies must be employed. This is pedagogically important as the common pupil error of 'proving a statement using an example' can find its roots in such strategies. Both teacher and textbook have used localising, procedural strategies in this instance.

ii) Prints and misprints

While pupils' textbooks are shut, the teacher as source of information is able to direct the lesson and regulate what the pupils are allowed to know. However, as soon as the pupils have access to another source, in this case the textbook, the potential for disruption arises. We see two examples of occasions where disruption of the teacher's plan occurs:

> I just want you to be careful when you make the greater than sign, try to keep it like that, more or less like on the board.. instead of.. oh I see, you are doing it the way it is in the textbook, okay then it's fine (VT:I 502-504).

The teacher uses an 'angled' inequality sign on the board (⩾) while the textbook prints it horizontally (≥). The teacher clearly demonstrates to the pupils that the textbook can be used as a source of authority. She does not go against the authority of the text, nor does she relinquish her own authority - pupils are given the 'message' that there are two sources of information. In this case they could choose their own course of action.

The teacher, however, shortly afterwards asserts her own authority by saying that there is a misprint in the text and pupils should find the correction already written in. On discovering that only three books had been corrected, she suggests that pupils attempt both possible examples. The given example reads: (3x-1)/4 + (3x-3)/8⩾ 19/8. The corrected example reads: (3x-1)/4 + (3x-6)/8⩾19/8. It was discovered that the answer to the given example was a fraction, but that there was no other difficulty. One could speculate that the teacher who changed the figure in the first place found a sequence that did not suit her (fractions too early). However, the class in question could clearly deal with the fractions. The teacher's use of the text thus caused a disruption in her control.

iii) Sequencing.

Another instance of disruption of the teacher's plan can be seen where she planned to leave graphical representation and discussion of number systems for the next lesson. Having mentioned four times that this was her plan, pupils still asked what they should do with them and what they meant:

> What's it.. what? I said x is an element of the natural numbers,.. leave that so long for number lines. Just focus on the inequalities and plan to find the value of x. If you are stuck then put up your hand (VT:I 301-303).

There were two more instances of hands going up to ask about the same point. There was thus a disruption in the teacher's control of the lesson, there was also a disruption of the timing and sequencing that the teacher wanted. She felt (IT:I 121-126) that the pupils would run out of time and not manage to understand number systems on the same day as learning inequalities. She felt the sequencing was too difficult. She 'judged' the ability of her class and regulated the text accordingly, but because she had given her approval to the text as a second source, the pupils kept asking when she changed the way it was done in the text. In this way, her use of the textbook as resource, became a disruption to her own plan, and regulated her responses.

iv) Blackboard.

The textbook is also mirrored in the teacher's use of the blackboard to some extent. We have just discussed an example of a case where the teacher used a different notation from the textbook and seen how it caused a disruption in the teacher's plan. She also departs from the text in that she does not use an 'implication' sign $\Leftrightarrow$ on the board as she solves the equation and inequalities. The pupils did not notice this difference and no comments were made. However, her use of the blackboard in other instances matches the text. She uses a layout consistent with the text, for example, she also draws a 'box' around the answer to emphasize importance. In the textbook a box is used for emphasis of a rule. The pupils whose books I looked

at, imitated her method and layout in their classbooks, they also imitated her 'conversational thinking' on the board as they completed the exercise. The microphone left lying on a desk for a while picked up pupils' murmered thinking eg. " it must be 93, no that's too big, take that across, its negative, divide by 3.. " (VT:I 425). This was the same type of thinking aloud that the teacher had been involved in on the blackboard. The fact that no pupil was invited to write on the board and no trial-and-error or rough working was seen on the board, is consistent with the lack of examples in the text which involve pupils constructing their own methods or experimenting with their own ideas. The authority of the transmitter is thus strongly maintained and the pupils remain explicitly in the subordinate position. Knowledge is once again presented as uncontested.

v) Domestic space

Textbook use also controls what mathematics is done at home. The teacher remarked that the pupils are "used to getting up to twenty or even more examples to do at home" (IT:I 152). They are given exercises from the text that are selected, ordered and sequenced by the teacher, they have examples to refer to in the text if they get stuck, so can model their working on the textbook. In this way the domestic space and the methods used when the pupils are alone, are also regulated by the text. The freedom to explore mathematics, argue and construct new ideas is, in this instance, regulated out by both the teacher and the text.

These examples demonstrate that the teacher is also positioned by the text. Her strategies are in some instances modelled on the text, in others, her lesson plan is

disrupted when she uses the text. In each case, the control is not entirely hers, she is in some way 'recruited' and 'organised' by the text.

5.4 Concluding remarks.

In the data analysis above I have attempted to uncover regulating strategies, in the areas of content selection, content control and content expression. I have described how the teacher recruits the text as object of classroom control and as a resource for the control of what counts as mathematical knowledge. I have described verbal exchanges between teacher and pupil and shown how the teacher controls these. I have shown also how the teacher is 'recruited' by the text, how she makes selections within selections, and how her language shifts from context-dependent elaboration associated with procedure, to context-independent elaboration associated with discourse. This more discursive language is based on the language of the text. I have shown also how in some cases the teacher's strategies mirror the strategies evident in the text and in others how her use of the text disrupts her strategy. I have thus pointed to a dialectical relationship where the teacher both positions, and is positioned by, school mathematics, represented in this case by the textbook. This dialectical relationship is clearly evident in the classroom under discussion where both classification and framing are strong. The pupil's power over what, when and how he/she receives knowledge is reduced (strong framing) while the teacher's power over what she transmits is reduced (strong classification). This results in the teacher having strong control over selection, sequencing and pacing within the pedagogic relationship, but little control

over the syllabus and curriculum. She thus controls and is controlled by, she recruits and is recruited by school mathematics, the textbook is used as a resource.

The concluding chapter will discuss some of the limitations in transformative potential of the textbook. In the light of this data, I will suggest that some ideas mentioned earlier pertaining to textbooks are problematic. I will argue that the textbook as a resource is limited, the teacher and the textbook are both positioned by school mathematics and both are limited by institutional and social factors.

CHAPTER 6. CONCLUSION.

In concluding this paper, I will briefly summarise the issues raised by this research and attempt to draw the themes and questions together into some coherent whole. This will include a discussion of the constraints on the possible transformative role of the textbook and the implications this may have in the development of new curriculum materials. I will argue that the teacher both recruits and is recruited by the text, each being recruited by school mathematics. Both teacher and text are constrained by the education system and for new curriculum materials to be effective, broader educational change is necessary. I will briefly signal Bernstein's remarks on educational change effected at the level of classification and framing.

This research set out to describe how the textbook was used as a resource in the classroom. Attempts were made to uncover control strategies, used by the teacher and implicit in the text. The textbook chosen was traditional rather than innovative and did not claim to be transformative. This book was considered suitable for uncovering existing classroom practices that could affect the way new materials might be used. A literature search around this topic led to readings in the areas of content selection (choices and omissions), content control (sequencing, pacing and authority) and content expression (verbal and textual modes). Bernstein's theory of classification and framing, and Dowling's work on discourse and procedure were found to resonate with these themes and were chosen as tools to analyse the data collected from the classroom.

The strategies discussed in the data analysis included the textbook as object of classroom control, knowledge control and what counts as legitimate knowledge, language interactions as strategy of control and the 'control' of the teacher implicit in the text. The hypothesis was put forward that the teacher both positions and is positioned by, the text. Each in turn is positioned by school mathematics, and this positioning shifts according to the strength of the classification and framing. Implications of this hypothesis are that the textbook is sometimes given far too great a degree of agency in curing educational ills, and is credited with achievements beyond its power.

Consider for example, the statement mentioned earlier which was put forward by the Curriculum Materials Research Group of NEPI: teacher productivity is enhanced by the textbook "since in large classes textbooks free the teacher to do a variety of education-related and non-related tasks" (Greybe and Woolley 1992:2). In the light of the data described above, this statement fails to take into account the fact that the teacher may be positioned or even directed by the text, rather than freed by it. The 'authority' of the textbook and the dependency of teachers on the text is under-estimated, as is the high degree of classification of content in school mathematics. This high classification results in a lack of teacher freedom. Luke et al (1989) support this notion and describe this lack of freedom in terms of the reader's prior knowledge, the institutional setting and the distinctive features of the textbook. They describe the relationship in the classroom as "delimited and constrained by the rules of schooling which position teacher, text and student in hierarchical levels of power and authority" (pg.258).

Fuller and Snyder's study in Botswana, also cited in the NEPI working papers (Greybe and Woolley 1992), concluded that the textbook's presence tended to make the classroom less teacher-centred and allowed more learner participation, even if it was only reciting chorally. Besides the enormous pedagogic problems present here, one could argue that learner participation is by no means increased. Rather, extremely strong framing is evident where the teacher, using the textbook as resource, has complete control over every aspect of selection, sequencing and pacing in the pedagogic relationship. Pupils have no control and even have to speak in time with one another. The textbook in itself thus cannot be said to make the classroom less teacher-centred.

Another statement made by the Curriculum Materials Research Group fails to take into account the impact of varying strengths of classification and framing on the 'functioning' of the textbook. They state that "(t)extbook content has offered one way of introducing students everywhere in the nation to common socialising experiences, thus giving textbooks a vital integrative function" (1992:3). The present research analysed data from a classroom where strong framing was evident. In this instance, the teacher made selections from the text and altered sequence and pace according to her perception of the needs of the class. She made an 'access to knowledge' selection by leaving out the enrichment exercises. One could argue that in a classroom where framing was weaker, the pupils would have been more actively involved in setting the pace and so forth, but in each case, criteria were chosen to make decisions about what to teach/learn, how fast to

proceed and what method to use. These criteria were not found in the text, but were dependent on social context. Another teacher, for example, may have stressed the enrichment and problem solving as the most important part of the lesson.

The point being made is that the textbook is not necessarily a resource that gives everyone "common socialising experiences", nor does it necessarily have a "vital integrative function". The way it is recruited, the way the teacher and pupils are positioned socially, what is perceived to be important valid knowledge, and the strength of classification and framing all impact on these socialising experiences. Anyon's (1981) research, quoted earlier, would support this idea. She shows how the same curriculum is interpreted and implemented very differently in schools from different social classes and concludes that curriculum is very different from curriculum-in-use. Bernstein comments that as classification and framing vary, there are changes in organisational practice, in transmission practices, in the concepts of the teacher and pupil, and changes in the concepts of knowledge itself. (Bernstein 1993:126).

The question arises then, if the textbook cannot be given so much status as agent of educational change, how and where does this change take place? Bernstein argues that change can come at the level of framing. He argues that classification and framing provide the rules of the pedagogic code. As they change from strong to weak so practices change (organisational, transmission and so forth). Thus the potential for change is found at this level:

> Although framing carries the message to be reproduced, there is always pressure to weaken that framing. There is very rarely a pedagogic practice where there is no pressure to weaken the framing, because in this formulation, pedagogic discourse and pedagogic practice construct always an arena, a struggle over the nature of symbolic control. And at some point, the weakening of the framing is going to violate the classification. So change can come at the level of framing. (Bernstein 1993:126).

If one accepts that change can occur at the level of framing, that is, within the pedagogic relationship in the classroom, there are great implications for curriculum designers and particularly teacher educators. This idea lends support to school-based reform and emphasises the crucial role of the teacher. The textbook then is a secondary resource and is only as important as its application. In practice, however, the strength of classification of school mathematics, that is, the content of the syllabus, results in even the least text-bound teacher referring to and deferring to the textbook. The pupils must after all pass their examinations and the school textbook is seen as representing the syllabus. Thus without changes in the strength of classification (which implies changes at the level of policy), the changes occurring at the level of framing remain limited.

The textbook then is a resource extensively used by teachers, and Olson's statement that classroom discourse is "about the text, based on the text, or directed by it" (1989:250) is supported by this study. However, the 'about', 'based on' or 'directed by' are of crucial importance. The mediation by the teacher and the meta-language with which s/he keeps a commentary running alongside the lesson significantly influence the access to knowledge, the expectations, and the social

positioning of the pupils. The teacher is constrained by the social context, the institutional context and the political context. She thus recruits the textbook as a resource, but she is in turn 'recruited' by the textbook and both are recruited by school mathematics. Implications for curriculum designers are that the text cannot be seen as the solution to educational problems, the textbook is "always the object of teacher mediation" (Luke et al 1989:250). It is used and changed significantly according to the beliefs and expertise of the teacher. These beliefs and competencies of the teacher manifest themselves in teaching practice and result in limitations regarding what credit/blame can be assigned to the textbook. As mentioned earlier, Apple supports this idea when he says:

> We cannot assume that what is "in" the text is actually taught. Nor can we assume that what is taught is actually learned. Teachers have a long history of mediating and transforming text material when they employ it in classrooms (Apple 1991:14).

To sum up briefly then, the textbook as instructional tool is constrained by many forms of regulation surrounding its use. As mentioned before, the teacher fulfils both an instructional and a regulative role, the instructional role being embedded in the regulative. The textbook is used as a resource by the teacher and thus participates in both the regulative and instructional discourses. The teacher positions and is positioned by the textbook, and, dominating this, is the strong classification of the context of school mathematics and the strength of the regulative discourse in the classroom. The transformative role of the textbook, then, should be seen in the light of the limitations and constraints on the possibilities available to the teacher within the context of school mathematics.

BIBLIOGRAPHY.

Allen, G. and Skinner, C. (1991) Handbook for Research Students in the Social Sciences London: Falmer.

Anyon, J. (1981) Social Class and School Knowledge Curriculum Inquiry 11:2 3-42.

Anyon, J. (1981a) Ideology and United States History Textbooks, in Dale, R. (ed.) Education and State Volume 2: politics, patriarchy and practice Lewes: Falmer.

Apple, M. (1986) Teachers and Texts: a political economy of class and gender relations in education New York: Routledge.

Apple, M.W., Christian-Smith, L.K. (1991) The Politics of the Textbook Routledge: New York.

Baker, C.D., Freebody, P. (1989) Talk around the Text: Constructions of Textual and Teacher Authority in Classroom Discourse In: Castell, S.de, Luke, A.L. & Luke, C. (eds), Language, Authority, and Criticism: readings on the school textbook London:Falmer.

Ball, D. and Feiman-Nemser, S. (1988) Using Textbooks and Teachers' Guides: a Dilemma for Beginning Teachers and Teacher Educators Curriculum Inquiry 18:4 401-423.

Bell, J. (1987) Doing Your Research Project Milton Keynes: Open University Press.

Bernstein, B. (1973) A Brief Account of the Theory of Codes, In: Lee, V. (ed) Social Relationships and Language. Some aspects of the work of Basil Bernstein Milton Keynes: Open University Press.

Bernstein, B. (1975) Class, Codes and Control Vol.3 London: Routledge and Kegan Paul.

Bryman, A. (1993) Quantity and Quality in Social Research London:Routledge.

Bryman, A. and Burgess, G. (1994) Analysing Qualitative Data London: Routledge.

Cazden, C.B. (1989) Texts and Contexts: A Response, In: Castell, S.de, Luke, A.L. & Luke, C. (eds), Language, Authority and Criticism: readings on the school textbook London: Falmer.

Cobb, P. (1987) An investigation of Young Children's Academic Arithmetic Contexts Educational Studies in Mathematics 18 109-124.

Cobb, P., Wood, T., Yackel, E. (1991) Analogies from the Philosophy and Sociology of Science for Understanding Classroom Life Science Education 75:1 23-44.

Dowling, P. (1993) A Language for the Sociological Description of Pedagogic Texts with Particular Reference to the Secondary School Mathematics Scheme SMP 11-16. Unpublished Phd Thesis, Institute of Education, University of London.

Dowling, P. (1995) Discipline and Mathematise: the myth of relevance in education Perspectives in Education (in press).

Dreyer, J.J., Dreyer, B. (1985) New Modern Mathematics 8 Juta: Cape Town.

Elbaz, F. (1991) Teachers' Curricular Knowledge in Fourth Grade: The Interation of Teachers, Children and Texts Curriculum Inquiry 21:3 299-320.

Freeman, D.J. et al (1983) Do Textbooks and Texts Define a National curriculum in Elementary School Mathematics? The Elementary School Journal 83:5 501-513.

Freeman, D.J. and Porter, A.C. (1989) Do Textbooks Dictate the Content of Mathematics Instruction in Elementary Schools? American Educational Research Journal 26: 3 403-421.

Freeman, D.J. et al (1983) The Influence of Different Styles of Textbook Use on Instructional Validity of Standardised Tests Journal of Educational Measurement 20: 3 259-270.

Goodson, I.F. (1988) The Making of Curriculum: Collected Essays London:Falmer.

Gordon, D. (1988) Education as Text: The Varieties of Educational Hiddenness Curriculum Inquiry 18:4 425-449.

Greybe, S. and Woolley, L. (1992) Analysis of text provision policy options: Focus on text provision models. Curriculum Materials Research Group NEPI unpublished working papers Curriculum Part 2 :19 June Draft.

Heap, J.L. (1985) Discourse in the Production of Classroom Knowledge: Reading Lessons Curriculum Inquiry 15:3 245-279.

Hitchcock, G., Hughes, D., (1989) Research and the Teacher London:Routledge.

Kim, H. (1993), A Comparative Study Between an American and a Korean Textbook Series School Science and Mathematics 93:3 123-126.

Luke, C., de Castell, S. and Luke, L. (1989) Beyond Criticism: The Authority of the School Textbook, In: Castell, S.de, Luke, A.L. & Luke, C. (eds), Language, Authority and Criticism: readings on the school textbook London: Falmer.

McBride, M. (1989) A Foucauldian Analysis of Mathematical Discourse For the Learning of Mathematics 9:1 40-46.

NEPI (1993) The National Education Policy Investigation. The Framework Report and Final Report Summaries. Cape Town: Oxford University Press.

NEPI (1992) Unpublished Report of the Curriculum Models Group Draft, June. In: Curriculum working papers Part 2:19.

Northam, J. (1982) Girls and Boys in Primary Maths Books, Education 3-13, 10:1 11-14.

Olson, D.R. (1989) On the Language and Authority of Textbooks In: Castell, S.de, Luke, A.L. & Luke, C. (eds), Language, Authority and Criticism: readings on the school textbook London:Falmer.

Potter, J.& Wetherell, M. (1990) Discourse and Social Psychology Newberry Park: Sage.

Shipman, M. (1973) The Limitations of Social Research London and New York: Longman.

Silverman, D. (1993) Interpreting Qualitative Data. Methods for Analysing Talk, Text and Interaction London:Sage.

Stubbs, M., Robinson, B.,Twite,S. (eds) (1979) Observing Classroom Language Milton Keynes: Open University Press.

Wolcott, H.F. (1994) Transforming qualitative data Calif:Sage.

Young, R.E. (1984) Teaching equals Indoctrination: the dominant Epistemic Practices of our Schools. British Journal of Educational Studies 32:3 220-237.