65

GENDER DIFFERENCES IN MATHEMATICS:

A DISCOURSE ANALYSIS

by

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Submitted in partial fulfillment of the requirements for the degree of Master of Education (Psychology) in the Faculty of Education at the University of Cape Town.

September 1993

ABSTRACT

The majority of perspectives from which the study of gender and mathematics has been approached have failed to move beyond the individual/society divide. The contradictory nature of subjectivity and the operation and interpenetration of power and knowledge in the production of that subjectivity has not been taken into account. This thesis is based on the theoretical framework of post-structuralism. The literature concerning gender differences in mathematics is criticized from this framework. In particular, the work of Walkerdine and her colleagues, which highlights the processes within the classroom which allow girls to succeed in mathematics but never actually be successful, is of interest. The methodology of choice in this study is that of discourse analysis which makes clear both the positionings available to the participants as well as the power relations formed. The sample was drawn from a top-achieving Std 8 Higher Grade class in an affluent Model C school. This sample represents a theoretically salient sample as the literature points to the `differences' being most pronounced in the upper levels of mathematics education. The analysis clearly highlights the double-bind within which girls find themselves in the mathematics classroom. The apparent equality of opportunity and non-sexism is counteracted by the positioning of girls as hard-working but without natural flair in mathematics. The characteristics that make it possible to achieve in mathematics are ascribed to males. The resistance to this powerful `disciplinary technology' is the invoking of the feminist discourse, which was done by some of the females in the study. It appears that there are very real barriers to girls' participation and achievement in mathematics. These barriers lie within the power relations and discourses/knowledges surrounding gender issues and mathematics education.

CONTENTS

ACKNOWLEDGEMENTS

I wish to express my gratitude to a number of people who contributed to the successful completion of this thesis:

* The nameless subjects who participated willingly and discussed issues in an open and honest fashion;

* A nameless mathematics teacher and a nameless principal of a nameless school who helped me to set up the project in the school;

* The Cape Education Department for granting me permission to carry out the study in one of their schools;

* Professor David Donald, my supervisor, as well as Associate Professor Ann Levett and Associate Professor Chris Breen, who acted as consultants; their incisive comments were invaluable;

* Ken Roper for sharing ideas and articles;

* John Reynolds, my husband, for fulfilling the tedious task of proof-reader, and for his support and encouragement.

* The Human Sciences Research Council (HSRC) for financial support during my studies; the opinions expressed in this thesis do not necessarily reflect those of the HSRC.

LIST OF FIGURES

INTRODUCTION

Much has been written about gender differences (or the lack thereof) in Mathematics. A variety of sociological and psychological theories have been called upon to account for the apparent differences (or lack thereof), and the debate still rages. However, with the exception of the work of Walkerdine and her colleagues, it is a debate which has locked itself into traditional dualisms such as individual/society, same/different, objective/subjective, and taken–for–granted notions such as the timelessness and universality of the mathematical discourse. In this thesis I shall attempt to move beyond these restrictions by
taking ideological structures and power/knowledge relations into account. The theoretical framework that I shall use for this purpose is that of post–structuralism. Post–structuralism steps outside mainstream psychological and educational theorizing, thus allowing for a different set of questions to be asked, and a for different set of conclusions to be drawn. It is through the glasses of the post–structuralist framework that I shall review previous work and propose the methodology for the research.

The aim of the study is to interpret themes (discourses) emerging in the written and spoken language of a group of high school students concerning gender differences in mathematics. The methodology used was that of discourse analysis. In this context, I use the word discourse in the post–structuralist sense, to mean any regulated system of statements. Put in another way, discourse is the `institutionalised' use (at a disciplinary, political, cultural or small group level) of language and language–like sign systems (Davies & Harré, 1990). Various discourses may compete with each other to create disparate and incompatible versions of reality. These competing discourses ensure that the process by which meaning is achieved is dynamic, progressive, multi–faceted, and contradictory.

The people who participated in the research belong to a top-achieving Higher Grade Std 8 class at an affluent Model C school. This sample was chosen on the basis of the literature which suggests that the apparent differences in mathematics appear in the upper levels of achievement. Thus we have what is called a theoretically salient sample. Within this school there are no apparent obstacles to females' participation and achievement in mathematics. All are given equal access to the courses offered (discrimination is on the basis of marks achieved in previous examinations), and there is a philosophy of equal opportunity in terms of education and future prospects. The questions which can be posed, when viewing this sample, are: In what discourses do the girls and boys of this class position themselves, and find themselves positioned (consciously and unconsciously)? What are the power relations that are operative within this classroom and what function do the discourses identified serve in maintaining those power relations? What are the girls' and boys' experiences concerning the discourses surrounding mathematics and mathematics education, in particular the notion of `non-sexism' or `equal opportunity'?

In chapter 1 of this thesis I give a brief review of the theory and principles of post-structuralism. This is intended to serve as a backdrop for the other chapters, in which traditional research is criticized, and the rationale for the use of discourse analysis is explained. In chapter 2 I review the literature concerning gender differences in Mathematics, discussing the biological, sociological and post-structuralist approaches. The nature of mathematics as a discourse in and of itself is also discussed. Chapter 3 concerns methodology. The rationale and process of discourse analysis are discussed, as well as how this particular research fits in with the principles of feminist methodology. Chapter 4 is the `results' chapter. The data is analysed and discussed under six broad headings. Following the procedure of discourse analysis, the data is presented in a narrative form. Interpretations of the data together with salient examples are presented. No pretense is made at discovering an objective and absolute interpretation of the data. Instead it is recognised within the post-structuralist paradigm (as well as within the principles of feminist research) that the researcher is very much part of the process - `the knower is part of the matrix of what is known' (Wilkinson, 1986, p. 13). The discourses within which I am positioned (as a woman, a white South African, ex-mathematics teacher, student, educational psychology intern to name but a few) are part and parcel of the entire endeavour.

CHAPTER 1

THE POST-STRUCTURALIST THEORETICAL FRAMEWORK

The post-structuralist framework has been taken up by various people working in the psychological and social science field (see, for example, the work of Davies & Harré, 1990; Henriques, Hollway, Urwin, Venn & Walkerdine, 1984; Levett, 1989a on child sexual abuse; Hollway, 1989 on gender relations; Walkerdine, 1988, 1989 on mathematics and education; Young, 1980 on stress). A major critique this framework levels at mainstream psychological theorizing is the individual-society divide within which psychology is beleaguered. The individual is treated as unified and rational, society and its effects as monolithic and historically isolated. The individual is inevitably reduced to some essentialist notion such as biology, personality or the mind, once the opposite - society or the context - has been used to explain the rest. The proposal of a `complex interaction' leaves the dualism in place, e.g. socialization theory, in which society somehow `gets inside' the individual.

Using the foundations laid by others (especially Foucault, Lacan and Derrida), post-structuralist writers stress the social and historical production of subjectivity and of knowledge (psychological knowledge included) through discursive and signifying practices. Authors develop their material along Lacanian, Foucaultian or Derridan lines according to the usefulness of the particular strand of theorizing for their purposes. In this thesis I shall use a Foucaultian approach mostly as it seems to be the most incisive of the post-structural accounts when trying to understand educative matters (see later discussion). However, the various strands of post-structuralism hang together and all of them need to be discussed here.

Language is of pivotal importance in post-structuralist theorizing. Post-structuralism is essentially post-Saussurean. Saussure's equation (see Hollway, 1989)

$$\text{SIGN} = \frac{\text{signifier}}{\text{signified}} = \frac{\text{sound or written image}}{\text{meaning}}$$

rejects the idea that words gain their meaning through being direct representations of things. His theorizing of language goes beyond a simple word/object association, allowing for shifts and slippages in the relationship between signifier (e.g. tree) and signified (🌳). The signified world may thus be divided up and labelled in various ways by the signifier. In other words, different discourses give meanings to things in different ways. The structuralist linguists (such as Saussure) have been criticized, however, for their theorization of language as a pre-given, fixed structure, prior to its realization in speech or writing.

Social constructionist writers (Armon-Jones, 1985; Berger & Luckman, 1966; Gergen, 1985a, 1985b; Gergen & Davis, 1985; Itzin, 1986; Shotter, 1989) go beyond this by demonstrating the role of language in the maintenance, modification and construction of shared meaning. In this they have much in common with post-structuralist theorists. There is a shift away from seeing language in terms of underlying structure and rules, to viewing it as a social achievement through which meanings are attained. These meanings take on the aspect of common-sense or unquestioned `reality', and get taken up in scientific and everyday discourse. In social constructionism `[T]he challenge .. has been to transcend the traditional subject-object dualism' (Gergen, 1985a, p. 10). Where post-structuralists depart from social constructionists is in their attempt to account for the social and historical reproduction of meaning. They stress the importance of the content of language as well as the ideological processes involved in the generation of knowledge and shared meaning through language and sign systems.

Derrida (see Sampson, 1989) takes a deconstructive approach to language. He uses the device of sous rature (under erasure) in which a term is written, written again and crossed out: A and ~~A~~. This emphasises the simultaneous necessity and inadequacy of the term. Derrida attempts to discover the opposite within the meaning of a single term. In other words A is simultaneously A and not-A. Meaning thus is a function of presence (that which is written or spoken) and absence (the chain of suppressed signifiers upon which the meaning of the present is based). The present is always already inhabited by the absent, and hence it is `mediated and derivative' (Sampson, 1989, p. 9). Language, in other words, is inherently unstable, but creates the illusion of being stable by producing binary oppositions which define each other (Mumby & Stohl, 1991). The stability depends on privileging the present term,

while marginalizing the absent one(s). Derrida's concept of `differance' underlies the deconstructive process. `Differance' stands for two other words: difference and deferral. `Difference' refers to the notion that all language exists as a system of differences, rather than as something essential or of intrinsic significance. `Deferral' describes the time lag or distance between the presence and the absence – `whatever is consciously perceived (the presence) may only be read in the past' (Sampson, 1989, p. 11). Thus in whatever we perceive as the present is always already absent, different and deferred. This implies that the present and absent terms define, and interpenetrate each other ie we do not have a case of either/or but rather both/and. This links up with the Freudian view of consciousness which is always already inhabited by the unconscious. Derrida's process of deconstruction thus turns oppositions into supplements, highlighting the absent, undermining the stability of the text and allowing for alternative readings. Derrida's theory has implications in terms of subjectivity: because presence is always mediated by the absent trace, `self–consciousness is not a direct and unmediated experience but rather is an indirect and always already mediated experience' (Sampson, 1989, p 13); the subject is `open–ended and indeterminate except as fixed in place by the culturally constituted order' (Sampson, 1989, p. 14). The notion of deferral means that the grounds of deconstruction are `necessarily historically contingent' (Michael, 1990, p 173), a point which links Derrida's work with that of Foucault.

Foucault's genealogies and his discussion of the power/knowledge axis (see, for example, Foucault, 1965, 1979, 1980) are of great importance in the `ideological' side of post–structuralist theorizing. However, before turning to this, it is important to elaborate on the meaning of the word `discourse'. Young (1987) provides the clearest review in this respect. A discourse, according to Young, is a field of statements, while discursive practices are the rules and institutional arrangements through which discourse statements are produced and communicated. Discourse has a dual character in that it is the mode through which the world of `reality' emerges, but at the same time it restricts what can be known, said or experienced at any particular socio–historical moment. It is this duality `through which action and understanding are simultaneously enabled and constrained, that links knowledge to power.' (Young, 1987, p. 114). Sometimes objects are situated in more than one discourse, in which case its form is `overdetermined' (Young, 1987, p. 113) An example of this could be the multiple positions in which a person could find herself in the classroom situation, for example as girl, pupil, daughter, sub–teacher, friend.

Foucault's genealogies delineate the historical and social circumstances or contingencies tied to the workings of power and knowledge. He traces the historical production of knowledge and, through this knowledge, of the individual's subjectivity. He demonstrates the linkages between power, knowledge and the subjectivities of subjugated people (he writes for example about knowledge/power attached to psychiatry, penal institutions and sexuality). Foucault compares the type of state control which emphasized public punishment and physical torture for `wrong-doing' with the present control techniques in which individual rights are suspended. This shift, he asserts, reveals a new type of power at work. The power utilized in present-day institutions, such as the prison, the school, the army or the work-place, is that of `disciplinary technology', which has as its aim the regulation and normalization of subjects (Parker, 1989; 1990; Parker & Shotter, 1990: Paternek, 1987). Although the individual ostensibly has more formal rights than previously, there is less room for deviance and disorder. The process is one which Foucault calls panopticism. Bentham proposed the Panopticon, a model prison in which the prisoners could be put under constant surveillance (a strategically placed light and tower would allow a warder to watch the prisoners without their being aware of his doing so). Foucault likens this to the practice in which people have become the objects of the `scientific' gaze. Measurement and observation have produced a `knowledge' needed to classify each subject in some hierarchical organisation. (Mostly there are many, overlapping and sometimes competing hierarchies into which the subject may be classified - this, however, is not generally recognised, as subjectivity is presented as unitary). Importantly, panopticism also extends to self-reflection or self-consciousness:

> `There is no need for arms, physical violence, material constraints. Just a gaze. An inspecting gaze, a gaze which each individual under its weight will end up interiorising to the point that he is his own overseer, each individual thus exercising surveillance over, and against himself' (Foucault, 1980, p. 155).

Foucault emphasizes that discourse links knowledge and power, and as such, power is not merely repressive, but actually <u>productive</u> of subjectivity (Parker, 1990). Thus, by defining the `nature of the child' or the `nature of girls', certain behaviours are produced and regulated as the subject invests in the premises of the discourse. Disciplinary power is `masked' (Parker, 1989, p. 62), however, by the modern discourse which locates responsibility for action and intention within the individual.

Foucault does not use the word `power' to mean disciplinary or repressive power only, but also liberatory power. He points out that power coexists with resistances to it. Reverse discourse seeks to subvert hegemonic discourses (Weedon, 1987). For example, the radical feminists have re-defined the traditionally devalued `feminine' characteristics of emotiveness and intuition as useful and powerful assets available to women. It is important to note, however, that Foucault does not see discourses as existing in simple bipolar positions of power and powerlessness. Power is a `force of field relations' (Weedon, 1987, p 110) of which the discourses/knowledges are elements or blocks. Power is thus never stable or unitary, but rather in a constant state of flux and redefinition as discourses/knowledges compete for hegemony. In studying relations of power, Foucault stressed the importance of formulating and studying the question in terms of `power at its extremities .. where it becomes capillary' (Foucault, 1980, p. 96), ie in the everyday lives, actions and processes of people. It is at this level that power `installs itself and produces real effects' (Foucault, 1980, p. 97) - in major as well as small ways. This view of power contrasts with Althusser's notion of ideological state apparatuses which `slides into a functionalist reading in which an ideological state apparatus functions for explicit goals determined by the state's interest in control and in domination.' (Henriques et al, p. 107).

Foucault has been criticized on a few counts:

1) He neglects to account for purposeful human action, ie he fails to accord the perseverance of certain patterns of power to conscious human action (Paternek, 1987).

2) His theory threatens to slide into rampant relativism as it can be read to imply that any transformations in hegemonic power are merely different - not better or worse - techniques of power (Paternek, 1987). Burman (1990) and Hawkesworth (1989), for instance, express doubt concerning the use of the post-structuralist framework in the feminist field. Although post-structuralism provides critiques and insights into dominant patriarchal discourses and into the constitution of the feminine positionings within those discourses, it fails to indicate `what action follows from this analysis' (Burman, 1990, p. 214). This stems from its inability to prioritise certain readings or to align itself with any particular ideology. Others, such as Weedon (1987), are not so pessimistic concerning post-structuralism's usefulness in the feminist endeavour. Ann Levett (personal communication) points out that the aims of Foucault's work were not partisan in any political sense, but were `absolutely political in a broader sense'.

3) Foucault is criticized for having `no sense of the antagonisms of discourses, no sense of the struggle for and between knowledges' (Macdonnell, 1986).

The concept of the antagonisms of discourses in the reproduction of subjectivity is taken up by Henriques et al (1984) in their book Changing the Subject. Discourses and discursive practices are seen as constitutive in that they allow certain subject positionings to be taken up within them. However, people take up positions within discourses according to the investment that this position affords them (the agentic aspect of subjectivity). Subjectivity is thus multiple and contradictory in that people will be positioned and position themselves (often unconsciously) in many, non-uniform discourses. Humans negotiate their positionings within the range of available discourses in order to provide meaning, a sense of self and purpose. Switches will be made from one place or time to another according to the emotional investment associated therewith. Davies & Harré (1990) talk of the process whereby people are positioned conversationally : there can be `interactive' positioning in which what one person says positions another, and there can be `reflexive' positioning in which the speaker positions her/himself. Henriques et al use a modification of Lacan's psychoanalytic account in exploring the concept of the non-unitary, non-rational nature of subjectivity (see especially Urwin, 1984).

The question now arises as to how the theoretical framework described in broad terms above may fruitfully be applied in a study to do with the various aspects of education, childhood, psychology, gender differences and mathematics. Each of these aspects will be dealt with below.

Any view of education rests on some (often unstated) assumptions about the nature of personhood. In most western schools these assumptions are rooted within a liberal individualist framework in which the person is seen as a rational and free-acting agent. In Walkerdine's (1986) words:

> `[W]hen we examine the actuality of pedagogic practices we are not so much faced with an "ideology of childhood" which distorts what children are "really like", so much as a "truth" which regulates what "should be"'(p. 58).

Indeed much of the practice of modern education is based on the premises of psychology with its `facts' of child development and its instruments of mental measurement which allow an individual to be monitored and classified.

Woodhead (1990) shows how the concept of "childhood needs" `conceals in practice a complex of latent assumptions and judgments about children' (p. 60), including the connotation of helplessness and passivity, and the imperative of appropriate intervention. Of specific interest here is his contention that `educational needs are largely a cultural construction' (p. 71). Woodhead says these `needs' should be viewed within the power relationship that exists between the educational `experts' (who make pronouncements concerning children's needs) and the parents and children (the recipients of the expert knowledge).

The notion of childhood is not a timeless and universal one as Aries (1973) discusses. Levett (1989a) identifies four contemporary models or discourses of childhood used in psychological talk:

1) the passive child: children are seen as passive recipients of socialization;

2) the innocent child: children represent inherent goodness or naturalness;

3) the organismic child: the child is an undeveloped adult whose growth will follow a natural developmental blueprint, given the correct environment; implicit in this notion is an ideal endpoint – the normal adult;

4) the cognitive/rational child: childhood is seen as a period of learning.

All of these have implications in terms of the reproduction and regulation of the `normal child'.

The notion of gender differences, the `feminine' and `masculine', are, in Wetherell's (1986) view `effective because they appear as natural and inevitable results of biology or experience' (p. 77). However, it is within language that differences become real. As previously discussed, language exists as a system of differences in which the present is privileged and the absent marginalized. Thus, in terms of gender, there is nothing intrinsic or essential about `maleness' or `femaleness'. Rather the male norm (the present) serves to define, and is mediated by the feminine (absent trace) – or vice versa. The content of these gender differences get taken up in everyday language to create a common–sense notion of gender.

But as any historical analysis will show, the content or substance of the feminine/masculine categories is highly flexible – women and men may be described in all sorts of ways. It is the possibility of differences, or the linguistic illusion of binary oppositions, that ensures the reproduction of gendered subjectivities.

Hare-Mustin & Marecek (1988) note that the primary meaning of gender in psychology has been difference. They differentiate between the alpha bias, which emphasizes differences by contrasting the experiences of men and women, and the beta bias, in which the similarity or equality of men and women is stressed. Beta bias is typically less prominent but manifests itself in theories such as androgyny. Hare-Mustin & Marecek explore the utility and consequences of each of these approaches in terms of the social construction of gender.

Turning to mathematics education, we can look at the mathematics curriculum which could be likened to what Parker (1990) calls the abstraction and representation of behaviour. Parker talks about the labour process but his insights may apply equally to the mathematics curriculum: we must pay attention to the `de-skilling and to the experience of alienation which arises when others control the labour [learning] process. ..in "scientific management" we ha[ve] .. the abstraction of behaviour from a meaningful whole and the re-presentation of that behaviour in the worksheets and ledgers [syllabuses] of the managers.' (p. 93). When one views the syllabuses together with the system of examinations and tests in schools, one begins to understand the process of panopticism and `disciplinary technology' operating at the level of institutionalized education. Learning, and what is `right' or `good' to learn, is clearly defined. The individual is monitored throughout the schooling process to determine whether s/he meets the required, predetermined standards of learning, and whether s/he adheres to the prescribed methods. The very nature of mathematics itself as laid out in the syllabuses may also be questioned. This and Walkerdine's post-structuralist approach to mathematics education will be discussed in more detail in the next chapter.

In conclusion, I argue, as Mumby & Stohl (1991) do concerning the work environment, that through a process of presence and absence of signification, certain conceptions of reality and of what is natural (ie. taken-for-granted notions) are organized into the everyday workings of education and schooling while other possible conceptions are organized out. These alternate conceptions or discourses may be the sites of resistance among teachers and pupils. Dominant discourses concerning mathematics, gender and schooling will compete with other, possibly contradictory readings. Children, in negotiating the process of mathematics education, will invoke different and often fragmentary discourses to make sense of their positions. The aim of this study is to explore some of the discourses available to children caught in the process of `learning' mathematics.

CHAPTER 2

GENDER-RELATED ISSUES IN MATHEMATICS EDUCATION

In this chapter I first review the `facts' of gender differences in mathematics as established by `empirical' studies. Criticisms surrounding the methodologies of these studies and the interpretation of the results will be discussed. An exposition of the explanatory models which theorize the perceived differences follows. Lastly I discuss the post-structuralist approach to gender and mathematics, and write about mathematics as a discourse embedded within the scientific and educational discourses of the day.

The `facts' of gender differences

The most common conclusion in the North American and British literature is that sex-related differences in overall performance in mathematics do not appear before junior high school, but that boys outperform girls from this stage onwards (Leder, 1990a; Selkow, 1985; Sherman, 1980; Shuard, 1986). Some authors claim, however, that there are differences in specific areas in younger children: girls are seen to score better on tests of computation, boys on problems involving measurement and spatial visualisation (Fennema & Tartre, 1985; , Shuard, 1986). Because computation skills become less important in the abstract problem-solving demanded in high school, this second observation is said possibly to explain the first. Hyde, Fennema & Lamon (1990) warn however against generalizing the results from studies using selected samples to the general population. In their meta-analysis of 100 studies they averaged the effect sizes based on general, unselected populations to find a negligible female advantage. As the samples become more highly selected however, so the magnitude of gender differences favouring males grows larger. They quote samples using college students and graduate students (ie. with age as a variable) and mathematically precocious youths as examples. This appears to indicate that the differences `are most pronounced at the highest levels of mathematical reasoning' (Benbow, 1988, p. 169). Hyde et al suggest however that the magnitude of gender differences in mathematics has decreased in the past three decades. It is not clear whether the same can be said concerning enrolment in mathematics courses. Certain studies show that, when given a choice, girls enrol less often in MB

mathematics courses than do boys (Ethington & Wolfle, 1984; Steinkamp, Harnish, Walberg & Tsai, 1985).

The same trends were found in a South African study. Delene Visser (1985, 1987) reports that although boys and girls do not differ in their average performance in later years, this may be ascribed to the fact that fewer girls (she believes the more intelligent ones) than boys continue with mathematics to matric. Among the top-scorers, sex-related differences do appear – in 1984, 3,2% of males and 2,6% of females obtained marks over 80%.

As with the study of any perceived phenomenon, there is debate concerning the methodology of the studies, and the interpretation of the magnitude or meaningfulness of the observed gender differences. Critiques are levelled from a positivistic as well as a post-structuralist framework. There are three main strands to the positivistic criticism. Firstly, the tests used to measure achievement are not in themselves unproblematic. Kimball (1989) found that when grades in mathematics classes are used as opposed to standardized measures, girls fare better than do boys, and that this holds consistently from junior school through to university. Secondly, Rosenthal & Rubin (1982) note that the d values reported in various studies differed significantly among themselves (d value is the proportion of the standard deviation by which the sexes differ). Thirdly, as Steinkamp et al (1985) point out, studies which report a significant difference may be reflecting psychometric bias rather than actual difference: in large samples, slight differences reach significance.

From a post-structuralist viewpoint, Walkerdine (1989) makes three pertinent points: (1) statistical significance does not necessarily mean educational significance; (2) studies (e.g. the Assessment of Performance Unit (APU) study done in Britain over a five year period) show that regional differences, and even the difference between schools with high and low percentages of free meals, are far greater than sex differences (the question which raises itself here is what purpose the emphasis on gender differences serves); (3) boys often show a greater variance of scores than do girls.

Explanatory models

In keeping with the old nature-nurture argument, there are those who argue that innate biological factors (visuo-spatial abilities; neuronal firing, brain lateralization; handedness)

explain the gender differences in mathematical achievement (Benbow, 1988; Davis, 1986; Halpern, 1986; Stanley & Benbow, 1983; Thomas, 1985). Others locate the causes within the environment, arguing that there is no empirical evidence for a biology–ability connection (Linn & Petersen, 1986; Peter, 1991). The latter view seems to be in ascendancy as there is far more recent literature dealing with aspects such as role–stereotyping, socialisation factors, cognitive styles and classroom interaction. These theories are discussed below.

Mathematics textbooks and histories define mathematics as a male province, according to Northam (1986) and Burton (1986). Northam analyses how the textbooks subtly exclude females, while Burton, in an effort to counter the invisibility of women in the mathematical histories, produces a brief mathematics 'Herstory' which traces the struggles of the few known great women mathematicians.

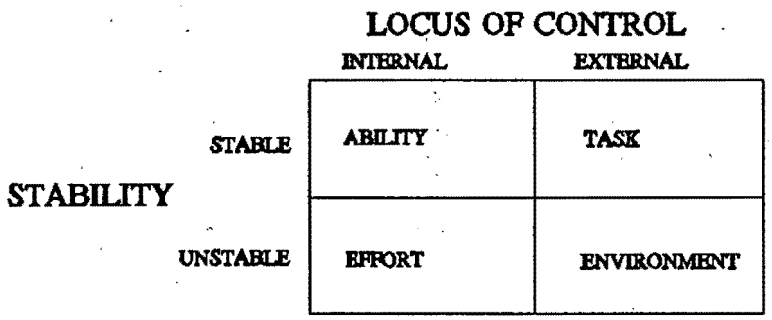
Leder (1986a; 1986b) picks up on the idea of mathematics as a male domain. She follows Horner's model of 'fear of success', positing that because achievement in higher levels of mathematics is seen as more congruent with the male role than with the female role, success in this field has more negative consequences for females (unpopularity, guilt, abuse or doubt about their femininity) than for males. In a meta–analysis of gender self–concept and mathematical and spatial performance, Signorella and Jamison (1986) found support for the hypothesis that higher masculine and lower feminine self–concept scores were associated with better performance. They propose that the masculine stereotyping of mathematics and the increased sex–role pressures at the time of adolescence go hand–in–hand in partially explaining the sex differences. Johnston (1986) in her study in three Cape Town schools reflects this view: 'as they begin to discover their femininity (after the first two years of high school), they may believe that success in a subject, that they perceive as more masculine in nature, will detract from this new–found attribute and may even attempt to hide their talent' (p 218).

Associated with the sex–role (in)congruency of mathematics is the notion of the perceived usefulness of the subject. It is claimed that females see mathematics as having less value to them than do males (Meyer & Koehler, 1990). Oakes (1988) points out that this type of perception is linked to current social conditions. Women (and minorities) are often unable to translate their achievements in mathematics into commensurate employment opportunities or

salary scales. An anticipation or understanding of career discrimination may play a significant role in shaping `negative' attitudes towards mathematics.

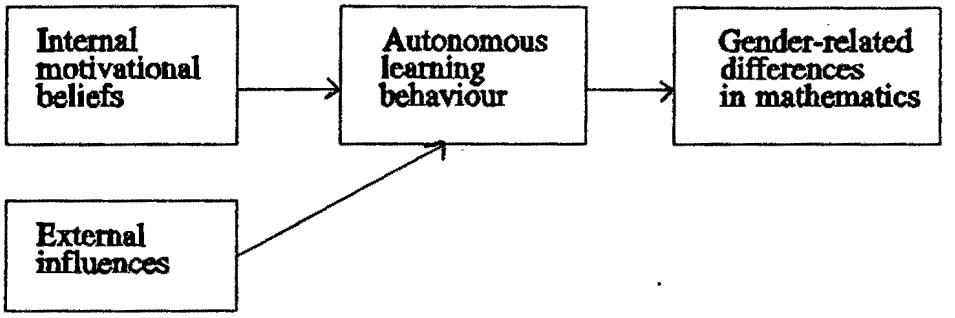
Weiner's classification of causal attributions (see fig 1) has been adapted to conceptualize students' attributions of success or failure in mathematics, along the dimensions of stability and locus of control (Fennema & Peterson, 1985; Meyer & Koehler, 1990). In various studies it was found that males were more likely than females to attribute their success to ability (internal and stable), and their failure to lack of effort (internal and unstable). Females, on the other hand, were more likely to attribute their success to effort, luck or help from others (external or internal and unstable) and their failures to lack of ability (internal and stable).

Figure 1: Weiner's classification of causal attribution



Fennema & Peterson (1985) believe that girls do not develop what they call the autonomous learning behaviours (ALBs) necessary for performance on `high cognitive level tasks' (p. 309). ALBs are: choosing to engage in high-level mathematical tasks, working independently, and persisting with the tasks. They attribute the development of ALBs to internal factors (attributional style – as discussed above, confidence in one's ability to do mathematics, perceived usefulness of the subject) as well as to external factors. ALBs, according to Fennema & Peterson, mediate between the external and internal influences, and performance in mathematics (see fig 2).

Figure 2



Cognitive styles have been said to contribute to success in mathematics. In his study of primary school students, Waxman (1987) reports a significant difference between the boys and girls in problem-solving strategies: the boys constructed models more often than the girls; the girls used objects such as coins or fingers when solving easier problems more often than did the boys. Scott-Hodgetts (1986) contrasts a serialist approach (in which the learner proceeds from certainty to certainty and learns information in small, well-defined units) with the holistic approach (in which the child explores the material, trying to understand the overall framework). She argues that the serialist approach which is encouraged in primary school disadvantages the student when having to tackle unstructured higher-level tasks in secondary school. She suggests that there are a greater proportion of girls than boys with serialist tendencies.

Classroom processes have also come under the spotlight in the study of gender and mathematics. Research (Leder, 1990b; Koehler, 1990; Fennema & Peterson, 1985) has shown that boys interact more with the teacher than do girls; they receive more praise and more disciplining. Teachers interact less with high mathematics achieving girls than boys, and encourage them to be dependent rather than independent workers. Girls spend more time helping others than do boys, and receive less help in return.

Kelly (1986) reports some of the findings from the Girls Into Science and Technology (GIST) project concerning the influence of gender roles at home. The parents interviewed saw English and mathematics as the most important school subjects for both their sons and their daughters, and their expressed commitment was to equality of education. However, their actual expectations of their children's performance, and the roles in the family were deeply stereotyped.

Maines (1985) criticizes theories (such as those discussed above) that use some form of `socialisation determinism' (p 315), personality trait theory or cognitive approaches to explain gender differences in mathematics. To quote Maines, `they rely on a priori imageries of barriers' and `they portray women as perpetual victims of the systems or of themselves' (p. 315). Walkerdine (1989) agrees with Maines in this respect in that `Deficit theories tend to blame the victim' (p 19) (or mothers or female teachers), and girls' performance is pathologised. Maines goes on to contend that the barriers to women's mathematics achievement exist in social processes rather than social structures. He proposes a theory based on Gilligan's work: men live in focussed worlds (which `involve primary meanings attributed to activities directly related to mathematics and the instrumental relationships through which mathematics is expressed' (p 315)) whereas women live in diffuse worlds (which `involve a wide array of primary meanings, which include not only mathematics, but also family and friends' (p 315)). Thus, because of an interaction of many primary meanings, mathematics becomes secondary to women. Their social relationships `mediate between them and mathematics' (p. 316). It is at this point that Maines and Walkerdine diverge. Although Walkerdine (1989) does not mention Maines directly, she criticizes the `Gilliganesque' approach – `because we think that gender differences are fictions with no firm basis in reality. To reassert femininity is to play up to these fictions and their dualism .. and thereby participating in the oppression of women.'(p 206).

Post-structuralist views

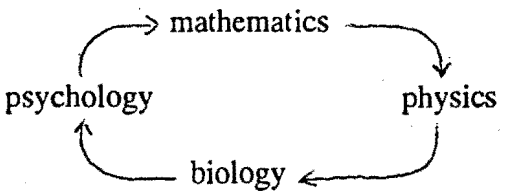
In post-structuralist terms, the models delineated above are problematic in a number of respects:

1) The taken-for-grantedness that `differences' is a legitimate site for investigation. The notion of difference in and of itself has little meaning (white is different from black – so what?). But as soon as the difference is studied within a framework (exactly how different and in what way is black different from white?) the notion of measurement comes into play. Measurement cannot exist without an ideal or starting point from which the measurement is taken. Comparison is the essence of measurement. When that starting point is western-patrocentric norm of performance in mathematics, the study of differences becomes very powerful in legitimating those exact norms, and marginalizing any alternate readings of the nature of mathematics education, and of performance therein.

2) Studies of this nature, whether feminist or not, remain trapped within the same categories (the reifying dualisms of girls/boys, individual/society) and within the same terms (the statistical search for differences or the lack thereof).
3) They tend to pathologise the performance of girls and suggest that all will be righted should such-and-such be done (more girls be encouraged to enrol in higher mathematics courses, mathematics not be stereotyped as a male domain).
4) The nature of mathematics itself is treated unquestioningly: these models bypass the embeddedness of mathematics as a discourse within the social and historical production of power relations and of gender differences (see following section in this chapter for discussion).

Walkerdine (1984;1989) argues that to understand the performance of girls in mathematics, one has to trace how this performance is produced and evaluated. Her treatment of the subject `girls and mathematics' is fairly wide-ranging (for example she explores the historical production of the `common-sense' notion of women as irrational and therefore not mathematically inclined, and the contradictory discourses within which mothers, female teachers, girls (and boys) find themselves in relation to mathematics education (see Walkerdine, 1989)). In this section I shall look specifically at her writings on the liberal `child-centred' pedagogy and its regulative classroom practice, and how this is interwoven with the reproduction of gender differences in mathematics.

In her chapter `Developmental psychology and the child-centred pedagogy: The insertion of Piaget in early education' in Henriques et al (1984), Walkerdine reproduces Piaget's scientific circle (p 175):



From this `one is led to assume that mathematics can occur naturally on the basis of sound psychological principles' (p 175). What has resulted is the philosophy of `child-centred'

pedagogy based on Piaget's theories. It is believed that within a child-centred environment the child will develop naturally (the corollary being that if she doesn't, she must be unnatural or irrational). The child becomes the `object of the scientific gaze' (Walkerdine, 1989, p 31) which ascertains whether the development of the appropriate mental strategies is taking place. Walkerdine (1989) views the shift from the `chalk-and-talk' method, which is seen as authoritarian, to the `child-centred' approach, which is seen as liberating the child's `natural' talents, as a shift from overt to covert regulation (Foucault's panopticism or disciplinary technology).

Within child-centred pedagogy, `real understanding' is what counts, what must be carefully looked for and encouraged. In other words, one may be successful but for the wrong reasons (the dreaded `rote memorization/rule-following'). It is possibly not co-incidental that `the characteristics taken to be indicators of "real understanding" are to a large extent co-terminous with those used to describe masculinity' (Walden & Walkerdine, 1985, p 104). In their studies Walden & Walkerdine (1982, 1985) found that teachers regarded girls as hard-working and good, boys as displaying `flair' (challenging the rules of mathematics was seen as an indicator of `flair' or `real understanding'). The boys were attributed with this quality even if they did not fare particularly well. Thus, within mathematics, girls have to deal with a double-edged sword. They can display the same behaviour as boys, but it will not be taken to mean the same thing. As Walkerdine (1989) points out, they can be `successful' but never actually `succeed' (p 128) (if understanding is not real it must be no understanding or false understanding). Their performance is denigrated, in the words of Johnston (1985), to `tidiness' and `strict adherence to rules' (p 218). It is not surprising possibly that girls, finding themselves within a constellation of contradictory discourses, may discover that one (participation and achievement in mathematics) may have little investment potential for them.

Mathematics as a discourse

Anybody who has had any dealings with the subject mathematics (which includes everybody who has gone to school) knows that there is considerable mystique surrounding it. Very few people who have come into contact with it in any formal sense can look upon it with neutral feelings. Much of this has to do with the dominant epistemological view of mathematics - that of absolutism. In this view mathematical truth is seen as `absolutely certain ... perhaps

the only realm of certain, unquestionable and objective knowledge' (Ernest, 1991, p. 3). Mathematics has the power, according to the adherents of the absolutist viewpoint, to render the universe unitary, timeless and ultimately knowable (providing that one has the requisite skills!). It does this by prizing form from content. The syntactical rules (3 – 1 = 2), the logico–deductive arguments (if a = b and b = c, then a = c) and the inductive reasoning are a form of rationality from which the referents are missing. Ernest (1991) shows, however, that the quest for certainty within mathematics, with its assumptions of axioms and definitions, and its use of the rules of logic, inevitably leads to an `infinite regression' or a `vicious circle' (p. 14).

A discussion of gender differences in mathematics necessitates a problematizing of mathematics as a discourse, in particular the absolutist view thereof. If, as the absolutists would have it, mathematics is the most certain and objective of knowledges, then the possession of mathematical ability and knowledge ensures the possessor of a certain amount of power. Walkerdine(1989) leaves us with a question mark here:

> `But what if it is all a fantasy, a very powerful fantasy of control over time and space? Doesn't that put boys' sure possession of "it" on an entirely different footing? And girls' lack?' (p. 43)

Various `alternative' epistemological perspectives of mathematics are being debated in the literature, the most prominent of these being fallibilism. The fallibilists view mathematics literally as fallible. Mathematics is a knowledge which is `embedded in history and in human practice' (Ernest, 1991, p. 26). It is thus value–laden, `imbued with moral and social values which play a significant role in the development and applications of mathematics' (Ernest, 1991, p. 26). Approaches to mathematics that would fall under the broad category of fallibilism are those of social constructivism, the social history of mathematics and ethnomathematics.

Social constructivism sees mathematics as embedded within socio–linguistics practices, and hence socially constructed. Mathematical truths are established and justified through the use of language and linguistic rules. Within this view subjective knowledge and intersubjective, social knowledge (what is seen by the absolutists as objective knowledge) serve to recreate

each other. It is `mathematical activity that produces mathematics' (Ernest, 1991, p. 37) rather than the other way around.

The social historians of mathematics locate the development of the Western mathematical discourse within the historical and social processes that have made its rise possible. The social history of mathematics `concerns itself with the influence of forms of social organisation on the origin and growth of mathematical conceptions and methods, and the role of mathematics as a part of the social and economic structure of a period' (Mehrtens, 1981, p 257). Mehrtens delineates various approaches that are taken in this field including a Marxist approach (tracing the emergence of certain fields in mathematics in relation to productive forces and the modes of production), a systems–theory approach (e.g. one may explore the integration of mathematics in the educational system), and a `social imagery' approach (which shows mathematics as embedded in the general change of world–views).

`[T]he category mathematics is our own so we cannot expect to find anything so labeled by other peoples'. These are the words of Ascher (1988, p. 19) in her paper on continuous figure–tracing amongst the Malekula. In the study of `ethnomathematics', mathematics is viewed as a cultural product. Mathematics, seen as a universal human activity, emerges and develops in different directions under different conditions. (D'Ambrosio, 1985; Gerdes, 1989; Hoyrup, 1985). Bishop (1988) argues that there are six fundamental universal activities (counting, locating, measuring, designing, playing, explaining) that are necessary and sufficient for the development of mathematical knowledge. Dowling (1988) warns against the `anthropological imperialism' (p. 107) to which this approach may lend itself:

> `It would seem quite clear that both Bishop and D'Ambrosio, like Gerdes are defining non–European cultural activities in European terms, failing, like generations of European anthropologists before them – to problematize their own culture' (Dowling, 1988, p. 108).

It would seem thus that the value of the study of ethnomathematics in this context is to challenge the notion of an abstract, objective, Eurocentric (and masculine?) mathematics.

Once the nature of the Western mathematical discourse has been problematized, the question arises as to whose interests the dominant absolutist perspective serves. Ernest (1991) believes that the absolutists will only admit as bona fide mathematics that which satisfies its values ie

that which presents itself as abstract, formal, objective, justified, rational, reasonable, generalizable, theoretical and cognitively-based. Using these values as a basis, the absolutists claim that mathematics is neutral. What this assertion does is legitimate the hegemonic position of those who define the subject: `among the university mathematicians .. it is white males of the middle and upper classes who overwhelmingly predominate' (Ernest, 1991, p. 260). Aside from this, the assertion that mathematics is neutral obscures the social function that mathematics serves in acting as a `critical filter' for the job market, particularly in well-paid technological jobs. The power of mathematics in this respect is well-illustrated by Fashesh (1988), a mathematician, who contrasts his mathematics with that used by his uneducated mother who makes clothes without a pattern:

> `Without the official ideological support system, no one would have "needed" my math; its value was derived from a set of symbols created by hegemony and the world of education. In contrast, my mother's math was so deeply embedded in the culture that it was invisible through eyes trained by formal education. Her math had no symbols of power.' (p. 58, my emphasis).

Conclusion

From a post-structuralist standpoint it would seem to be important to follow two strands of thinking in terms of the discussion of girls and mathematics. The first is to critically view the subject from an educational perspective: the performance of girls (and boys) is located and reproduced within a certain framework - that of the disciplinary technology of institutionalized mathematics education which allows for certain (taken-for-granted notions) to be read as unproblematically real and normal. The second is to problematize the dominant epistemological view of mathematics and to see it in the context of the power relations that it reproduces.

CHAPTER 3

METHODOLOGY: DISCOURSE ANALYSIS

Discourse analysis has been used by a number of researchers in the psychological and sociological field. Potter & Wetherell (1988) analyse a section of interview transcript concerning `Polynesian immigrants' to elucidate racist discourse. Potter, Wetherell & Chitty (1991) illustrate how the quantification rhetoric heard on television is used to support or undermine argumentative cases. Billig (1988; 1989a; 1989b) takes a slightly different approach in stressing what he calls the rhetorical nature of thinking which he describes as a dialogic process of criticism and justification – he focuses on the discourses of a family discussing the British Royal Family to illustrate his argument. Several other studies could be mentioned (e.g. Davies & Harré, 1990; Hollway, 1984, 1989; Levett, 1989a; Potter, 1988; Potter & Edwards 1990; Potter & Reicher 1987; Wetherell, Stiven & Potter, 1987).

Discourse analysis must be distinguished from content analysis. Content analysis, although dealing with language and language systems, works off the basis of a different philosophical model from discourse analysis. Language is used `as a convenient dependent variable which records causal processes revealed by the numerical assessment of occurrences within categories' (Potter & Wetherell, 1987, p. 173). Content analysis thus allows for a certain amount of statistical analysis, something that runs contrary to the principles of discourse analysis as strictly applied.

Discourse analysis involves a number of stages. These are discussed below with reference to the study proposed (see Potter & Wetherell, 1987, Levett, 1989a, Hollway, 1989 for writings on methodology):

1) The research question:

Discourse analysis allows for the re-formulation of traditional research questions. The goal of discourse analysis, according to Potter & Wetherell (1987) is to `clarify the linguistic resources used to make certain things happen' (p. 171). The texts obtained are analysed as social texts of meaning, in which there are a multiplicity of discourses being negotiated. There is no sense of having arrived at any `truth' concerning peoples' `attitudes' or actions,

and no attempt to control for variability. The strength of discourse analysis is that it shows `how daily language usage, on study, reveals slippages of understanding and of subjectivity ... and to deconstruct the assumptions that underlie the apparently simple ideas expressed in a statement' (Levett, 1989a, p. 196). The aim in this study thus is to elucidate the range of themes (dynamic, contradictory and constantly reproduced) that have implications in terms of social relations and power within a mathematics classroom. What is of interest is the functions that the various versions serve in defining the `reality' surrounding mathematics, and gender differences within mathematics.

The aims of discourse analysis coincide with those of the grounded theory approach (Glaser & Strauss, 1967) in which theory is systematically generated from the data obtained. This contrasts with the trend in psychological research to verify theory which has been arrived at by logical deduction from a priori assumptions. Glaser & Strauss delineate two levels of theory that can be generated using their approach viz. substantive and formal. Substantive theory applies to a specific area of sociological enquiry while formal theory is conceptual in nature. Given the scope of this research, the interpretive formulations generated will be of a substantive nature.

2) Sample selection and method:

In discourse analysis the notions of statistical sampling and generalization are abandoned as this `does not address the complex conditions of people and their conduct, either in their uniqueness or their commonality' (Hollway, 1989). The choice of subjects is guided rather by theoretical sampling (in which groups are chosen in terms of theoretical purpose and relevance), and by the comparative method (in which attention is drawn to similarities and differences – bearing in mind that these similarities and differences are linguistically rather than empirically real, as discussed in Chapter 1). These sampling principles are important components of the grounded theory approach. Generalization is not automatic in discourse analysis, and has to be once again guided by theoretical principles rather than statistical ones. Hollway (1989) delineates this quite clearly:

> `any participant is valid because that account is a product (albeit complex) of the social domain. If this domain is analysed in its specificity, the resultant interpretation will be valid without the support of statistical samples; that is, without evidence that whole groups do the same thing' (p. 15).

As one is interested in linguistic patterns rather than the people that generate them (a large number of patterns are likely to emerge from a few people), and because discourse analysis is very labour intensive, sample sizes tend to be small.

In this study, students from a reasonably affluent Cape Town model C school constituted the sample. The students came from the top Std 8 Higher Grade mathematics class. This selection is important in two respects. Firstly, according to the literature concerning the `facts' of gender differences in mathematics, the differences are most pronounced at the upper range of achievement. Given that the aim of the study is to understand the linguistic resources that produce and/or modify gender differences in mathematics, this selection constitutes a theoretical sample. Secondly, using students from one class meant that they knew each other and were comfortable with discussing issues with each other.

Participation was done purely on a volunteer basis, and the students self-selected themselves into three groups, one consisting of 5 males, one of 4 females and one of mixed sex – 2 females and 3 males. The rationale for the division into these groups has to do with the notion of sampling according to similarities and differences of the comparative method. The participants were similar in that they came from the same high achieving class. The differences of the groups were formed along gender lines. This choice was informed by a recognition of the importance of the notion of `difference' in constituting gendered subjectivity. The comparative method must not be confused with the statistical search for significant differences. Rather, it is the creation of variability along theoretically salient lines.

Each group was presented with a vignette concerning a situation in a mathematics class (see appendix 1). The choice of the story was informed by the literature – themes of stereotyping mathematics as a male domain; patterns of interaction between teachers and boys versus girls; mathematics anxiety and mathematics performance; gender-related success at mathematics. The sex of the protagonists was vague, thus allowing the students to make their own ascriptions of gender. The vignette was followed by a set of open-ended questions concerning the vignette and the subjects' responses to it (see appendix 2).

At no time was I, as researcher, present during the group discussions. I merely introduced the exercise, assuring confidentiality, and asking the group to appoint a facilitator who would read the questions. This, I rationalized, would remove my influence as a potentially imposing, teacher-like figure, and allow the students maximum freedom for exploring the issues within the parameters of the vignette and questions.

At the conclusion of the discussion, the subjects were asked to write a short anonymous essay on the following topic: `It has been said that boys are better than girls at mathematics. Do you think that this is an accurate assessment? What leads you to this conclusion? Please expand as fully as possible, citing examples from your personal experience where possible'. These essays were included in the analysis.

3) Collection of records:

The sessions were videotaped. In a pilot study run at a school at which I was teaching at the time, I used only an audiotape. On listening to the tapes I found tremendous difficulty in distinguishing the talkers from each other. I thus decided to videotape the sessions in order to facilitate this process, although I only used the actual spoken text for analysis. The tapes and essays formed the raw data.

4) Transcription:

Each session was transcribed word for word. The details of timing and intonation were not recorded as the analysis was done on the basis of meanings (informed by theoretical understanding) rather than on the structural components of the linguistic features. Marked silences, laughter, and hesitations were however recorded.

5) Coding:

At this stage the body of the transcribed discourse was coded into thematic chunks. This was done as inclusively as possible, including all borderline cases (so as not to cut out variability). Statements were not seen as clearly defined entities (for example as a sentence) but as a unit of text that refers to an idea related to a discourse. Thus a statement may consist of a number of sentences or merely of a single clause. A single statement may refer to several discourses, which may be contradictory. The question of how to select the thematic chunks presented itself here. According to Levett (1989a) this `comes out of background reading, theoretically

informed thought, and from repeated readings of the text' (p. 194). More specifically, I found Davies & Harré (1990) and Parker (1992) useful. Davies & Harré write of extracting the positionings of speakers from a text. They talk of interactive positioning in which one person positions another and of reflexive positioning in which one positions oneself. `Positions are identified in part by extracting the autobiographical aspects of a conversation in which it becomes possible to find out how each conversant conceives of themselves and of the other participants by seeing what position they take up and in what story, and how they are then positioned' (p. 48). Parker (1992) sets out seven criteria for distinguishing discourses:

i) Discourses are realised in texts, and thus the object of study is the text.

ii) Discourses are about objects. There are two levels of objectification, firstly where objects are constituted through discourse (the simple use of a noun gives an object reality), and secondly where a discourse refers to itself or other discourses as if they were objects.

iii) Discourses contain subjects. A discourse allows space for a certain type of self. This criteria links up with the idea of interactive and reflexive positionings made by Davies & Harré.

iv) Discourses present a coherent system of meanings. They map a picture of the world and include ways of dealing with objections to that view.

v) A discourse refers to other discourses. A discourse will `presuppose other discourses to the extent that the contradictions within a discourse open up questions about what other discourses are at work.' (Parker, 1992, p. 13).

vi) A discourse reflects on its own way of speaking. This is where the terms used within the discourse are commented upon, for instance `for want of a better word' or `don't get me wrong'. Derrida's notion of absence and presence also refers here in that the written or spoken word always contains traces of its complement or absence. In other words, implicit themes suggested by the absence of certain terms should be analysed.

vii) A discourse is historically located, in that `the objects they refer to are objects constituted in the past by the discourse or related discourses.' (Parker, 1992, p. 16).

Parker (1992) warns that the researcher should reflect on the terms s/he uses to refer to a discourse, a matter that involves moral and/or political choices (for example using the terms `racist' or `liberal' to describe a discourse).

6) Analysis:

At this stage the organizational features of the transcript were identified. I looked for the `patterns that connect' by searching for both variability and consistency in the discourses identified. The analysis involved the forming of hypotheses concerning the functions and effects of these patterns. In other words it is at this stage that an attempt was made to answer the questions generated in the initial setting out the research `problem'. In this regard Parker's (1992) three additional criteria are important:

i) Discourses support institutions, in that they validate certain behaviour styles and meanings while attacking or marginalizing others.

ii) Discourses reproduce power relations. To disentangle this, one would look at which categories of people would gain and which would lose from invoking a particular discourse; who would want to promote the use of the discourse and who would want to discourage it.

iii) Discourses have ideological effects. For example, discourses may be used to sanction oppression, and to `allow dominant groups to tell narratives about the past in order to justify the present' (Parker, 1992, p. 20).

7) Validation:

In general, discourse analysis possesses ecological validity in that `the findings ring true with everyday experience' (Levett, 1989a, p. 194). Validation procedures for specific discourse analyses are:

i) Coherence: The analysis should demonstrate how the discourse fits together, taking account of the broad patterns as well as the micro-sequences.

ii) New problems: Secondary discourses, which exist to cover problems generated by inconsistencies of the primary discourses, act as validity checks for the primary discourses.

iii) Fruitfulness: `This refers to the scope of the analytic scheme to make sense of new kinds of discourse and to generate novel explanations' (Potter and Wetherell, 1987, p. 171).

8) The report:

The report forms part of the confirmation and validation procedures. Therefore a representative set of examples together with the detailed interpretation thereof is presented so that the reader is able to assess the researcher's analysis.

During the course of the research, there was a fluid movement between the stages of the discourse analysis, each feeding back and informing the other. Repeated reading of the raw data and re-arranging of the coded material allowed for flexibility and for new insights into the linguistic patterns.

The choice of a discourse analysis approach in this study is important in terms of the principles of feminist research. These principles distinguish feminist research from `non-sexist' research (Wilkinson, 1986), or research <u>for</u> women from research <u>of</u> women (Nicolson, 1986). Briefly, these principles are:

1) An examination of the researcher's role in the research process: This recognises that the `knower is part of the matrix of what is known' (Wilkinson, 1986, p. 13), i.e. there should be a reflexive and self-reflective quality to the research. An important aspect of this principle is a recognition of the power differentials operating in research. Bhavnani (1990) delineates two (interwoven) aspects of power that should be considered. Firstly, there is the power of the researcher in the position of expert vis-a'-vis the subject. Secondly, there is the socially ascribed characteristics of the participants. This implies that aspects such as the race and gender of the researcher and subjects should be analysed.

2) A critical evaluation of the research process. There is a recognition that traditional research is not value-free, and that it fails in many cases to specify the assumptions on which it is based. A reconceptualization of the whole research process is necessary. `[S]ome of the research will not look like traditional science, nor be capable of evaluation by traditional criteria' (Wilkinson, 1986, p. 2).

3) A recognition of the inseparability of theory and method (Hollway, 1989). The feminist approach criticizes traditional research for prioritizing `objectivity' within a theoretical vacuum.

4) An examination of who will benefit from the research. In feminist research the participants should gain in a positive way from the consequences of the research.

Although points 2 and 3 above are satisfied through the use of discourse analysis, points 1 and 4 need further discussion. `The knower is part of the known': as the researcher I framed the process in terms of providing the vignette and the questions that followed. The issues that were important to me were thus introduced. This probably means that certain discourses were invoked, while others, possibly as important, were not revealed. While this in no ways

invalidates the analysis (the discourses that are invoked will have meaning), it must be recognised that these will not be inclusive, and that different discourses may be invoked by the participants under different circumstances. In terms of power, it is recognised that the pupils probably saw me as a relatively powerful figure, especially as I was introduced by their teacher as a friend of his and as somebody who was doing her Masters at the University of Cape Town, a university many of them aspire to attend. Racial issues did not have to be faced directly, although one could argue that the history of racially divided education is a pervading factor. In terms of gender, there may have been an unconscious perception of my being less powerful than say their male teacher, but this remains a supposition.

The fourth principle as outlined above presented me with some difficulty. The prime and most obvious benefactor in the research process is myself, as this thesis is a requirement for a Masters degree. On reading the transcripts, however, I noticed that several of the students, most especially the female participants, were feeling alienated from the classroom processes in mathematics. I decided to ask them whether they would like me to show their teacher those extracts which most clearly brought this to light. The aim of this was to sensitize the teacher to processes that he was possibly unaware of, not being able to tap into the type of feelings expressed in the group discussions. The subjects were assured of anonymity were I to do this. The response to the idea was positive.

CHAPTER 4

ANALYSIS OF DATA

The process described in Chapter 3 was followed in analysing the data. More specifically, I analysed the data in terms of the following:

(i) The positionings that were made available to the pupils and teachers within the discussions and essays. These are the discourses within which the pupil/teacher may operate within the mathematics classroom.

(ii) The gendered discourses (non–sexist, male norm and feminist) that were woven into the dialogue both consciously and unconsciously.

(iii) The subject positionings which were invoked along gender lines with respect to both the teachers and the pupils.

(iv) The pupils' perceptions of mathematics as a subject, ie. the discourses they invoked surrounding mathematics.

Throughout my analysis I tried to identify the `patterns that connect' by looking at how the discourses fit together to reproduce power relations within the classroom, and how they legitimate certain readings of institutionalized education, in particular mathematics education. Much of this is discussed in the conclusion. Also, the ways in which the discourses that were used reflected on themselves (caveats, arguments/justifications) were identified (for the sake of ease of reading I have put the discussion on these reflections before the discussion of points (i) to (iv) above).

The figures overleaf give a brief overview of the analysis. The discourses identified and the ways in which they fit together are presented. The rounded arrows indicate discourses that complement each other. In other words, these discourses serve to define or reinforce each other. The pointed arrows indicate discourses that stand in opposition to one another, and that therefore, in some way, need to take account of each other. This figure is intended to serve as a brief introduction and orientation for the reader. Further discussion and examples from the texts are presented afterwards. In the discussion the discourses identified will always be referred to in inverted commas. This is done to avoid the danger of reification.

FIGURE 3

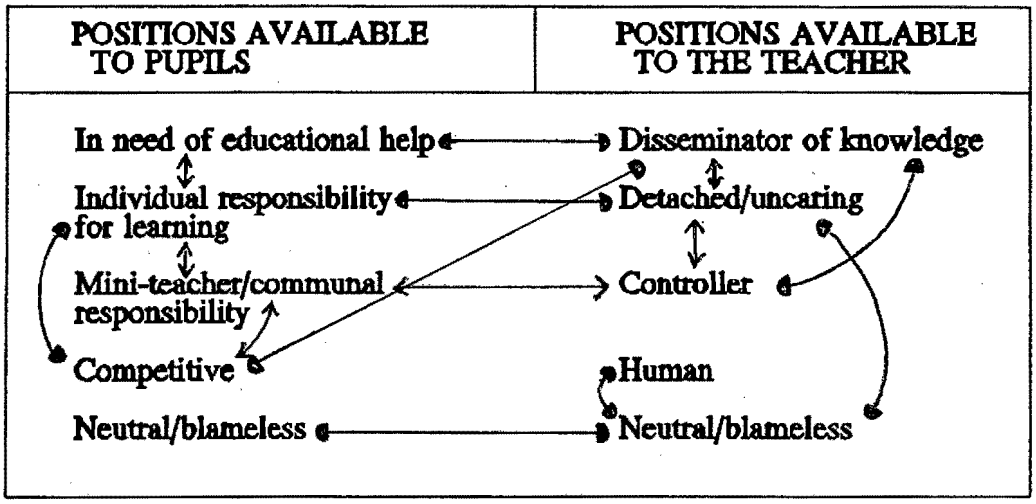


FIGURE 4

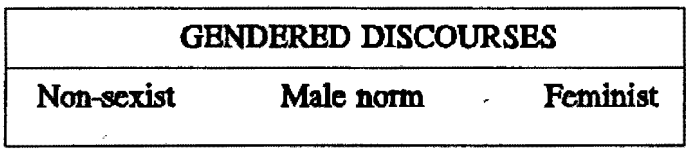


FIGURE 5

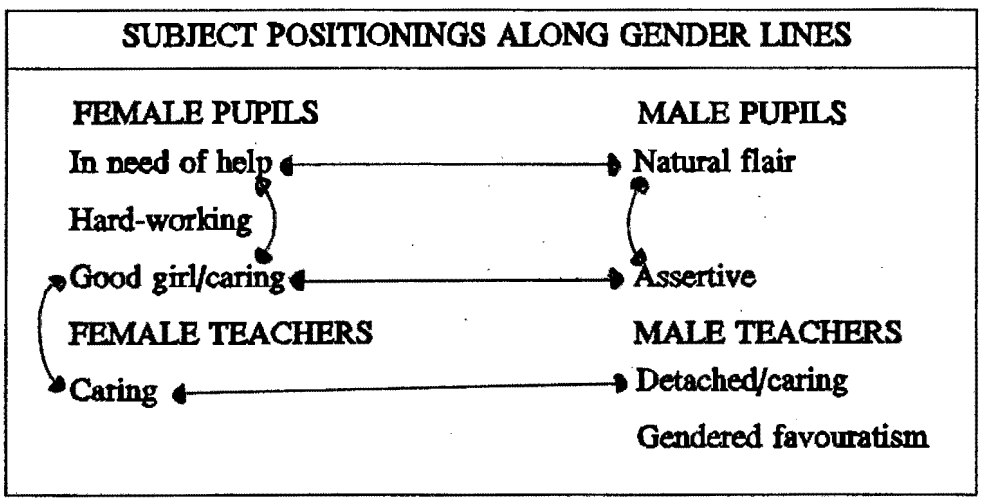


FIGURE 6

NATURE OF MATHEMATICS				
Process	**Answer**	**Powerful**	**Alienating**	**Stagnant**

REFLECTIONS OF DISCOURSES ON THEMSELVES

As we have seen, Parker (1992) points out that discourses tend to comment on the terms that they use. This implies that there is an awareness of the absent trace, or of contradictory discourses. Throughout the discussions and essays caveats and arguments/justifications were used as reflections.

1) Caveats

`It depends on the problem; it all depends on the situation'; `in an ideal situation'. These statements recognise that discourses are contextually embedded, ie. that different discourses may be invoked in different circumstances. The word `generalization' was used – in two senses. The first was to recognise that other discourses exist, but still to defend the one that the speaker was invoking, as in `I'm generalizing now, but ..'. The second sense in which it was used was to counter the discourse that a previous speaker had been using: `That's a vast generalization'.

The use of humour was interesting, for example: [laughing] `It's not fair, I want to get the sum right first'. On the surface this statement invokes the `competitive' discourse. However, the use of humour implies that the speaker is actually coming from another (although not clearly defined) position. Putting the words into someone else's mouth was used as an effective way of countering a discourse, e.g. `which is what a lot of people say'.

2) Justifications/arguments

Within the conversation there were demands for the truth, or for evidence: `but how do you know ..?'; `there is not enough information ..' There was an appeal to various bases to substantiate a point. For example there was an appeal to common knowledge (`you know what I mean') to a moral code (`I don't think it's the right thing to say'), to personal experience (`the only maths teacher we know personally is Mr X'; `my mother is an actuary'), to `scientific' evidence (`it is proven';`I read in Cosmopolitan'; `In a Time magazine report') to nature (it's human nature to just say ..'; `boys are naturally better than girls are [at] Maths') to biology (their [boys'] advanced figures brains'; `males' brains are heavier than females'); to socialisation (`it all has to do with what the child has been exposed to when he/she was young').

POSITIONINGS AVAILABLE TO THE PUPILS

As seen in Figure 3 various subject positions are available to the pupils in the class viz. `in need of educational help'; `individual responsibility for learning'; `mini-teacher/communal responsibility'; `competitive'; `neutral/blameless'. Some of these discourses contradict each other while others reinforce each other.

1) In need of educational help

Here the pupil is situated in the position of needing the assistance of a more knowledgeable person to show her/him the `correct' procedure. S/he doesn't understand (`didn't like click'), and has to ask the neighbour or teacher for help. This position is relatively powerless, and the person situated within this discourse seems to experience negative emotions: `confused', `desperate', `insecure', `very unimportant'.

The following extract indicates how pupils may interactively position each other in this discourse:

> E: [the neighbour] saying `oh it's easy' makes the guy [J] feel bad about it, so in future he's going to kind of .. he's probably going to think that he's stupid on problems like that.
>
> B: Well, he is.

In this extract we note an unconscious recognition of the reproduction of subjectivity, in terms of E's noting that J is being interactively positioned as `stupid' (and therefore in need of help) by the neighbour, and the possibility of his taking this on as a reflexive positioning in the future.

Within this discourse the notion of children's educational needs and the deleterious effects of these not being met comes strongly into play (recall Woodhead's (1990) discussion of children's needs):

> E: And then in exams they then lost marks in that section and then they never like understood that .. yes, they could ask again, but what happens if they don't get one, like, that tricky again. Ja, ja I'm just saying that the teacher not teaching that guy could have like bad effects, because he wouldn't know it in future.

Within this discourse is the implicit right of the pupil to be angry if his/her needs are not met. The contract between the pupil and the teacher has been breached and the child may feel rightful indignation. S/he may feel `pretty miffed', `irritated because nobody helped you', `frustrated'.

2) Individual responsibility for learning

> `I think sometimes it's best if you try and work it out yourself. It's difficult asking other people sometimes and you don't really learn from it. Especially in this specific example I don't think she learnt; it wouldn't help her in future.'

In the `individual responsibility' discourse the pupil must take an active role in ensuring that something is done to aid her/his learning process. There are various alternatives in this regard: s/he could work it out her/himself (as above); s/he could try harder; s/he could look in the text book or ask again if s/he didn't understand. Note how in the above quote the speaker creates caveats while invoking the `individual responsibility' discourse. She uses the word `sometimes' and also refers to the `communal responsibility' discourse.

3) Mini-teacher/communal responsibility

Within this discourse there is a communal responsibility for learning. For example: `you're always asking the neighbour for help and the neighbour asks you, so it's kind of mutual'.

Implicit in this discourse is the recognition of the power invested in the pupil-teacher vis-a'-vis the helped pupil: `sometimes if you explain something you feel all powerful'; the pupil may `show off how clever they are'. There is an emotional gain in adopting this position of power, as indicated in this passage:

> D: [he] would feel content, feel content because he has helped someone, and helped something and he realises that he's ..
> A: Why should you feel good?
> D: He's cleverer than that person .. and I don't know it's just an advantage on your psychological brain.
> E: Oh, right, like feeling contented that you helped someone.

Vis-a'-vis the `real' teacher, this position is simultaneously powerful, and powerless. The pupil has the power of understanding the unique problems of his or her peers:

> `He didn't wait for the teacher to finish with the other pupil; he um just asked his neighbour because like a lot of people rather like to get help from people, people on their level, you know from their friends and that than from teachers.'

On the other hand they do not possess the same powerful knowledge that the teacher has invested in her/him:

> `In the long run our teacher is better than some pupils who think they can teach';
> `Yes you know it's also junk asking friends because you know they never sort of explain it properly'.

4) Competitive

This discourse extends the discourse of `individual responsibility' for learning into one where learning is seen as a competitive, rather than a communal activity. If somebody interrupts you or holds up your individual progress, you have the right to be angry:

> F: You feel irritated, especially if you are going ahead.
> H: Especially.
> F: Somebody asks you and you've got to like turn back a few pages ..
> Q: You get to a certain line of thinking.. Everybody is always irritated [laughter]
> G: You want to get your work done because you want to finish it in class, or you just want it finished; you don't want it hanging over your head.

Notice in this passage how mathematics work is seen as a burden – it hangs over your head and you want it finished.

It is not only you own time that is precious, it seems – there is also competition for the teacher's time and attention:

> `you wouldn't care [if the other pupil did not get helped] – you'd rather have it explained to you...I wouldn't care; I'd probably be happy'.

5) Neutral or blameless discourse

In this discourse the pupil is given no responsibility for her/his actions; circumstances are merely occurring around her/him. For example:

> `that pupil probably didn't know that J was waiting to be helped';
> `you don't really notice'.

Or responsibility may actively be denied:

> `it's not your responsibility to look after everyone else in the class'
> `I don't think that you can really blame the person sitting next to him because he is not employed as a teacher here'.

These last statements support the `competitive' discourse as well, in that one has to look after oneself.

The following extract indicates how the taking up of certain positions is not a straightforward process. Here we see a negotiation of various positions:

> G: You would have felt irritated.
> H: Irritated.
> F: But the thing is you, you can feel irritated when somebody does it to you, but then you're going to do it to somebody else.
> Q: I don't get irritated though; I can see other people do, but I don't get irritated.
> F: Depends. [...]
> Q: I don't mind but you see I'm quite stupid so I get flattered if someone asks me. [laughter]

G and H situate themselves in the `competitive' discourse. F's statement highlights the contradiction of the `competitive' discourse and the `in need of help' discourse. Her statement, `Depends' indicates how different discourses may be invoked under different circumstances. Q initially places herself in the `communal responsibility' discourse, but then

takes up the `in need of help' position. Her use of the word `flattered' implicitly recognises the power advantage of the `mini-teacher' position.

POSITIONINGS AVAILABLE TO THE TEACHER

Figure 3 shows us how the discourses available to the pupils either contradict or complement the discourses available to the teacher. This figure highlights the assertion that subjectivity is not an individual attainment, but rather a socially negotiated process. Within this classroom the teacher may be the `disseminator of knowledge', `detached/uncaring'. the `controller', `human', or `neutral/blameless'.

1) Disseminator of knowledge

> E: Ja, but the point is that I think it is always better to get it explained by a, by a teacher than just to get the answer.
> D: They are qualified to help you like that. They are qualified from university.
> E: They like know how to teach rather than to just give the answer.
> B: Depends on the teacher. I think that being taught how to do it is far more beneficial than ...
> D: In the long run our maths teacher is better than some pupils who think they can teach.

The `disseminator of knowledge' discourse clearly links power and knowledge, as seen in the above passage. The teachers are interactively positioned by the speakers as qualified to explain. It is their (the teachers') responsibility that learning take place. This discourse is the complement of the `in need of help' discourse in which the pupils may be positioned, as indicated in the statement:

> `you [the teacher] would just know that somebody needed you which is usual. I mean they're always going like "Help me"'.

It also stands in opposition to the mini-teacher discourse as seen in D's last comment.

In the above example, B's use of the statement, `Depends on the teacher' allows for the possibility of other discourses concerning teachers. In other words, there are teachers who may fall short of the standards set by this discourse. This view is reinforced in the statement made by a person in another group:

`If you are a good teacher you won't forget when someone needs you.'

The use of the word `good' is very powerful here – it allows the pupil to arrange teachers hierarchically within this discourse, or to exclude the teacher altogether from the discourse. It is expected that the teacher would pay an emotional price for falling short of this discourse:

> `he [the teacher] would have felt like guilty that he had like left it so he [the pupil] could just get the answer and not get it explained'.

2) Human

In this discourse the teacher falls from her/his pedestal, and is allowed to join the ranks of the ordinary person, which means, it seems, to make mistakes:

> A: I don't think that's serious. Teachers are fallible. It does happen.
> D: Teachers also are humans and they do make mistakes.

3) Detached and uncaring

Within this discourse the teacher is seen as uncaring, distant or merely detached:

> G: The teacher's probably, probably thinking of his own ..
> F: The teacher shrugs it off.
> G: He doesn't really care – he's thinking more about, about, something about him, his work load or something. He doesn't care about J.
> H: Very busy.

4) Controller

The teacher is seen as powerful or in control in a couple of respects. Firstly there is the knowledge that the teacher holds concerning the subject matter and concerning the `correct' way to teach that subject matter, as exemplified in the `disseminator of knowledge' discourse. Secondly, the teacher is able to determine the timing and nature of the teacher–pupil interaction as indicated in the following statement in which J has to try and try again to gain the teacher's attention:

> `After she, J, put his (sic) hand up for like a few, like half a minute or something and the teacher didn't come, he should have reminded him and then when the teacher went to someone else he should have maybe waited for the teacher and reminded him again';

How much the teacher interacts with the pupil may depend on how s/he feels about the pupil:

`maybe [the pupil] think[s] that the teacher likes the other person more than he likes you; he [the teacher] thinks that you are quite irritating or stupid'.

There is an implicit recognition of the right of the teacher to adopt the punitive mode: `maybe he [the teacher] was deliberately irritated' and `maybe he [the pupil] was coming late'.

This positioning of the teacher as in control is not without resistances from the pupils. The one mode of resistance is to appeal to a moral code: `it's actually, it's very unfair'. The resistance may also take on a more unconscious quality. This was demonstrated by the teacher being given a nickname, and by the statements:

`Shall I tell you my reasons for it [the teacher] being a guy'
`it's just the sort of behaviour that a boy teacher ..
[laughter] ' (my emphasis).

The use of the nickname and the words `guy' and `boy' subtly undercuts the power of the teacher and brings him/her down to the level of the pupil.

5) Neutral/blameless

As with the pupils the teacher is seen as an innocent bystander within this discourse. Examples of statements illustrating this are: `I don't think it's the teacher's fault'; `I don't think you can blame the teacher. Because the other people also need help'; `he probably didn't even do it on purpose'.

GENDERED DISCOURSES

Throughout the discussions and in the essays the were three gendered discourses woven into the fabric of what was being said. The `male norm' discourse was mostly used unconsciously, while the `non-sexist' and `feminist' discourses were invoked on a more conscious or explicit level.

1) Non-sexist discourse

In this discourse there is a deliberate effort to move away from any talk that could be labelled as sexist. There is an appeal to individual differences rather than sexual differences:

`the difference between a male teacher and a female teacher -- it all just depends on the style of teaching and not on the sex';
`the person who is confused – it's an equal amount of chance that it's a girl or a boy'.

The generic personal pronoun (`him, or her', `they' and even `it') was used: `you've been calling the teacher it'.

Within this discourse there is a strong anti–sexist sentiment: `unless you are saying the teacher is sexist'

2) Male norm discourse

Within this discourse the world is described as masculine:

`J is a boy's name';
`Because J is the main character, I took J to be a guy'.

The following is a statement that was made in the female only group:

`I thought it was female and you guys thought it was masculine' (my emphasis).

In the extract which follows interesting slippages between the male norm and non–sexist discourses are illustrated [male only group]:

D: it could be either [sex], I don't think that ..
A: Well, it's easier to give him, well, she, I say him, she, her, it's easier.
E: Well, most peo .. guys automatically say he and most girls say he.
B: She.
E: She, did I say he. [..]
B: ..people generally, when you are talking about people generally you usually talk about them as he; that's not, not like sexist or anything.[....]
E: We've just been saying `he' for everything because it's easiest. We haven't tied any sex into it.

In this conversation there is a conscious statement of non–sexism and an attempt at being egalitarian (e.g. boys say `he' while girls say `she'), mixed with unconscious slippages into the male norm discourse. A gets so confused between the two that he lands up saying nothing sensible. E attempts to be egalitarian, but notice how guys (who started off as people) `automatically' say `he', while only `most' girls say `she'. The rest of the girls presumably join the boys in saying `he'. The `he' slip made by E is, of course, very telling. At the end

of the extract we see how B and E use the non-sexist discourse to legitimate the male norm discourse.

3) Feminist discourse

Feminist readings of the gender issues were invoked, although not predominantly. One person wrote in her essay:

> `The only reason for people believing this myth [that boys are better at mathematics than girls] is that boys often achieve higher marks in maths than girls do, but this, too, is caused by the belief that boys are better at maths. [..] It's a vicious circle'.

This type of alternative positioning was also evidenced in the female only discussion:

> `Only because women weren't allowed to [do mathematics].. I mean it wasn't expected of them'.

Words such as `patronizing', `discriminated against', `disadvantaged' were also used, but by the females only.

SUBJECT POSITIONINGS ALONG GENDER LINES

As seen in Figure 5 the female pupils were interactively and reflexively placed in the `in need of help', `hard-working', and `good girl/caring' discourses, while the male pupils were positioned in the `natural flair' and `assertive' discourses. The arrows in this figure are all rounded, indicating a fairly rigid and neat picture concerning gendered positionings (the discourses all serve to reinforce each other). The only discourse that tends to create a dissonance in this structured picture is the `feminist' discourse discussed above. This discourse, it is to be noted was only invoked by the females in the groups.

As far as the unconscious ascription of gender in the first five questions is concerned, there was no fixed pattern. The teacher was described as male by both the males only group and the females only group. The mixed group used both genders for the teacher. The boys only group used masculine pronouns across the board (all the pupils and the teacher), while the

mixed and girls only group seemed to be more aware of the ambiguity with respect to the pupils, sometimes even using `it' for the personal pronoun.

FEMALE PUPILS:

1) In need of help/helpless

Female pupils were more readily positioned in the `in need of help' discourse. This was done both interactively (e.g. `must be a girl because she doesn't understand'; `you probably won't get the answer [from a girl]') and reflexively (e.g. `I never know the answer anyway'; `sometimes I feel like such a moron in the class'). That the girl positioned in this discourse may have a certain amount of power is recognised in this statement:

> `she really can't help herself or something, she's playing the, the ..'.

This sentence was not completed by the speaker, but it is suggestive of manipulative behaviour on the part of the person, indicating that she is gaining something (in this case attention) from adopting the helpless position.

2) Good girl/caring discourse

Within this discourse the females were positioned as polite and understanding:

> `A girl would've asked politely ..';
> `A girl won't go "It's easy" `cause they are much more sensitive; they know they're being patronizing'.

Girls would `have the temperament [to explain]' or `would have more patience'. This discourse is the opposite of the assertive discourse in which the male pupils were interactively positioned – the girls are seen as passive and accepting:

> `a girl would like put up with it ..';
> `she is not as assertive with the teacher';
> `they [girls] sit quietly'.

3) Hard–working

In this discourse girls are organised and efficient in terms of their work:

A: Girls are far more hard–working, that's also a factor.
B: They care more about their work.
A: Ja, they do. They are conscientious.

Tied to this hard–working ethic is a sense of tension and pressure. The girl is `like always in a hurry'.

MALE PUPILS:

1) Assertive/aggressive

Males are situated as demanding and as receiving attention in this discourse. They know what they want, and go after it. For example:

`guys just go like "yuu"';
`the guys would either start to irritate the teacher, bang on their desk'.

Boys are seen as `arrogant' and irritable:

`The way that it was said, like quickly, just give the person the answer, is very boy–like'.

There is a recognition of a fair amount of insecurity within this discourse:

`boys don't like to admit that girls are better than them in anything'.

2) Natural flair at mathematics

Within this discourse there is the suggestion that boys are somehow naturally better at mathematics than the girls are. Boys `have much more logical thinking'; `they seem to see through figures'. A statement from the males only groups was:

`some of us [boys] have trusted records. I mean we've been in certain maths competitions etc. etc. while this group [of girls] over there they don't ..'.

In the females only group one of the girls said:

> `After all the best maths results are achieved by men,
> aren't they? All mathematicians were men.'

These statements indicate a fair amount of anger. But, importantly in this context, they imply, through the use of the word men, that boys have a future in mathematics.

In the following extract we see how H and G from the females only group position boys as knowledgeable:

> H: they [males] wouldn't know what the answer was [laughter]
> G: But if they did know the answer, then .. well, they
> probably would know the answer.

The laughter implies that H does not really believe her statement. Her words place the males in the `in need of help' discourse, but her use of humour negates this, making them in fact knowledgeable. G recognises this and makes a direct statement situating the males within this discourse.

The boys are seen as good at mathematics even though they `hardly do their homework, usually' and are `more careless' and `messy'. Their natural ability in mathematics also makes boys better sub–teachers thereof:

> `I find it easier to understand when .. Z[male] explains to
> me than when someone like X[female] or Y[female] explain to
> me'.
> `people that people usually go to for help are boys'.

The following is an extract from the mixed group discussion in which the gendered positions are negotiated. In the group K and L are females; N, M and O are males:

> K: Shall I tell you my reasons for [it] being a guy? .. a
> girl would have asked politely; guys just go like "yuu".
> Then another one ..
> L: I don't ..
> M: No, no they do. Sometimes girls just stick up their
> hands. Well, girls and guys do that ..
> K: I'm just generalizing now, and also I think the "How'd
> you do this one?" That's more like a guy talking. "Please

can you help me with this?" That's more like girls ..
O: ..It's just how you say it
L: It's not like [whining] "How'd you do this one?"
[laughter]
K: But you don't go "How'd you do this one?"[stern voice]
N: Okay, I can understand that.
O: Lots of girls do that.
K: Okay, I'm generalizing
O: Must be a girl because she doesn't understand the question.

K positions females in the `good girl' and males in the `assertive' discourses, while L and M try to counter this by invoking the `non-sexist' discourse. K defends her argument by using the generalization caveat, and by using other examples to back it up. L and O counter again, but N eventually accedes to the dominance of the `good girl' discourse. Up until the last statement made by O the good girl discourse invoked by K places the females interactively in a powerful position (although it should be noted that this is an investment that L is not prepared to take up personally). The male assertiveness is put in a negative light. O uses an effective strategy to swing the discussion away from the good girl/male aggression argument (which has little investment potential for him in this context). He introduces the `in need of help' discourse, thereby depowering the females.

FEMALE TEACHERS:

1) Caring

Although female teachers did not feature heavily in the discussions, when they did it was within this discourse:

`you immediately think of a female teacher more motherly type-of';
`And caring'.

MALE TEACHERS:

1) Detached and uncaring

`Male teachers generally think of themselves and their own work load'.

2) Gendered favouritism

In this discourse male teachers are seen as giving special attention to either males or females depending on what position the male/female is taking up. The following extract (from the female only group) serves to illustrate this:

> Q: And especially Mr X. He never asks girls anything.
> F: It's true, ja.
> Q: And when he does it's only because he is trying to pick on them.
> G: No, but it is, it is like a male teacher thing. It's true. They would forget about you and go to someone else and the chances are that the someone else is a guy.
> [laughter]
> F: Or a very pretty girl.

And later:

> H: the male teacher went to help the female because he or she, well she really can't help herself....
> H: The male teacher might feel that it is more important to help the guy because he might feel .. (sentence not completed)

The female pupil is favoured only when she is passively positioned within the `in need of help' discourse, or when there are sexual innuendoes. The male pupil, on the other hand, has a natural and obvious place within the sphere of `teacher's help' and, it seems, a future in mathematics. Note also how the male teacher is situated within the `controller' discourse in this extract in that he is punitive, and the initiator of contact.

Contradictory subjectivity:

It is interesting to note how contradictions are dealt with in the discussions. There is a need to resolve any trend that does not concur with the notion of unitary subjectivity, as evidenced in the following extract concerning gendered subjectivity (females only group, discussing how a male would respond to a classmate asking a question):

> I: A guy probably wouldn't even tell you [laughter]
> G: The guy would say ask some ..
> H: No, the guy would probably be more relaxed, would just say "Oh" – I don't know

F: Actually guys are more relaxed. If you think about the guys in our class they won't say it so fast .. You know they'd like say .. I don't know how they'd say it.
H: But girls also, she, she knew what to do; sometimes guys aren't as – I don't know.
G: They get like ..
H: They are not as organised in their thoughts.
G: But actually it doesn't make sense because we first said that the teacher wouldn't be a woman because a woman is more caring and now we are saying the neighbour is a woman, and she, and she is doing this.
I: No, but that's not, that's not not caring ..
H: It's different though ..
I: Just more organised.
G: Ja, like more efficient.

The many `I don't know' statements in this extract indicate that the speakers are having trouble situating males within the caring discourse. The contradiction that is pointed out by G is quickly resolved by uniting the `caring' and the `hard–working' discourses.

NATURE OF MATHEMATICS

As we saw in Chapter 2 the way in which mathematics is viewed has very real effects in educational terms, as well as in terms of power. The pupils in this sample seemed to see mathematics in an absolutist sense, although there were variations as to the exact nature thereof. Sometimes it was the process that was important, and sometimes it was the answer. The power of mathematics in an absolutist sense was recognised, and tied to this was a sense of alienation, and a view of mathematics being stagnant.

1) A process

Within this discourse Mathematics is seen as a process; the final answer is of little importance:

`He didn't really get the answer. Well, he got the answer, but not ..';
`Teachers aren't there to give you the answer; they are there to explain how to do it'.

The concepts are important, not rigid rule–following:

`it's a way of thinking, not a way of doing something';
`if they just say "oh, just move this over there", and they don't explain why you should do that, then it doesn't really help'.

2) An answer

Within this discourse, contrary to the above one, the answer is all important, determining right from wrong:

H: We get the answer [from the teacher] but you look at the answer and you like look at your working out and you think that your working out is right and you like say "whoa!" [laughter]
G: And there's like no way on earth, there's no way that you can change your work to get to that, the answer'.

3) Powerful

In this view mathematics is seen as unproblematically real and absolute. It is able to express the world in unitary terms:

`I think it's teaching you to convert real-life problems into geometry problems and they can then be converted back.'
`Basically a real-life situation can often be expressed into a formula and maths is just teaching you how to break down those formulas, and how to work with them'.

This view of mathematics is closely linked with its power within the technological and scientific spheres, as illustrated in the following passage:

B: The point is to use it in the professional ..
E: If you become any kind of engineer, then you need maths to work out stresses. Any kind of scientific thing, you just need maths.
D: Science can be called practical maths. That's one for the record.

There is an implicit recognition that there are those who are good at mathematics and those who are bad at it. Thus mathematics has the power to differentiate between the possessors and the non-possessors of its powerful knowledge:

`I think the stream-lining is good';
`That type of subject is the type where you are meant to be good at it and you meant to, you meant to know everything [laughter]'

4) Alienating

In many respects the pupils seemed to feel alienated from process of learning mathematics. They perceive it as difficult, and something with which one has to struggle. Statements such as `it's quite intimidating'; `we can't all handle it'; `I didn't know what was cutting' and `now I am so unconfident' indicate this. It appears also that mathematics is not seen as something meaningful and real in the students' lives:

> `They say imagine this is a tree and this is a yacht sailing whatever, it's totally irrelevant';
> `very few people are actually going to use our maths'.

5) Stagnant

One single statement in the discussion showed that the speaker sees mathematics as a stagnant, rather than as developing discipline: `All mathematicians were men'.

In this chapter we have viewed the discourses that seem to be operative in this Standard 8 Higher Grade class. We have seen how some of these discourses complement each other or alternatively contradict each other. It is important to note that the processes by which meaning is achieved are complex, and we cannot hope to capture the all the intricacies thereof. Nevertheless there seem to be some identifiable patterns that have emerged, and which have an important bearing on the power relations and the position of girls in mathematics education. This is discussed further in the conclusion.

`it's a way of thinking, not a way of doing something';
`if they just say "oh, just move this over there", and they don't explain why you should do that, then it doesn't really help'.

2) An answer

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There is an implicit recognition that there are those who are good at mathematics and those who are bad at it. Thus mathematics has the power to differentiate between the possessors and the non-possessors of its powerful knowledge:

`I think the stream-lining is good';
`That type of subject is the type where you are meant to be good at it and you meant to, you meant to know everything [laughter]'

4) Alienating

In many respects the pupils seemed to feel alienated from process of learning mathematics. They perceive it as difficult, and something with which one has to struggle. Statements such as `it's quite intimidating'; `we can't all handle it'; `I didn't know what was cutting' and `now I am so unconfident' indicate this. It appears also that mathematics is not seen as something meaningful and real in the students' lives:

> `They say imagine this is a tree and this is a yacht sailing whatever, it's totally irrelevant';
> `very few people are actually going to use our maths'.

5) Stagnant

One single statement in the discussion showed that the speaker sees mathematics as a stagnant, rather than as developing discipline: `All mathematicians were men'.

In this chapter we have viewed the discourses that seem to be operative in this Standard 8 Higher Grade class. We have seen how some of these discourses complement each other or alternatively contradict each other. It is important to note that the processes by which meaning is achieved are complex, and we cannot hope to capture the all the intricacies thereof. Nevertheless there seem to be some identifiable patterns that have emerged, and which have an important bearing on the power relations and the position of girls in mathematics education. This is discussed further in the conclusion.

CHAPTER 5

CONCLUSION

In the first two chapters of this thesis I briefly discussed the theoretical premises of post-structuralism, and reviewed the literature concerning gender differences in mathematics. These chapters formed the backdrop for the rationale and methodology of the research. As we saw in the section on the `facts' of gender differences in mathematics, the `differences' appear mainly in the upper levels of mathematics. The use of a top achieving higher grade class in a `good' school in this research thus represents a theoretically salient sample. The conclusions reached from an analysis of discourse within this sample should be incisive in illuminating the processes that are in operation concerning gender differences in mathematics. As we have seen the conclusions that research such as this brings to light are vastly different from those allowed by traditional methodology. The post-structuralist framework demands a questioning of taken-for-granted assumptions - the usual is viewed as strange, and the obvious is unpicked. These `alternative' conclusions are discussed below.

It is interesting to note that many of the arguments and justifications used by the pupils participating in this research are reflections of the arguments and justifications put forward by the `professional researchers' in this field (see literature review in Chapter 2). There is an appeal to biology, nature, socialisation, and `scientific' evidence. That these arguments and justifications are similar is no accident. They form different layers of a powerful social dynamic that situates girls and boys within certain positionings concerning mathematics. They are, in other words, part of the dominant discourses that serve to reproduce and concretize the notion of gender differences in mathematics. How these dynamics play themselves out are, to a certain extent, illuminated in this research.

Within the mathematics classroom a tacit contract exists between teachers and pupils. This contract has many clauses, some of them very subtle and unconscious. In the analysis of the data, we have seen just some of the patterns of interaction that are allowed pupils and teachers within this contract. Note how the discourses within which teachers are positioned to a large extent complement the discourses that position pupils. The teacher is responsible for learning and is in control within the classroom. The pupil is in need of educational help, and

is a passive recipient thereof. When the teacher, on the other hand, is detached and uncaring, the pupil must take individual responsibility for his/her own learning. The teacher sets examinations which discriminate amongst children on the basis of achievement therein, and the pupils engage in competitive behaviour in the classroom. The interactions in the mathematics classroom are bound together by the dominant discourses within which the teacher or pupil may be positioned. Other anomalous themes and discourses appear as resistances to these discourses (e.g. the teacher as `human'; the use of a nickname for the teacher; placing the pupil in a neutral/blameless discourse; refusal to be positioned within a certain dominant discourse), but these generally do not have the power to subvert the dominant readings. Teacher and pupil alike adopt the positions offered by the dominant discourses as they (through long practice by high school stage) have discovered the investment potential therein (such as power within the classroom, regularity, security, feelings of achievement, feelings of satisfaction in being a carer or a good helper). These patterns are contained, of course, within the wider institution of schooling, with its numerous contracts and subcontracts between the various players. The existence of a higher, more pervasive structure, which influences the interactions within the classroom, is subtly recognised within the discussions: `it is not her fault'; `you can't blame the teacher'.

The negotiation of power within the classroom is clearly a dynamic and multi-faceted one. While the teacher has institutionalized power and is attributed power by the pupils by virtue of formal qualification and training, the pupil gains informal power in various ways - by being a mini-teacher; by achieving his/her (the pupil's) aims by manipulating the teacher (e.g. by acting helpless); by undermining the teacher's authority, either overtly (e.g. by not doing the homework prescribed), or in a more subtle way (e.g. by making him/her `human' or by ridiculing him/her).

It is clear from the discussions and essays that the girls in this top achieving class are caught in a double-bind situation as far as mathematics is concerned. Despite the fact that there are more girls than boys in the class and that `a girl got the highest mark in the last exam', they are not seen as being good at mathematics. They `learn by wrote [sic]', `work harder', `are more organised'. Their success, it seems, has little to do with their ability, but is rather a function of their putting in sustained effort. Boys, on the other hand, seem to have a natural place within the mathematics world. They `hardly do their homework', yet always know what

is going on. They have a `natural flair' which means they have access to a world where understanding is of key importance. This is reflected in the professional literature where it is posited that girls' strategies are not suitable for the higher levels of mathematics. A further twist in the tale appears however when one views the epistemology surrounding mathematics. The dominant notion of mathematics is that of absolutism – it is a sure and certain knowledge. When viewing the power/knowledge axis, boys `natural flair' at mathematics starts to take on a powerful meaning.

It is not only girls' (lack of) ability that mitigates against their position within mathematics however, but also, it seems, their positioning within the good girl/caring discourse. Mathematics, seen as a competitive subject, is more suitable for those who assert themselves and are confident, even aggressive, in their right to be heard within the mathematics classroom. As we saw, this positioning was only available to boys within the discussions.

In chapter 1 I reviewed Parker's (1990) discussion of the process of alienation that occurs when responsibility is taken away from those working within organisations or institutions. It is evident that the pupils who took part in these discussions find the system of tests, exams and set work alienating: mathematics is `irrelevant', `pointless'; there is a concern for what is coming up in the exams – one girl said quadratics was sure to be in the exam; `I worked so hard for it [the test] you won't believe and I got like an E' (for this girl the reward is not in the intrinsic value of doing the work but in obtaining a satisfactory grade); it is the type of subject where you are `supposed to know everything' (in other words there is no place for ordinary mortals). While both girls and boys are exposed to this process, I would argue that girls are further alienated by their positioning as hard-working, but without natural flair in mathematics. The characteristics that make it possible to achieve in mathematics are ascribed to males. This reading, which is legitimated by the historical reading (`all mathematicians were men'), means that for girls there is little unconscious investment potential in being a `mathematician'. Yet, on the other hand, they are being constantly encouraged to participate in mathematics by the non-sexist discourse. This creates another double bind, from which there is little escape (as a mathematics teacher I was constantly being told by parents that they want their daughters to continue with mathematics to matric as it is also important for girls nowadays; almost in the same breath I would hear how girls are not as good as boys in mathematics).

The use of the gendered discourses in these discussions is interesting. The male norm discourse, which defines the mathematics world in masculine terms, serves to entrench the superior positioning of males within this world. The non-sexist discourse which is used concurrently with the male norm discourse serves to obscure this definition (because after all we all have an equal chance at it). This combination is tremendously powerful. The resistance to it is the invoking of the feminist discourse which in this case was used exclusively by females. These girls, it could be argued, being consciously or unconsciously aware of the double-bind position within which they are caught concerning mathematics, are using a counter discourse in order to make sense of their positioning, and possibly to disentangle themselves from that position. The feminist discourse allows an alternative reading, and for the females to achieve some degree of power within the situation.

In summary, it seems that some of the processes of disciplinary technology concerning gender and mathematics have been highlighted in this research. The patterns that are at work within this high-achieving, middle-class mathematics classroom are similar to those found by Walkerdine in her extensive research. It appears that there are very firm and clear barriers to girls' participation and achievement in the upper levels of mathematics. These barriers are made all the more powerful by being obscured by the apparent equality of opportunity.

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Appendix 1

VIGNETTE

J was working on a maths problem. The figures seemed to be coming out all wrong. J felt anxious and thought that it was probably best to ask for help. J signalled to the teacher, who responded by nodding. After waiting for a while, J realised that the teacher had forgotten and had gone to help another pupil in the class. J leaned over to the person next door, saying `How'd you do this one?'. The neighbour replied, `It's easy. Just take the 3 across and make the plus a minus, and then put the 2 under the 3'.

Appendix 2

QUESTIONS WHICH FOLLOWED THE VIGNETTE

1. How would you have felt if you were J?
2. How would you have felt if you were the teacher?
3. How would you have felt if you were the pupil the teacher went to help?
4. How would you have felt if you were the neighbour?
5. Do you think that any of the people in the story should have acted differently? How?
6. Think carefully of the sex that you have been calling J. Is there something in the story that suggests that J is a boy/girl? If you think that it has nothing to do with the story, please expand.
7. Think about what sex you have been calling the teacher, and answer the questions of 6.
8. Do the same as in 6 for the neighbour.
9. Do the same as in 6 for the helped pupil.
10. How do you feel about Maths yourself? What would you like to be different?

Appendix 3 Transcripts of group discussions

Transcription of group 1 boys
From left to right A B C D E
Question 1
E: how would you have felt if you were J? If you were the person who was working on the problem
: Quite con ..
B: Pretty desperate
E: Well, why desperate?
D: I would be confused because ..you really haven't done couldn't do it
A: That's happened to me before with Strauss
E: oh right
D: And his neighbour said um His neighbour said something that doesn't make sense. It would only work for that one problem. It wouldn't work for any others.
E: Oh right, his neighbour didn't explain to him how to do it, he just told him.
D: Ja, just told him the answer which is, which would work for that one question
A: It would have been better to just try to do it again
E: And then afterwards J would have thought how do I do this in future, if I get a similar problem
A: Just look in the text-book.
E: Ja, what so you feel
A: It should be in the text-book..
E: Desperate
B: Ja, well, I mean, you know when you can't do a problem, you feel quite..
A: I mean this happens to lots of people.
E: Well, I mean, ja if you can't do a problem basically.
A: The figures coming out all wrong
C: Feel insecure. Doesn't know what is going on
A:..he was just like getting confused and doing something wrong. B: I would probably feel more confused after this, the way that he has explained that.
E: Well, I mean, obv.. it must like resolve the problem. J must say `oh ja. okay, that's how you do it'.
B: He won't know how to do that kind of problem though in future. A: Just ask another st.. another person
B: Well, ask the guy to explain generally how do you do it
C: the process behind it, and if he doesn't he's going to be confused.
A: He can also go onto another sum.
E: Ja, so basically it's best to get it explained rather than just
Question 2. How would you have felt if you were the teacher?
E: Well, I don't know, I've never been in that situation.
B: Well, the teacher forgot about him, so..
E: Oh, like afterwards.
B: Well, the teacher wouldn't have known about it.
E: How would you have felt if you were the teacher.
C: The teacher would have.
A: The teacher wouldn't have felt anything.
GEN:Ja [laughter]
B: Well, this doesn't relate to ..It has got nothing to do with the teacher.

E: Well, hang on, I guess when the teacher calls him. The teacher would have thought a kid with a problem.
B: What, the teacher nodded.
E: Ja, the teacher thought `Well okay I'll get to you, just like hang on and obviously had some or another other. No, the teacher would just ..
B: Well, the teacher just forgot about it.
A: If there was a problem the girl/boy would just ask him again. E: I think the point is if the teacher would had then found out afterwards what had happened, he would have felt like guilty that he had like left it so he could just get the answer and not get it explained.
B: Are you assuming that the teacher found out that the guy's neighbour explained to him..
E: Well, we can't really analyse this if the teacher doesn't find out ..Okay otherwise the teacher just thinks okay I'll help this. B: What would happen if the teacher does find out?
A: Well then the teacher would say `Okay, I'll help you now'
E: Ja, quickly correct the situation, explain how it happened. A,B:Ja.
D: Otherwise, the teacher would forget and that would be the end of the story.
E: It would You're not saying much. Okay, next question.
B: It doesn't matter who says what.
Q 3:
B: Eh, quite guilty because the teacher chose to help you over the other...
C: No, I don't think you would feel anything .. the teacher went to help you.
D: Because you wouldn't realise that the other ...
C: you were not aware that the other person had signalled.
B: Just assume that everybody knows exactly what the position is E: Ja Everybody knows everything 'cause otherwise other pupils will think that I'm getting help and they know the whole situation up there
A: But, if you're the pupil, you don't feel anything. You just think `Oh he'll go to the person afterwards....
B: I might say, I might say, `Oh, but he was asking first', or something I mean I wouldn't just ...
D: I think that is a bit of a exaggeration, because the teacher could help the pupil afterwards ..he's helped that person.
E: Well the teacher forgot and then he got the answer while the teacher was helping someone else.
B: He didn't really get the answer, Well he got the answer, but not ...
D: He could go ask for further help.
B: Teachers aren't there to give you the answer; they are there to explain how to do it.
E: To teach.
B: So the teacher could still help.
E: Ja,ja
B: Okay but the question is how would you have felt if you were the pupil the teacher went to help.
A: I wouldn't have felt anything, I mean you don't think like shame C: You just want the teacher to answer your problems quickly as possible.
E: Ja ..teach teacher, and you want to get on with your work.
C: Don't want to hold up your hand for ever ..
A: Ja, I suppose so.
E: Ja, um I think .he would have felt quite happy that the teacher comes gets explained and the teacher leaves rather than sitting there while the teacher walks around the class.
B: Probably wouldn't be such a big thing in his life. [laughter] E: I doubt it. Shall we go on? Ja, Okay.
Q4.

E: Aha, that's a good one.
A: The neighbour?
E: Yes.
A: The neighbour wouldn't have felt anything.
B: Ja, the neighbour would have felt good that you had helped someone.
C: But the neighbour doesn't really know how to do the thing.
D: He knows what's cooking so he would be, ... so he would just quickly tell this person J the answer, so that he could get on with his work.
E: Well, I think that there are two possibilities – the neighbour could either have just felt irritated – how do you so this one? just do this one quickly, just try to. If the neighbour is doing their own work, they probably feel quite irritated, with the guys leaning over.
B: No, I don't mind.
E: Ja, that's your personal thing. Sometimes I get irritated because people ask me over and over again.
D: But look at this: How'd you do this one; it's implying, it's implying that he, he's already asked his neighbour um several times.
B: No, no, it doesn't mean that. It just means that `How'd you do this one; how'd you do this'.
E: But the point is that the neighbour could either have felt irritated that he was distracting him from the one that he was doing.
B: Well, most people don't mind helping other people.
A: The neighbour shouldn't have said `It's easy'
B: I don't mind helping people. Most people don't mind helping. E: I Don't mind helping, it's just that sometimes I have to help the whole double...no, no, the point is that the neighbour would probably have felt like quite good in saying like `Oh, it's easy' and try and make the ou you know, show off how like clever they are, 'cause saying `It's easy' when somebody else can't solve something always makes you.
B: I think it's asking not how 'cause we can see how this neighbour felt from the story it's saying if we were the neighbour before he said that it's easy and all that.
E: I see.
A: He really shouldn't have said that it's easy though.
C: If you're saying it's easy he's just saying to the neighbour. In other words `Don't feel so uptight about the question'.
E: That's possible, that's possible., But, ja, he possibly just gave the answer and he probably felt like quite good that the other guy couldn't do it, Whether the `It's easy' was because he thought that it was easy.
B: No, he wouldn't have felt good.
A: Why would he have felt good?
B: Well, I wouldn't have felt good, it's asking how we would have felt ...
D: I would feel content, feel content because he has helped someone, and helped something and he realises that he's ..
A: Why should you feel good?
D: he's cleverer than that person – his or her person, and, he or her, ja, and I don't know it's just an advantage on your psychological brain.
E: Oh, right like feeling contented you've helped someone.
B: Ja.
E: Right.
B: Wait, wait, um ???
C: It's easy. In other words, I know the question, it's easy for me, but it's not for you.
E: Ja, Ja that's what I'm saying – like putting the other guy down. B: But also this thing about the guy he didn't wait for the teacher to finish with the other pupil; he um just asked his

neighbour, because like a lot of people rather like to get help from people, people on their level, you know from their friends and that than from teachers.
E: Ja.
B: That's why I find ..'cause I mean a lot of people would have just waited for him to finish with the other person and then asked him to come; you know like reminded him that he had called him, whatever.
A: I always ask Strauss, I never ask Mr B. Yes, because I think he's always walking around with us, I would , I would prefer to ask Strauss
Q 5/ Ja, oh, well okay.
B: Well the neighbour shouldn't have said it's easy.
E: [Completes q.] I was just saying the teacher immediately, shouldn't have forgotten the guy ..I mean that's the first obvious one.
A: I don't think that's serious. Teachers are fallible. It does happen.
D: Teachers also are humans and they do make mistakes.
E: No way.
A: I don't think the teacher really is wrong, I mean what can you do?
D: In a situation like this, a teacher would go up and help that pupil first because he asked first.
E: I think, I think that, ja, okay this is just one little thing and it seems to be a fairly easy problem. I mean, imagine if it was a large problem and the person then never got it explained, they like solved the problem, and they were still unsure about it. A: But they can ask again.
E: And then exams they then lost marks in that section and then they never like understood that.. Yes, they could ask again, but what happens if they don't get one, like, that tricky again. Ja, ja, I'm just saying that the teacher not teaching that guy could have, could have, like bad effects, because he wouldn't know it in future, because it is better to get it just actually properly taught than just told the answer.
B: Um, also, maybe, even, even those people who don't understand a lot of them prefer to maybe he shouldn't have asked his friend, because teachers, well that's what they are there for.

A: No, but they are supposed to be teaching and you're supposed to be ask your neighbour before you ask the teacher.
D: No, you're not.
E: No way.
B: The teachers don't think that. That's the wrong way around. I think that
A: Like in Science, Mr XX said `Well, just discuss with your neighbour, like if you ..
E: No, then he's telling you.
A: Then later if you don't understand it really then you ask .
B: We aren't supposed to talk in class.
E: In certain situations. Ja, but the point is that I think it is always better to get it explained by a, by a teacher, than just to get the answer.
D: They are qualified to help you like that. They are qualified from university.
E: They like know how to teach rather than to just give the answer. B: Depends on the teacher. I think that being taught how to do it is far beneficial than ...
D: In the long run our maths teacher is better than some pupils who think they can teach.
B: Ja, some pupil.
E: Pupils generally, generally, can just give the answer.
A: No, but pupils also are, are on the same level
D: this is a general statement of course
A: I can't see why there shouldn't be able to explain ...
E: Okay, and then the neighbour? Should the neighbour have given him answer?

B: No, wait, there's another .. the guy that the teacher helped. I mean, if you want to be moral and that then he should have said `Look, he had his hand up first'.
E: Aaah, I doubt he knew.
B: But, that doesn't happen.
E: Okay, I think that's minor.
D: You wouldn't do that though.
B: Ja, I know; maybe it's the right thing.
E: But the one thing. Shouldn't the neighbour have given him a little bit of time and like tried to just like give him a hint. A: No, he should have shown him what to do.
B: Ja, he should have shown him what to do.
E: Ja, well basically not just given him the answer and also I mean he says, he says um take the 3 across and make the plus a minus and then put the 2 under the 3. Why doesn't he just say take the 3 across and make the plus a minus um giving the guy you know like a start in the problem. What he did ..
B: Well that doesn't help ..
A: Surely he should explain like what to do not just..
B: Ja. explaining what to do is better than giving half the solution and then asking you to work out the rest.
E: And I think that we've said before that saying that oh it's easy kind of makes a guy feel bad about it so in future he's going to kind of like I don't know he's probably going to think that he's stupid on problems like that.
B: Well, he is.
E: I don't know.
A: Totally depends on that person. Okay next one.
QUESTION 6 Have we done 5 questions already. Think carefully .... B: Well, J is a boy's name.
E: I think .....Being confused it's probably a girl.
D: That's a very general remark, please excuse E's ..
E: Shut up.
A: Often you just think say like the teacher's a male because we have like a male teacher.
E: Ja ..
B: No, we're talking about J, not the teacher. We're talking about the sex of J.
A: I mean J could be either.
B: J is the pupil ...
D: Ja, it could be either, I don't think that ..
A: Well, it's easier to give him, well, she, I say him, she , her, it's easier.
E: Well, most peo..guys automatically say he and most girls say he. B: She.
E: She, did I say he. I mean, I generally when I refer to a person, I just say like he.
B: But also people generally, when you are talking about people generally you usually talk about them as he; that's not, not like sexist or anything.
E: I think it's only guys who do that; I think that girls..
A: But J, I mean it's not nice saying the person ..
B: So what we are saying is, no but the person who is confused it's an equal amount of chance that it's a girl or a boy....
D: Shall we bring up that controversial discu, discussion of the heman instead of the hewoman.
B: Ja it's the same thing. It could be either, heman or he-woman. E: I think that the girls group will make a good deal of that question. No, I think ... `If you think that it has nothing to do with the story, please elaborate'
A: It has nothing to do with the story unless you are saying that the teacher is sexist.
D: No, we are just saying that that is one possibility ..

B: Oh, oh ja possibly if it's a girl and the other guy who the teacher helps first is a boy, maybe the teacher has, you know, like tried to encourage the boys more than girls, which is what a lot of people say.
E: Well, we've been saying `he' for everything, so we are not discriminating. [laughter] Right, shall we go on .. anyone?
A: But J is usually a boy's name.
E: No but it not meant like J. You use it just as a place holder. A: It's usually like John Junior, J.
E: Call it Z okay.
D: Z, well done.
E: Oh, I see things starting with J.
A: J J J Whatever, if you take anything.
B: So James starts with a J.
E: Well, so does Janet.
A: Joyce.
QUESTION 7:
E: I told you, no I didn't tell you, I thought it.
A: What , repeat what ..
E: [repeats q]
A: No.
B: Well, our maths teacher, my maths teacher for the last two years has been male.
D: Same with myself. So, you associate maths teachers with..
E: I've been imagining it in this class; I've been imagining a male teacher; I've been imagining that..
D: ja one person who sits over there over here and the one person that sits over there and so forth.
A: I always sort of think of Mr Z isn't. I wasn't thinking of Ms Y B: I think what it is basically asking is do you think the teacher whatever sex he has she was would have helped a person of his or her sex first. But I don't think really applies. I mean I don't think.
E: We've just been saying `he' for everything because it's easiest. We haven't tied any sex into it.
B: I don't think a teacher would have gone to someone of their sex first.
C: Depends on how ..
E: What's that?
C: Depends on how much he was chauvinist.
E: Ja, of course. Just trying to find out what our views on ..
B: There was another question with question 6, wasn't there.
E: [reads q] Our teacher is a male, so why can't we make this one a male. Okay, well, I think these are pointless.
QUESTION 8;
A: If you think your neighbour is a male.
C: Well, it depends if you think boy as to boy
E: In our maths class the people that people usually go to for help are boys.
B: Namely E.
E: And you.
A: Put it this way S sits next to me, so it's very personal.
C: A boy will ask a boy and girl will ask a girl.
E: No.
B: No way, they'll go to the best in the class.
A: You'll ask anyone.

E: But R[f] asks D[f]. R and D are always conferring. I think that it's only if they have like a really tough problem.
B: R always come to me and you for help.
A: No, they do they always confer with each other during class as while he's teaching.
C: Put it this way, I think the first thing you do if you're unsure about a problem is you walk around to find someone to answer for you
E: Nearby
C: and if it's a girl you most probably will go and find another girl.
E: But then you probably won't get the answer.
A: That's sexist.
C: and if you're a boy you turn around to the nearest boy and say.. D: .. question. first of all I think the question in this is `do you think the neighbour is a boy or a girl? I think it was a boy because a girl would ..
B: Firstly, a girl sits next to a girl and a boy sits next to a boy.
A,E,C,D: No, rubbish.
B: No, okay, it is it is.
E: No, okay, generally.
D: Can I finish, please, can I finish, please. You just take it from my. The way that it was said, like quickly just give the person the answer is very boy-like.
B: Sounds like a boy.
D: Sounds very much like a boy.
B: because boys are more arrogant than boys.
D: A girl is likely to sit down and discuss.
E: I don't think so.
D: I would think so. Would have temperament, and wouldn't ..
E: You can't say that ..
D: would have more patience.
E: I don't think. This group over here, nobody ever goes to them for help. No names. Well they sit over here.
D: I think that girls explain a lot more slowly than boys.
E: The point is why does no-one ever go to this group for help? Because they'll..
A: They sit quiet..
E: They'll come from there to come to our group to ask for help but I mean are equally, are almost as good as us.
A: They're too quiet though, they wouldn't help you.
E: Do you think that they wouldn't help?
A: No ways, they're too quiet.
D: Do you think that this group of girls ..
A: They are very quiet in class. They wouldn't readily help you. D: Depends very much on the girl.
A: I mean if B[m] went over to there. I can't see them like being very friendly.
E: The point is that when someone asks me I never just give them the answer.
C: But some of us have trusted records. I mean we've been in certain maths competitions etc. etc. while this group over here they don't ...
B: Can I talk, please.
E: Yes, B.
B: Also, I'm pretty sure that a boy wouldn't go to a girl for help.
E: Do you think so.
B: Cause boys don't like to admit that girls are better than them in anything.
D: Ja, that's a good point.

E: That's that's possible. I mean I like ask N[f] for help but that's a strange situation. Well, when I can't get something like you ??? in class [l].....
QUESTION 9
C: Depends on how mature you are.
D: Haven't we already discussed that?
E: No, the helped pupil, the pupil the teacher goes to help. C: Well, it depends what the teacher is, what sex the teacher is that determines ..
A: What's the question?
C: If the teacher is female..
E: Okay the question is.. Hang on.
A: No, we've gone over this.
E: The helped pupil, we haven't done that one. Ja. I think we've, in my mind I have actually been thinking of the helped pupil as a girl, which is strange because it is generally the girls who like ask.
D: Girls ask all the time. Because J is like in the story, like the main character in the story I took J to be a guy.
B: I think that you're assuming too much, you're jumping to too many conclusions. Maybe the answered person was just closer.
A: No, B, you take our class, the girls always ask all the time and the boys never ask.
E: Ja, that's true.
A: They never ask, once in a while, one question, sort of. And then that corner asks all the time.
E: But, um, in my mind I've been imagining the helped pupil as a girl because..
A: You associate it from this class.
E: From this class though.
B: So why's it like that in our class? Why do you think it's like that?
A: Well, there are more girls than boys in our class, I must say though. And the boys, there's a lot of top boys, like Q.
E: D, why are you writing on your wrist this is a sexist discussion.
D: Give us a break.
A: Girls are far more hard-working, that's also a factor.
B: They care more about their work.
A: Ja, they do. They are conscientious.
C: Maybe the teacher is avoiding that J 'cause maybe J should be a GCD.
A: And half the boys in our class don't do their homework.
B: What's a T C D?
D: That's because the teacher involved does not check.
A: The boys hardly do their homework, usually, but they don't care so much, as much. Okay next question.
C: What have you been talking about?
A: We've been saying that the girls are more conscientious.
E: Okay, so they ask more questions, but why didn't the teacher..
D: I think the teacher forgot.
B: The teacher, ja possibly, but maybe the teacher wants to help a girl first before a boy because like in science class for instance the boys there are quite a few boys that ask ..
E: Stupid..
B: Totally unrelated questions.
D: In my science class the girls never ask questions.
E: Okay, no no but this is specific to maths class and I don't think there are very few people who ask questions like, really like advanced questions in this in this class. I mean like occasionally if ...

B: Remember we had G in our class last year, yes G [laughter].
E: I mean, ja, he would have asked ...
A: They were so stupid his questions. Perhaps Mr B would have avoided them because he was just showing off. That's another thing – guys show off a lot and so the teacher might have avoided him. D: They want attention.
E: But I mean we know that J isn't like this because I mean J ..Ja, because J is stupid. Well, whatever, not stupid, um, whatever, He wasn't like showing off to the whole class which is calling the teacher over.
C: I think that J was asking this question in other words saying I'm dumb, whereas in the case of G he's asking super-complex questions to make sure that the teacher cannot answer.
B: To make sure that everyone else ??Finished
D: I think that J, I think that J..
C: Felt anxious.
D: Wait, wait ..
C: Felt anxious.
D: Wanted attention.
C: No.
D: She or he when the teacher walked to the other side would have called out to the teacher and said `Hey, I put up my hand, so'. B: Ja, that's possible. A boy would probably have objected if the teacher went to the other one first.
A,D,E:No, no.
E: Girls do. come on girls always do.
A: You're taking it from like very immature people, I mean it's.. E: Well, we're talking about people in this class and generally they are very immature.
A: They aren't , I mean they aren't so immature that they asked you first.
D: The new prefects
A: Maybe the prefects would ask them.
QUESTION 10:
D: What a big question.
B: What , maths classes. Ja, that's a major question.
C: I more hands on sort of thing.
E: More active problems.
B: I think maths.
E: What's on the board at the moment. We're working out cost price and sales price and vat inclusive price. I mean that is , I'm just looking at the board, okay. I mean this whole bit is totally and utterly un..
B: You know what I can't stand is when you are doing trig or something and they ask you a question..
E: more practical..
B: about height and they say imagine this is a tree and this is a yacht sailing whatever, it's totally irrelevant and you have think oh it's this triangle, and you are basically learning with triangles.
E: But I think it's teaching you to convert real-life problems into geometry problems and they can then be converted back.
B: The thing is it's pointless.
D: It isn't pointless, because you..
B: At the moment we're learning basics, how to do.
D: Okay, you go out into the world and you are not going to do it and you're going to go okay what did I learn in school, oh I learned that so, so and so, so, but if you if you use that information that you learned in a real-life situation, for practical use.
A: But I think that maths..

D: It's a way of thinking, not a way of doing something.
E: Basically, basically, a real-life situation can often be expressed into a formula and maths is just teaching you how to break down those formulas, and how to work with them. Like, I mean, a quadratic ..you are not going to look art a tree outside and think hey I can solve that tree which with a quadratic. No, no but there might be something about the height of a tree.
A: Very few people are actually going to use our maths.
B: But learning maths at school, the point is not to apply it in real-life; the point is to, is to use it in the professional, I don't know. It's nothing.
E: If you become any kind of engineer, then you need maths, to work out stresses,.
B: But that's at university.
E: Any of the scientific thing, you just need maths.
A: You do that at UCT.
D: Science can be called practical maths, that's one for the record.
A: No, not really
E: Ignore it, it will go away.
A: No, not really.
B: Is this the last question.
E: Yes. Sets is definitely a good idea.
D: Ja, working in groups, working with people.
B: Still, there is still a huge division in the sets among our people.
E: Yes.
B: It would be ideal if we could have like 25 sets or something. A: No,no, I think this set should be about 20. Ja. 'Cause not everybody in this set can understand what is going on. Every set should be about 20. There are about 10 actually.
E: Yes, but, I mean the point is the set is usually..
C: What if you did the sets like a ?? diagram, where you have the few at the top and the few at the bottom.
E: That's true, that would be ideal because the bottom and the top should need special attention, kind of thing. But then you send them off to gifted schools.
A: Often, like I'm not logical enough to follow everything just like that and it's taught just like blah blah blah. He doesn't stop to exlpain things very often.
E: I think that a lot of people in this set are very lost. I'm going to move on ..time..
A: Don't worry about time. Okay we're now back on question on. B: No, we haven't finished q 10.
E: Okay how would you like maths to be different. I think that they should include more, you know like you learn ?? theorem.
B: Ja, the syllabus is very limited. To make maths more interesting we should learn more interesting things.
C: You do it all hands on, and you don't just watch the teacher do it.
E: No, no but the thing is that syllabus is going very far forward kind of thing and we're learning quadratic, imaginary numbers ... B: We are extending ourselves.
E: I think that if we learnt stuff like, aah man what's that stuff? ?? theorem. Like do more maths instead of getting to more and more advanced maths you pick up maths at a more basic level.
B: And then you never get anywhere.
E: Anyway, but why do you need that? I mean how many people in this class know how to test for water visibility by eleven. It's a useful thing in everyday life it's something that you never use and there are so many little useful things in everyday life that we never learn and meanwhile we're learning abstract quadratics and stuff which is a little bit useless.
B: Ja, things like trig and .. And if you want to go into the maths profession.
A: Imaginary. okay are we finished

Transcription 2 girls only
From left to right: F G H Q
H: You all read that? and the first question is...
F: Confused.
G: I would have felt very embarrassed.
Q: Yes, you know it's also junk asking friends 'cause you know they never sort of explain it properly.
F: In a hurry.
Q: Just tells you what to do, but not why you do it.
G: And if they say to you it's easy then you feel, then you feel.. even worse.
H: I think sometimes it's best if you try and work it out yourself. It's difficult asking other people sometimes and you don't really learn from it especially in this specific example I don't think she learnt, it wouldn't help her in the future.
G: I would have felt quite irritated if the teacher just forgets about me, cause what right you know.
H: Yes MM that's right. Okay, so we generally feel quite unhappy. G: Unhappy and embarrassed and irritated or what.
H: Yes. Next?
QUESTION 2:
H: Well the teacher doesn't really say much ..
G: The teacher's probably, probably thinking about his own..
F: The teacher shrugs it off.
G: He doesn't really care – he's thinking more about, about, something about him, his work load or something. He doesn't care about J.
H: Very busy [laughter].
G: Ja, so the teacher's probably feeling that, I suppose – he doesn't really care about you.
H: It doesn't really say much about him – he probably just, I don't know. Maybe, he didn't – he probably didn't even do it on purpose. He's probably, I don't know, quite busy.
G: Ja, well if he does it..
H: I know, but he should take more notice.
G: If he does it to J then he would most probably do it to everyone else in the class as well, just like forget about them. Do it to one. [laughter]
H: What's our conclusion?
F: He didn't notice.
G: He didn't really care enough. He didn't care.
H: Probably wasn't so very – what's the word –
Q: Involved.
H: Committed, that's the word.
Q: Um, aren't we supposed to be spending a bit longer on each question? [laughter] What else are you supposed to say? would have felt sort of yes. Maybe we can come back to them.
QUESTION 3:
G: Well, that pupil probably didn't know that J was waiting to be to be helped, but if, if they..

F: The teacher went to go and help another pupil.
G: Ja, the teacher had forgotten and had gone to help another pupil.
F: Oh, well I don't think, you don't really notice.
Q: But what if he did notice, what if he did notice, that's probably the thing, how would you feel if you did notice?
Q: Depends on the person.

G: You would probably think like it's not really fair that he comes to you.
Q: Ja, but normally, I mean normally ..
G: But you wouldn't care; you'd rather have it explained to you
Q: Ja, you'd try and get it, everybody, they don't really care if someone else.
F: I mean it's such a little thing, it's like..
G: Ja, but if, if, if he came to help me instead of going to help someone else I would think shame, you know.
Q: I wouldn't.
G: I wouldn't care. I'd probably be happy.
F: You probably wouldn't notice. If I did notice I would think shame it's unfair.
H: You might also think well there must be a reason for it. Maybe he's coming late, or something, I don't know.
Q: It depends on the situation.
G: I've got a point for the first question [laughter] y
H: Yes.
G: Sorry. You would maybe think that the teacher likes the other person more that he likes you – that he thinks that you quite irritating or stupid ...
F: In a normal maths situation, you don't really notice things like that, you just sort of push them aside.
G: No, but I mean if, like sometimes in our class someone, someone asks a stupid question and they don't just don't answer, like you made to feel stupid, like ..
Q: In Science especially ..
G: Ja.
H: But I think our class is pretty relaxed though. We don't have, Mr B is not too..
G: Ja, but ..
H: Is not too pressurized.
F: Ja, but if you put your hand up and he goes to somebody else you're going to think `humph'; you don't think any more of it.
G: If, if it happens more than once then you start seeing things in it .
H: Yes, no. that's right.
G: I mean, you start thinking that he does that, thinks your questions are stupid, and.. Well, I do – I don't know about anyone else.
QUESTION 4:
F: You feel irritated, especially if you're going ahead.
H: Especially.
F: Somebody asks you and you've got to like turn back a few pages. Q: You get to a certain line of thinking. Everybody is always irritated [laughter]
G: You want to get your work done because you don't want to finish it in class, or you just want it finished, you don't want it hanging over your head. a
And then they come and they say why and this and that and they go on and on and it just gets ..
Q: Ja, no X [f] was getting irritated with me.[laughter]
G: Shame.
F: But, I mean that's why they make the answers so short because they don't want to loose their train of thought, and..
Q: It's not their fault, I mean it's not their fault.
F: It's not ..
Q: No, it's not your responsibility to look after everyone else in the class.
G: No, but still, I explain to people I suppose, not really.

H: I think that it's especially irritating in maths when somebody asks you because you really have to think sometimes. You really have to think and if somebody just interrupts you at the wrong moment, you just really want to ..
F: I mean the thing is we all very seldom ask someone else cause you want to get on with your work.
G: You want to have it finished and done with and then if someone asks you, you have to totally break your train of thought and then start with the one you're on again and..
H: Ja. So, what shall we sum up for that one, how would you have felt if you were the neighbour?
G: You would have felt irritated.
H: Irritated.
F: But the thing is you, you can feel irritated when somebody does it to you, but then you going to do it to somebody else.
Q: I don't get irritated though; I can see other people do, but I don't get irritated.
F: Depends.
G: Ja, but if it goes on, like if someone says `How'd you do no 1?' then you say `You do this and this'.
Q:I don't mind but you see I'm quite stupid so I get flattered if someone asks me [laughter]
F: But I mean it's not irritating if it's one, but if it's like every second question.
H: And it's when they ask you. If they ask before you've started or when you've just finished something then it's fine, but if you're in the middle of something, then it's irritating, I find.
G: Mmm.
QUESTION 5
G: Yes, the teacher shouldn't have forgotten her, or him.
F: No, it's an honest mistake, you know.
Q: Well, depends, it might not be.
G: No, it's not, it's actually, it's very unfair, if you think about it and if you are a good teacher then you won't just forget when someone needs you. If you're a fairly good teacher.
F: But, he forgets me every now and again, but obviously if it becomes like a repetitive thing then it's a problem.
H: Well, I think the neighbour should maybe have also reacted differently. They shouldn't have started with `it's easy' They should have said `Well, what don't you understand, cause then you can learn from, but if they just say oh just move this over there and they don't explain why you should do that, then it doesn't really help.
G: And also J shouldn't have – it is J? Yes, J shouldn't have like waited for the teacher for 10 minutes and then seen him go to someone else, you know. After she, J put his hand up for like a few, like half a minute or something and the teacher didn't come, he should have reminded him and then when the teacher went to someone else he should have maybe waited for the teacher and reminded him again. So, basically everybody should have acted differently.
Q: Well, I mean, what could the other pupil have done – `Um, excuse me , don't come to me please go to the other person'.
F: Ja, but I mean it's very well and good to say you should have done this or you should have done that; that situation is very .. it comes through in class lots of times. Maybe not the teacher forgetting, but you put up your hand and someone else puts their hand up after you and ?? goes to the last person first.
G: I mean it's human nature for the pupil, I mean your neighbour to say to you just do this and do that and do that and not sit explaining because if you're in the middle of another thing you're not going to sort of want to explain it to someone else.
H: Ja, you just want them to leave you alone so that you can carry on.
G,I: Ja

H: So, just summing up that one, maybe everybody should have, but in the situation it's difficult sometimes to just change what you do.
QUESTION 6:
H: It's quite an interesting one. You've been calling ..you've been saying that J's a him and a she [laughter].
G: First I said it's a him or her, and then I turned it into a him, I think.
F: I always thought of it as a her.
G: I first thought it was a her. I, I also..
Q: I thought it was a him but only because J is a boy's name.
G: It's not [laughter]
Q: That's all that registered.
H: It's an interesting question. I thought it was a female and you guys thought it was masculine.
G: Actually now that you think of it does actually act more like a girl, isn't it?
H: Ja, because, probably because she is not as assertive with the teacher. Sometimes [laughter]
G: ?? will kill you is she heard you say that .
H: I know, it's terrible. I know, but this is a generalization, it often happens.– a female won't be as .. and it's a male teacher. F: Ja, if you think about the guys in our class who go `Sir, sir' while he's writing on the board or something.
H: Ja, I think if it's a male teacher as well, it would be more..
G: Ja, it's definitely a male teacher, and J is a girl.
Q: Ja, I did take the teacher as male.
F: But then we've got a male teacher.
G: No, no it's just the sort of behaviour, it's just the sort of behaviour that a boy [laughter] teacher, male teacher would display.
F: We're forgetting things. No, the reason that it's a girl is, ja, a girl would like put up with it, generally speaking of course. Q: Of course.
G: I would probably act like that, knowing me.
F: No, the guys would either start to irritate the teacher, bang on their desk ..
G: And they wouldn't wait so long, they wouldn't be so patient, I don't think, you know what I mean.
Q: That's true.
H: That's quite interesting. Ja, very interesting.
QUESTION 7:
H: Oh, we've answered that.
G: He's a male because it's male behaviour.
Q: I think we should elaborate.
G: Ja, I would say so. Um.
H: Well, well you immediately think of a female teacher more motherly–type of.
G: And caring.
F: Caring, ja.
Q: You're generalizing.
H: Ja, we are, it is, it's terrible. Well, well the thing is ..
G: But the male teachers generally like think of themselves and their own work load, like our xx teacher.
Q: And especially Mr zz. He never asks girls anything.
F: It's true, ja
Q: And when he does it's only because he is trying to pick on them. G: No, but it is, it is like a male teacher thing. It's true. They would forget about you and go to someone else and the chances are that the someone else is a guy. [laughter]

F: Or a very pretty girl.
G: No, I wouldn't go that far.
Q: I would, especially our xx teacher [laughter]. That's true, it is true, you must admit.
QUESTION 8:
H: `It's easy ....'
G: It's a girl.
F: Ja, it's like, it's like always in a hurry.
G: It's definitely a girl.
Q: A guy probably wouldn't even tell you [laughter].
G: The guy would say ask some.....
H: No, the guy would probably be more relaxed, would just say `Oh', I don't know.
F: Actually guys are more relaxed. If you think about guys in our class, they won't say it so fast. I don't know the way it's written it's like said very fast. You know they'd like say .. I don't know how they'd say it.
H: But girls also, she, she knew what to do, sometimes guys aren't aren't as, I don't know.
G: They get like what you do into such an easy thing.
H: They are not as organised in their thoughts.
G: But that actually, it doesn't make sense, because we first said that the teacher is a woman, the teacher wouldn't be a woman because a woman is more caring and now we are saying the neighbour is a woman and she, and she is doing this.
Q: No, but that's not, that's not not caring..
H: It's different though..
Q: Just more organised.
G: Ja, like more efficient, because you like tell them what to do and now that they know what to do they can work out for themselves why you don't have to show them every step.
F: The thing is if you say something like that often you are looking at your problem and it is totally wrong and you cannot, you can't work it out so quickly. You've got to write it down.
Q: Especially, I mean especially with our maths , we get the answer but you look at the answer and you like look at your working out and you think you're working out is right and you like `whoa' [laughter].
G: And there's like no way on earth, there's no way that you can change your work to get to that , the answer, and it's just. But except that she didn't give the answer, the neighbour. She, she told you what you have to do.
F: If you think it's quite a simple problem, you know take three to the one side, put it ..
G: But you don't know what, there could be x's and y's and b's and a's and everything in between.
F: Ja. So ..
Q: And why would you take the three across and make the plus a minus. Now why the hell do you make a plus a minus?
G: You do, when you take it across you swop signs.
Q: Ja, but how do you know that that has to do with taking the three across.
G: You don't. But that's not what we care about [laughter].
Q: Ja, that's true. This isn't a valid question..
G: So what's our conclusion?
H: That the neighbour is female, because she is more efficient and organised in her thoughts.

G: But what would the neighbour do if it was a guy?
Q: If it was a guy ..
F: They would probably be more patient.
Q: No they wouldn't know what the answer was [laughter]
G: But if they did know the answer, then ..Well, they probably would know the answer.

F: They would probably just go that would go there, like point, you know so you could actually see what was going on.
G: No, but I think that girls would also point, they would say to put this there and put that there and do this. Maybe a guy would explain more.
Q: Mmm. The clever guys would explain, the more stupider, the more stupid ones.
H: Ja, X, X explains nicely.
G: X is good.
F: X is tied up.
H: That's quite interesting, that's probably why there's a boys' group and the mixed group. It would be interesting to see what the boys said. Okay ..

QUESTION 9.
H: It does really say that much about the helped pupil. We made it a guy. Well, we thought that if it was a male teacher, then they had probably gone to help another guy.
G: No, but on the other hand we can't really say that 'cause some teachers don't.
H: Or, you know what if J, J could have, J could have been a male and then the other pupil could then maybe have been a, a female and then the male teacher went to help the female because he or she, well she really can't help herself or something, she's playing the, the ..
G: No, but J's behaviour is a girl's behaviour, I would say.
H: Ja, no. No I think J is a girl because but then other pupil, I don't know.
G: I would say the other pupil's probably a boy.
Q: Pass.
G: That's rugby [laughter].
F: Well, it's probably quite sort of a loud person, gets his attention.
H: Ja, a guy.
G: Yes, it's like one of the guys, like M.
H: The male teacher might feel that it is more important to help the guy because he might feel that ..
G: Cause after all the best maths results are achieved by men, aren't they [sarcastic]. All mathematicians were men, hey?
Q: Only because women weren't allowed to ..I mean it wasn't expected of them.
F: Ja, discriminated against.
H: What?
F: Discriminated against when it comes to maths and that sort of stuff.
H: Yes, no it is, it's true. Disadvantaged..
G: So, so the helped pupil is a boy.
Q: Hey, wait what is this, X[f] gets the highest mark in our class, not Z[m].
F: But, Z ..
G: But she doesn't need help from anyone, you see. She does it on her own, she doesn't get help.
F: Z doesn't do his maths.
Q: Yes. Mmm, Z has other interests [laughter] Anyway that is beside the point.
G: Ja, that is quite beside the point.
H: Okay, our conclusion is that the helped pupil is a male because ..
G: It's not just a male, it's like an extrovert male who has like a big role in the class, while J is one of the people who sit there and don't know what is going on.
H: He's more passive. Okay.
G: Don't you think that J would be someone who like doesn't know when they are talking about these so called interesting things in maths, these extra things, then J just sits and doesn't know what is going on.
F: Just sits, ja probably.
G: Ja, like me [laughter] Like when you start talking about that delta stuff then it goes straight over my head.
H: Yes, definitely, I know exactly the feeling.
QUESTION 10:
H: That's quite a broad one.
F: I mean I like maths, it's my favourite subject, but I mean um, Q: don't know, often, I often I find that the class is like going `whizz' and I'm going like `What?'.
Q: I'm always like that, I'm very slow to catch on.
G: Ja, once I catch on I'm fine, but ..
Q: Ja ..

G: But until I do it's quite a struggle, not a struggle that's making me out to be worse than I am ..
F: But I mean I ask questions because I know you not going to get anywhere if you don't. You feel like you're holding the whole class back.
G: You feel very stupid, I hate Ja, especially if you are asking questions.. I hate asking questions in maths, I just feel that. Q: Especially Mr X, he's so horrible to you.
G: Ja, no, the one day, I think last week Monday, he all said why are you all acting so stupid or something. I don't know about what. I don't know, I just feel really dumb asking questions when everyone else seems to know exactly what is going on, and the teacher is impatient.
F: The thing is that some people pretend, but they don't know what is going on, and when people like have the courage to actually ask then they say `whew'.
G: But the worst is when, it's not so much the rest of the class, it's the attitude of the teacher of that specific subject, not only maths, science and that type of thing as well.
F: `Why don't you understand, you stupid idiot'
G: Ja, like you're doff, so..
H: Maybe group discussions like this could help a lot, like it says, `What would you like to be different'. Where you get together with people and discuss your problems.
Q: That's what's nice about the Std 9 thing.
G: But then on the other hand you can't have individual attention. F: You do, you have supervised and non-supervised ..
G: Ja, I'm talking when you've got a group of people of all the std 9s doing that, is that what you talking about, or the little groups?
Q: The little groups.
H: I don't know anything about that.
F: No, you see what happens is the std 9s all get together and then they, for the other four periods they go off into little groups. H: Oh.
G: No, I don't think that's nice.
Q: It is, 'cause you get a chance to ask the teacher ..
F: To sort out your problems.
Q: But you also got a chance to talk to fiends and stuff about .. and normally they can help you.
H: Because practically they should be able to help you more cause they're on the same level, they can understand what your problems are.
Q: Mmm.
G: What I would like to be different is when people explain to you, teachers as well, they don't just do it, they give you the concepts behind it, cause often, like with this revision stuff people explain to you, or I went to him today to explain, and he did it and I had to work out why, and I did it. It's wasn't like a major complicated thing, but it's just so much easier if they ..
If he like says what's this and your mind's not working very fast, and you go `um, um' then you feel so stupid.
G: Ja, you feel really dumb, and the worst is when is when they ask you questions in class about things that you don't know. Like when we started graphs and I was the public ..it was the day of embarrassing I day, do you remember? When we started graphs and he asked me everything and I never knew a thing. It's not my fault, I didn't know about graphs then. Ja, ja. It was so, it's just, I don't know what, I don't have a suggestion for them to improve it, but they must just try not to make people feel stupid in maths.
F: Ja. I think the stream-lining is very good, cause I mean okay our class, I mean you can't have like a fifteen people class which would be the ideal. The people who go to that class. But, I mean, like basically our class sort of goes at the same-ish level. G: Mmm.

F: I mean we haven't got people who like fail, and who ask like you know...
G: No. But on the other hand it could be bad like the stream-lining because some people maybe in this class might think it's too fast and they feel stupid at times.
F: I wish, I want to be in the second set next year.
G: Ja, me too.
F: But the thing is, not everybody can be in the second set. You've got to have people in the first set.
G: And if you have a set lower set then you, then you think oh well the teacher's think I'm stupid, so I probably am stupid at maths.. I: And also some like, there are people who aren't like as fast may benefit from being in a cleverer class.
H: Ja.
F: Ja. I mean, I find that I can usually keep up with the normal maths. As soon as it starts getting into 9, 10, varsity stuff, then ..
H: Mmm..
G: No, but most people are, very few people actually keep up with that stuff that we did last week, which is meant to broaden our horisons, but anyway. [laughter]. Ja, okay. So how do we feel about maths? Quadratic equations, and the different methods.
H: I think we do enjoy it generally except we feel very threatened when the pace is too fast for us.
F: Ja, the thing is you can't slow it down.
H: Ja, true, but you need lots of, lots of patience
G: Patience and individual attention.
F: You actually need to do a lot by yourself. Ja. I mean that that's what I find. You know when I am struggling with a situation , to actually go and sit down with the chapter, next day then ..
G: And you need support from like the teacher and that but proper support; you mustn't be scarred to ask because you will be treated as a fool.
H: Mmm.
F: ??? I Q of a mouse
G: Oh please. [laughter] No. A mouse. But I think that that's like um maths and science and that type of subject is the type where you are meant to be good at it and you meant to, you meant to know everything [laughter] and that's why they don't like answering questions because it's, it's, according to the teachers it slows everyone down and it's not really necessary because they think you can work it out on your own, but you can't, well I can't anyway. F: Don't you often find that if you, you got a problem, and you start explaining to a friend why you got that problem suddenly just sorts itself out. You go `Oh ..'
H: It's very important to ask questions because there are lots of people who might be too scarred to ask questions and you not only helping yourself, you're helping other people too.
G: And to verbalise your feelings.
H: No, it is, it's important.
G: And then we should definitely have more opportunities to do that, cause I know that I never ask questions unless it's absolutely vital. I mean I would rather go to extra maths lessons than sit in class and ask questions in case everyone thinks I'm this fool.
H: So when it says here what would you like to be different, maybe just having sessions in maths periods where everybody just asks questions about something that they are worried about.
G: Ja, but you can't really have that, it doesn't really work because when I've got a problem then someone else won't.
H: Mmm.
F: Ja.

G: Maybe, maybe just to make it clear to all the people in the class that you are welcome to ask questions and like the teachers must just become more patient, and become more approachable.
H: Ja, that's a good.
F: But often, like the teacher explains something to you, and you understand half way through but you can't actually stop them there and say, you know I understand; like you got to carry on to the end.
G: Mmm. And, ja. I had something else to say but I've forgotten what. How irritating. That's the last question.
H: It would be interesting to see what the boys group and the mixed group say. The mixed group would be quite heated. Aah, no, there are only 2 guys, they need ...They've got like not such strong guys and very strong girls, they need somebody like else.
F: Not strong enough guys – overpowered by the girls.

Transcript 3: mixed group:
From left to right K[f] L[f] M[m] N[m] O[m]
QUESTION 1:
M: Pretty miffed [laughter]. Confused.
L:Irritated, because nobody has helped you.
N: And especially..
M: Frustrated.
N: I mean after having waited for a while to realise that the teacher had forgotten.
K: But teachers often do that.
? Pretty angry, ja.
O: No, but I mean J probably understands, because I mean the teacher's teaching.
K: I think also though that you would feel very unimportant, when the teacher forgets you, and when also you ask your friend or the person next to you to explain to you. `It's easy'
L: `It's easy' , ja. You feel so dumb, like a doze.
N: And he doesn't know what is cutting afterwards cause..
M: The friend hasn't done it properly.
O: The friend doesn't take much time.
L: And if the friend had also explained step-by-step exactly what was happening it probably would have been better.
K: Mmm. And J would have been able to understand it more.
L: Exactly. [laughter]
QUESTION 2.
K: I wouldn't have known.
L: You wouldn't have known, so you wouldn't have known the difference.
K: So you wouldn't have felt anything. You would just know that somebody needed you which is usual, I mean they're always going like `Help me', like me and X[f] [laughter].
L: Okay cool, I am coming now, just relax. Like `Sir'.
K: I think also that the teacher wouldn't have necessarily forgotten about ..
M: It wouldn't have affected him.
K: Because he was going to help someone else.
O: It's not as if he deliberately didn't care.
K: Maybe he was deliberately irritated; he didn't want to come because he knew ...
L: I am sure he/ she/ it, it, the teacher knew that even though he was helping someone else that J was needing help.
K: Ja, but then he is gong to come to him.
N: Must have been like quite busy though.
O: Ja, if there were other people also asking.
M: But, I mean if there were other people then surely the teacher must have that maybe he didn't explain the thing properly.
K: But it's probably all about the same question, so they asked the teacher because they couldn't do it.
L: But, maybe, um for example in our class if one of us don't understand and Mr B is busy with someone else then we can always go to someone else, sort of I'd go to you, or you'd go to ..
O,N,M: Z[m]
M: It helps to sit with Z[m].
L: This is Z though, Z is like this.
O: Z'll explain it properly.
M: Sometimes, Z or Y[m].

L: That's the thing, when there are people in the class who can do that, the teacher won't necessarily go speak to every person.
QUESTION 3:
L: I'd be embarrassed.
O: Why?
K: I wouldn't because he had got the question ..
L: But the thing is if J asked the teacher for help before I asked the teacher for help and the teacher came to me instead of J, I'd feel very embarrassed, 'cause..
K: Ja, but it happens all the time.
N: But how were you to know, because the teacher forgot, so the pupil would have forgotten as well.
L: No, but you would have heard.
N: Ja, but it would take a while for the teacher to forget.
O: Ja, but you sitting there working and then you say `Sir' and then he comes to you, you don't know if someone else has asked him. L: But you do, it's as if turn by turn.
K: She asked first, go there, you know, okay cool ?? It's not fair, I want to get the sum right first [laughter] ?? went well ??That's me, Miss [laughter].
M: Our first 3 minutes.
L: But seriously, how would you feel? I know how I'd feel. I'd get impatient. I wanna, wanna ...
N: Ja, we're ...
O: If you were pupil the teacher went to help – you wouldn't get impatient.
L: Ja, I suppose so, but is I were J, I would get impatient.
K: I wouldn't care, I would just think `He can go to her afterwards'.
L: I'd think `Neh, neh, neh ..'
K: You don't even think about it, you just want to get your sum over and done with 'cause .. you doing it, so you just want to get it over and done with quickly.
N: So you don't have so much homework.
K: What?
N: So you don't have so much homework.
L: I think that the basic consensus is that you wouldn't know the difference.
K: And if you would, you wouldn't care [laughter]. I won't, I think ... I'd think take such a long time to get to you anyway ...wouldn't make a difference if it came straight away.
L: But, I mean, ja, if, for example I had a problem, I was J, and she was the person that the teacher went to go help then I would, would be irritated because I'm J, and I'm sure – okay, let's put it the other way around – she was J and I was the person the teacher was going to help.
K: So I'll be J, I don't mind being J [laughter].
O: J suits you.
K: You think so, I think so too.
L: I would feel very bad. I'd say `she was before me'.
K: I wouldn't. I wouldn't.
L: I would.
K: It doesn't phase me. I mean you don't even think about it.
L: Aah, it phases me. I'd feel bad.
N: I think by the time I got ..
O: She's got a conscience [laughter].
L: No, it does phase me – not always.
K: A conscience about the maths teacher going to somebody else first [laughter].
L: Don't laugh at me, that's what I actually feel.

N: By the time you got around to asking the teacher to actually come and help, I'd been trying for so long that I'd just want to get it over and done with, so I wouldn't really worry about what else happened.
L: No, I'd ask him the second I see him. I'd go `Oops. Hi'
K: Every second `Sir, sir, wanf, dosh' [laughter]
QUESTION 4:
K: The neighbour of who?
L: The neighbour seems very irritated, very rushed. Very rushed, ja.
M: No, the way that I feel when I explain something to somebody and they don't understand I feel lank frustrated and I go over it again, and I do it quicker the next time and they still don't understand, and it gets worse and worse.
L: Ja.
K: But I mean you always asking the neighbour for help and the neighbour asks you, so it's kind of mutual.
N: Also, depends if you work well with the other person.
L: I mean, sometimes ...[laughter] you both don't understand.
M: No, but assuming that one person does understand.
K: That's not the situation though. No, but I mean if someone asks me for help, I, I sometimes get irritated because I want to get on with it and do it so that I don't have to do it for homework and then..
L: Ja – you have to waste you time explaining to someone else.
O: Sometimes if you explain something you feel all powerful.
K: I don't mind because I never know the answer anyway, like ???
L: The thing , the thing is though also, what was I going to say; you made me forget my thought.
K: I'm used to L asking questions.
L: You ask just as many as I do. [laughter].
K: I'm joking. I ask X[f]. X: `Oh no, not you two again'.
L: No, I mean, it's just that if you in the middle of a problem and the person bugs you, they say `What's the answer to this? What's the answer to this?' then you like say `wait, wait, I'm coming now' `what's the answer, what's the answer? what do you do from here?' K: Then you go three lalala.
L: And you just go look and you get like all angry and you say `well, this one you put the three that side and minus like five ..' K: Ja, you get all irritated.
O: Ja, this seems quite rushed.
K: Ja, irritated.
O: Not irritated. I mean he doesn't sound really angry, just like he couldn't care.
K: It's probably because J couldn't, you know like, see the problem straight away .. couldn't like click ?? going like ` Hey, how could you not see that'. So maybe, he needed like a little hint, like just put the 3 across and minus it.
O: Ja, because like often..
QUESTION 5:
M: Well, I should have asked again if the teacher forgot.
L: I still think the teacher should have said something like `Just hold on a second, I'll be with you now'.
O: The teacher shouldn't have forgotten.
N: Ja, the teacher shouldn't have forgotten.
L: Ja, now, but the teacher might not have forgotten.
M: You don't actually know if the teacher ??? She may have just nodded but it hadn't hit home yet.
O: Yes, definitely I think the teacher should have ..

L: He responded by nodding. So obviously the teacher did forget. The teacher shouldn't have forgotten, or J should have reminded him.
O: Ja, J should have reminded him, and the teacher shouldn't have forgotten, and what about the third person, that's not really ...
K: It depends on the problem, it all depends on the situation.
O: Because J didn't understand after the neighbour had told him the answer, I mean she should have said `Ja ...
K: But how do you know that he didn't understand ...
O: But he didn't ..
L: Also if, if J didn't understand then often the person next to you, you get a puzzled expression on your face if you don't understand ...
K: L's face[laughter] No, but seriously, I mean, it all depends, the sum was really easy and the person thought if you just click once then like you've got to put the 3 across you like sometimes you wax ...
L: Something, the `It's easy' here is very patronizing, I don't think that that's the right thing to say.
K: Well, maybe it's showing her that it's not such a difficult sum. M: Ja, but I don't think you can really blame the person sitting next to him because he is not employed as a teacher here. He's not ...
L: Ja, I know that, but the thing is that they say do you feel that the person should have acted differently. I mean, obv ..
M: Ja, okay, in an ideal situation he should have acted differently ...
L: would have said `Okay sure, I'll help you'. They wouldn't have said like `It's easy' because you feel every small, you feel very patronized. `Oh, it's so easy and you're so dumb'.
K: Okay, let's start from the beginning. For one, she should have tried longer, then the teacher should have said, she should have like asked the teacher again or the teacher could have gone to J straight away instead of going to the other person, and then she should have asked the neighbour after she had asked the teacher twice, and then the neighbour..
O: But the teacher is .. it says there the teacher was already helping someone.
L: Ja, but often.
N: It just depends if the teacher is working.
L: Ja, I mean, often what you can do is, if you've got a problem you leave it out and you go on to the next one and when the teacher is free you like say to the teacher `Please will you come back here and explain this', two problems, one problem before.
N: So, about the only person who isn't at fault here is the second, the pupil the teacher is actually helping.
L: Ja, basically.
K: I don't think it's the teacher's fault.
M: I don't think you can blame the teacher. Ja. Because the other people also need help, I mean.
O: Maybe. Nothing drastically went wrong.
K: Maybe, the other guy had asked first before you'd asked, you just hadn't noticed.
M: Ja, maybe.
K: Maybe he's just going there in order.
O: I mean, it's not that important if the teacher doesn't come to you, you can just call him later.
QUESTION 6:
O: Oh, jeez.
N: Ja, I've also been thinking of this. You've been calling him a she.
L: You've been calling him he. You've been saying he and you've been saying she.
N: You've been calling J she, you've been calling him he.

L: I've been saying it.
N: No, D been calling J she.
M: You've been calling the teacher it.
L: I've been calling J J.
K: Shall I tell you my reasons for being a guy. A girl would've, they wouldn't have like said J signalled to the teacher, a girl would have asked politely, guys just go like `yuuu'. Then another one..
L: I don't.
M: No, no, they do. Sometimes girls just stick up their hands, I mean, and then. Well, girls and guys do that ..
K: I'm just generalizing now, and also I think the `How'd you do this one?' That's more like a guy talking .... `Please can you help me with this?' That's more like girls not `How'd you do this one?', you know. It seems more like a guy to me.
O: `Please help me' It's just how you say it.
L: It's not like [whine] `How'd you do this one' [laughter].
K: You know what I mean. He like leaned across to the person next door, I mean you can like see a guy ..
L: I do that sometimes to you.
O: Lots of girls do that.
K: No. But you don't go `How'd you do this one'.
N: Okay, I can understand that.
O: Lots of girls do that.
K: Okay, I am generalized, but I', just saying probably that's why..
O: Must be a girl because she doesn't understand the question.
L: I haven't been giving a sex to the person, I've been calling it J. No, I don't know.
O: Why've you been calling it a he, she.....
M: I think that it's a boy because it says the way the person next door replied, I mean that's kind of typical of a guy. I mean you don't expect a girl to go `Oh, it's easy, just take this to the other side or whatever'.
L: No, but that's not what I'm saying.
M; No, still okay if you need help with a maths problem, I'm sure I'd be more comfortable asking someone of my own sex than asking a girl to help with a maths problem, I mean.
L: I don't. I ask any of you guys, Z[m] and Z[m]
K: No, but it's true, okay this is a total generalization you can't take it out on me or whatever – girls are like much more understanding.
L: I don't think so.
N: I don't think so.
K: A lot of guys would just go `Okay it's easy, just do that'.
L: I find it easier to understand when .. with Z[m], or Z explains to me than when someone like X[f] or Y[f] explain it to me.
N: Ja, it just depends on the person.
K: Ja, ja, I'm generalizing now, but what I'm saying is a lot of the time a girl won't go, you know, like `It's easy cause they are much more sensitive, they know that they're being patronizing.
M: Depends on the girl.
O: Lots of girls are..
N: Just depends on the person who's speaking, because we know that, I mean, the difference between a male teacher and a female teacher, it all just depends on the style of teaching and not the sex.
O: I mean, take .. I think that has nothing to do with the question, nothing to do with the story.

L: Ja, ja, I agree.
O: I mean, he, she, it.
L: I mean J could be a guy or a girl, just anyone that doesn't understand.
O: I mean, he's just a pupil.
L: I mean there's nothing there that shows that it's a guy or shows that it's a girl.
K: And also I think that people who have a lot more understanding, this is my thing, the thing is, actually no, now I'm contradicting myself.
O: Vast generalization, girls are so sweet and polite.
K: No, but it could be a girl, because, I'm, I'm just saying because like the guy, I don't know, actually, no I'm contradicting myself so don't worry ...
L: I mean, you, you can't say there is not enough information there that shows us that it is a girl or it is a guy.
N: And I think it doesn't really matter, I think it is made to sort of stress you out, and I mean people normally generally realise to their own sex, obviously that is not what has happened, no but still, it just that's what usually happens, you, you, people normally put pronouns in instead of like trying for a name.
K: I think I called him a he and a her.
M: Ja, I definitely remember you saying she once.
K: He or her, it.
L: I think it doesn't make a difference, it's got nothing to do with the problem.
QUESTION 7
L: Well, we've been saying it's a guy.
K: A guy [laughter].
N: That's because we've got a male teacher.
L: Ja, I think that we think it's a man, male teacher because the maths, only maths teacher we know like personally Mr Z.
M: No, Ms X.
L: No, no but I'm saying that this year our maths teacher is Mr Z.
K: I haven't had anybody besides Mr B, except in my first year I had Miss X, then I had Mr Z.
N: We had Miss X, and then Z [shortening].
L: I mean I just think that we, well personally I think it's a male because I have a male maths teacher.
O: Ja, no, I mean, you think maths teacher, Mr Z.
N: I mean it could really be any, there is no indication.
L; No, there isn't an indication just in this story. But we think maths teacher, we think that it's Z.
K: And I can see Mr Z going, nod [laughter]. I don't know if I can see Miss W going `Okay I'm coming now', you know.
N: Take out our water pistols and shoot you. [laughter]
Q8
L: Oh, I don't think we can say.
O: What sex is the neighbour? The neighbour is, the neighbour is.. N: I think he's male.
K: I think he's male as well. I don't think.. `it's easy' ..
L: I don't think you can say that.
O: It's just, it's just – again it all depends on what happens.
K: It's not, it's a male thing, `it's easy, just take the 3 to the other side.
L: You can say like `it's easy, look all you have to do is you do this and then you so that'.
O: Both males and females ..go `oh, it's easy'.
L: I mean, it's the same thing there's just not enough information on that sheet, that shows us whether it's a guy or a girl.

O: And it really doesn't matter.
L: Ja, it doesn't make a difference because guys do that and girls also do that.
K: I mean I think girls would go `oh don't worry about that it's not as difficult as you think it is'
M,N,O: K! K!
M: No, I really think about this sweetness thing, it really depends on how well you know the person, if you don't know them that well, you just go `oh, it's easy', and like make them feel stupid and stuff.
K: No, that would be sarcastic.
M: No, no listen, if I ask Z[m] for help I get told what a dunce I am [laughter], but he'll help anyway. If I ask X[f] for help then she'll say something `Oh, oh well'.
O: Ask you ...
M: Ja, but that comes later, but she won't say `oh it's easy' or something.
L: Ja, I agree, you can't say whether it's a guy or a girl, there's not enough information.
QUESTION 9;
L: You can't say that.
N: We've just done that.
O: No, no the helped pupil.
L: You can't say that, you can't say that, it's the same thing.
M: No, no that really doesn't have any information at all about it.
N: It's just another pupil.
M: Do you think that a male teacher would favour a female pupil, as in like ...
L: Depends on the teacher.
N: Depends on the teacher, ja.
M: Well, in general, do ..
L: Well, Mr Z doesn't.
M: Ja, I know he doesn't, but in general do you think.
N: Ah, no Mr Z does favour the girls.
L: He doesn't.
N: That's true, that's true.
L: No ways.
N: He always does.
L: What do you think O? Do you think he favours the girls?
O: No.
N: He does, O.
M: Look, he answers, he answers more girls' questions that ..
K: Cause girls ask more questions. Just listen ..
N: Okay, fine girls ask more questions [laughter] Well there we have it, there we have it.
M: But there are more girls in our class than guys.
L: Exactly. Something like 13 to 16, it's not much but still. Like it just so happens that the girls in our class are the people who don't understand the majority of the work cause they..
K: No, no, they're not embarrassed about saying they can't understand, most of the guys..
L: And they're lazy.
K: No, a lot of the guys sit there and wait for the ..you know.
O: You know why it is cause the guys never do the their homework. They don't work. Ja [laughter]. That's why they've never got any questions about it the next day.
M: Okay another thing is..
L: I don't always do my homework. .. a lot of us like X[f], Y[f], not X, me and Y and stuff, we ask Z or R, so. I mean exactly, so. Or S. P[f], Q[f] and I sit in a group of 3, and we don't always understand and P is often too busy doing her own stuff.. talking to the ous across the class.

K: Who me?
L: No, P, don't worry, P.
N: P doesn't talk to ... talk to ?? across the classroom.
L: Anyway that's going off the topic. So you can't say what sex the person is because there is not enough information.
N: Ja, it, but it still definitely depends on the teacher.
K: Whatie? Whatie?
QUESTION 10:
L: Umumum.
K: I used to absolutely love maths but sometimes I feel like such a moron in the class.
N: Ja, especially Mr Z's class, it's quite intimidating.
M: When you are in class of people who generally know what is going on. I mean there are people who get 100% and 95% and everything. like you really, no especially when you are good friends with these people. like who get 100% and who get IMOs and stuff like that, and when you ask a stupid question it really makes you feel stupid.
L: I mean, take for example I think I'm like in the lower half of the class.
N: Certainly are in the lower half of the class.
L: Thanks, N.
N: We are, I said.
L: Oh, , um, but the thing is that I think that because we're in the class that we are where it's mainly the top stream maths, Mr. Z goes quicker, cause..
K: It is the top stream maths.
L: Ja, it is. Mr Z goes quicker because he thinks we can handle it.
N: Because he thinks we get bored.
L: I mean. We can't all handle it, I mean, it's not fair.
L: The majority of the class can.
L: No, not really.
K: No, no they can't.
N: I promise you you speak..
O: The majority can ..
N: No, no, I mean you speak to the people in like Miss X's class, she does second set, I mean they know their work so much better.
K: They spend about four weeks on .. Whereas we spend about two days.
L: They are so waxed and everything they hardly have to learn, I mean for these exams I have been going through every single chapter of maths of my text book and teaching myself all the work again, cause we did it so quickly in class that I didn't understand it.
N: Ja, ja, I mean in English classes.
L: I mean I have to go for extra maths lessons.
N: In Std 6 and 7 D C came to me and sort of asked me some of the problems, and then he's doing indices as you say in English class when we had a free period and I mean I didn't know what was cutting. I had forgotten everything.
K: Ja, I know and I used to get much higher marks than I do now.
L: Ja, I know definitely. My marks have dropped, I was getting at the top of my class.
N: I was getting 80s, now I'm only getting..
O: Some people in this class have to get like stimulated.
K: Ja, I know just because he wants to stimulate the other, doesn't mean that we must like all fail..
L: Just because like P and Q and R S and T and people like that are good at maths it is not fair to make the rest of the class suffer ..
M: It's it's not only them because if they like ..
O: It's just like the 10 people, like the really top guys.

L: They should put them in a different class.
O: They would be doing a whole lot less on the stuff that we actually learn, but they would be doing like a whole lot of extra stuff.
M: Ja, I mean it's nice to do extra stuff.
N: Can I just say something?
O: It's sort of like a compromise because if, if there weren't, if everybody in the class could cope, they'd do they'd do, other things.
M: More probability.
L: Ja, but the thing is, for example I approached Mr Z this year and I asked him if I could drop down a set..
N: Ja, same here.
L: Because sort of the whole pace of our class was too fast for me and he said, no you can't because you can cope with this class and you're just not working hard enough, you. No, he said something like you don't know properly what is involved in maths, or something to that effect, like you don't yet know what you have to do to work in maths, or something like that , I can't remember what it was, something about I wasn't working hard enough, and I promise you for the one test that we wrote, the first test that we wrote, it was an algebra test I think it was I worked so hard for it you can't believe and I got like an E for it.
N: No, we didn't get that test back [laughter].
L: No, this last one.
N: No, the first one, I mean ja.
K: And also it does something to my confidence, I mean when I was confident about my maths, I used to wax As so easily, and now I am so unconfident because every time I open my mouth people shut me down and I sit there, and all of a sudden I realise, you like you do something with K or something and I actually realise that I'm not that stupid as everyone else makes me out to be, but I never like say anything because I'm so, I've got no confidence in myself. N: Ja, I know.
K: Especially in this class I feel so stupid.
N: You and I, remember we were getting As last year and now in the tests you get like 50%.

L: I mean I was top of my class. For the one test I got the lowest mark in the class for the test.
M: Can I just say something like what you saying about being stimulated and stuff it's not only the Z[m] and Y[m] and people because I'm not a Z or Y or someone like that, but I mean last year in Miss X's class I mean it was getting like quite boring because like I mean, she was going too slowly, and I mean so many people.. N: It was a compromise.
L: The thing is that when we got to the exams though it benefited us.
N: No, but I mean I think I think.
K: Maths is not only exams.
M: I've learned a lot more generally in maths. Okay look, last year I got a very high mark for maths, but this year I got less, but I mean I know more maths. I actually don't find it that way..
N: Enjoying it more..
L: I enjoyed it a lot more last year.
M: I actually enjoy it more when it is more challenging. I don't like it when it is just dead easy., I quite like finding out about quadratics and probability, and..
L: Quadratics are in the exam just to inform you, the other class have learned about them. But I mean take for example studying maths. Studying maths you do problems and examples. Before I was in Mr Z's class this year I used to love studying maths, I used to start studying maths months, 2, well a month before the exam, because I used to find it such fun because I could do it. No, seriously. I can enjoy it and I can do it. I used to love it, so it was the only

thing I wanted to do, I mean I used to spend all my time studying maths and this year I have no desire to study maths, I mean it's a week away from the maths exam and I have just started studying maths. I mean it's just because I know that I'm not good at maths this year and I can't handle it. Mmm. Maths is generally okay, it's just when you, you've got to be in a class of people on your level because is you're not then lose out so drastically.
K: I got one of those problems right in one of those maths digests. I nearly had a nervous breakdown, I mean I was ..
N: Ja, no, me too.
K: I was so shocked, I mean I actually got it right and nobody else got it right first. I was like `wooo' you know, and that's what's nice because in the other class you wouldn't do that, because I actually enjoy doing maths.
M: Ja, I actually enjoy doing, like remember those problems that he gave us in the beginning of the year, where people got things wrong, I don't think I got one right.
L: I can't do that. Those were like so hard.
M: And then Mr Q, remember when Mr Q came and he gave us those other problems and those I got a lot right and I kind of like ..
L: Glad you did.
M: No, no seriously I did and it was quite a like confidence booster.
L: No, I mean, like last night I went to and extra maths lesson, and with just me and the teacher, I didn't feel stupid, because she would explain things to me and she would carry on doing examples and saying to me this is how you do it, do this one one your own, I could do them and I could get them right, so my confidence went up, I mean.
O: So, maybe if you don't feel confident in maths class you should go to extra maths or something.
N: No, but you shouldn't ..
L: No, but you see I don't I don't need it. It's not necessary, do you understand that?
K: You shouldn't need that.
L: I personally do not need extra maths; it shouldn't be necessary for me to waste my money on extra maths, because I can do maths, it's just that the pace that we doing it in class is too fast for me. Anyway ...
N: What would you like to be different? I don't know maybe separate the class, have more individual attention.
L: I like it the way that it is.
M: It's fast, but I find it more challenging.
N: Remember, WW (school) is preparing us for after school. Exams are not what really count – well, it does count for something.
O: It's all to stimulate your mind. So long as well you do well in Matric.

CONTENTS

CONTENTS

It is not only you own time that is precious, it seems – there is also competition for the teacher's time and attention:

> `you wouldn't care [if the other pupil did not get helped] – you'd rather have it explained to you...I wouldn't care; I'd probably be happy'.

5) Neutral or blameless discourse

In this discourse the pupil is given no responsibility for her/his actions; circumstances are merely occurring around her/him. For example:

> `that pupil probably didn't know that J was waiting to be helped';
> `you don't really notice'.

Or responsibility may actively be denied:

> `it's not your responsibility to look after everyone else in the class'
> `I don't think that you can really blame the person sitting next to him because he is not employed as a teacher here'.

These last statements support the `competitive' discourse as well, in that one has to look after oneself.

The following extract indicates how the taking up of certain positions is not a straightforward process. Here we see a negotiation of various positions:

G: You would have felt irritated.
H: Irritated.
F: But the thing is you, you can feel irritated when somebody does it to you, but then you're going to do it to somebody else.
Q: I don't get irritated though; I can see other people do, but I don't get irritated.
F: Depends. [...]
Q: I don't mind but you see I'm quite stupid so I get flattered if someone asks me. [laughter]

G and H situate themselves in the `competitive' discourse. F's statement highlights the contradiction of the `competitive' discourse and the `in need of help' discourse. Her statement, `Depends' indicates how different discourses may be invoked under different circumstances. Q initially places herself in the `communal responsibility' discourse, but then

Implicit in this discourse is the recognition of the power invested in the pupil–teacher vis–a'–vis the helped pupil: `sometimes if you explain something you feel all powerful'; the pupil may `show off how clever they are'. There is an emotional gain in adopting this position of power, as indicated in this passage:

> D: [he] would feel content, feel content because he has helped someone, and helped something and he realises that he's ..
> A: Why should you feel good?
> D: He's cleverer than that person .. and I don't know it's just an advantage on your psychological brain.
> E: Oh, right, like feeling contented that you helped someone.

Vis–a'–vis the `real' teacher, this position is simultaneously powerful, and powerless. The pupil has the power of understanding the unique problems of his or her peers:

> `He didn't wait for the teacher to finish with the other pupil; he um just asked his neighbour because like a lot of people rather like to get help from people, people on their level, you know from their friends and that than from teachers.'

On the other hand they do not possess the same powerful knowledge that the teacher has invested in her/him:

> `In the long run our teacher is better than some pupils who think they can teach';
> `Yes you know it's also junk asking friends because you know they never sort of explain it properly'.

4) Competitive

This discourse extends the discourse of `individual responsibility' for learning into one where learning is seen as a competitive, rather than a communal activity. If somebody interrupts you or holds up your individual progress, you have the right to be angry:

> F: You feel irritated, especially if you are going ahead.
> H: Especially.
> F: Somebody asks you and you've got to like turn back a few pages ..
> Q: You get to a certain line of thinking.. Everybody is always irritated [laughter]
> G: You want to get your work done because you want to finish it in class, or you just want it finished; you don't want it hanging over your head.

Notice in this passage how mathematics work is seen as a burden – it hangs over your head and you want it finished.

`the difference between a male teacher and a female teacher – it all just depends on the style of teaching and not on the sex';
`the person who is confused – it's an equal amount of chance that it's a girl or a boy'.

The generic personal pronoun (`him, or her', `they' and even `it') was used: `you've been calling the teacher it'.

Within this discourse there is a strong anti-sexist sentiment: `unless you are saying the teacher is sexist'

2) Male norm discourse

Within this discourse the world is described as masculine:

`J is a boy's name';
`Because J is the main character, I took J to be a guy'.

The following is a statement that was made in the female only group:

`I thought it was female and you guys thought it was masculine' (my emphasis).

In the extract which follows interesting slippages between the male norm and non-sexist discourses are illustrated [male only group]:

D: it could be either [sex], I don't think that ..
A: Well, it's easier to give him, well, she, I say him, she, her, it's easier.
E: Well, most peo .. guys automatically say he and most girls say he.
B: She.
E: She, did I say he. [..]
B: ..people generally, when you are talking about people generally you usually talk about them as he; that's not, not like sexist or anything.[....]
E: We've just been saying `he' for everything because it's easiest. We haven't tied any sex into it.

In this conversation there is a conscious statement of non-sexism and an attempt at being egalitarian (e.g. boys say `he' while girls say `she'), mixed with unconscious slippages into the male norm discourse. A gets so confused between the two that he lands up saying nothing sensible. E attempts to be egalitarian, but notice how guys (who started off as people) `automatically' say `he', while only `most' girls say `she'. The rest of the girls presumably join the boys in saying `he'. The `he' slip made by E is, of course, very telling. At the end

Appendix 1

VIGNETTE

J was working on a maths problem. The figures seemed to be coming out all wrong. J felt anxious and thought that it was probably best to ask for help. J signalled to the teacher, who responded by nodding. After waiting for a while, J realised that the teacher had forgotten and had gone to help another pupil in the class. J leaned over to the person next door, saying `How'd you do this one?'. The neighbour replied, `It's easy. Just take the 3 across and make the plus a minus, and then put the 2 under the 3'.

Appendix 2

QUESTIONS WHICH FOLLOWED THE VIGNETTE

1. How would you have felt if you were J?
2. How would you have felt if you were the teacher?
3. How would you have felt if you were the pupil the teacher went to help?
4. How would you have felt if you were the neighbour?
5. Do you think that any of the people in the story should have acted differently? How?
6. Think carefully of the sex that you have been calling J. Is there something in the story that suggests that J is a boy/girl? If you think that it has nothing to do with the story, please expand.
7. Think about what sex you have been calling the teacher, and answer the questions of 6.
8. Do the same as in 6 for the neighbour.
9. Do the same as in 6 for the helped pupil.
10. How do you feel about Maths yourself? What would you like to be different?

CONTENTS

CONTENTS

CONTENTS

CONTENTS

ABSTRACT

The majority of perspectives from which the study of gender and mathematics has been approached have failed to move beyond the individual/society divide. The contradictory nature of subjectivity and the operation and interpenetration of power and knowledge in the production of that subjectivity has not been taken into account. This thesis is based on the theoretical framework of post-structuralist. The literature concerning gender differences in mathematics is criticized from this framework. In particular, the work of Walkerdine and her colleagues, which highlights the processes within the classroom which allow girls to succeed in mathematics but never actually be successful, is of interest. The methodology of choice in this study is that of discourse analysis which makes clear both the positionings available to the participants as well as the power relations formed. The sample was drawn from a top-achieving Std 8 Higher Grade class in an affluent Model C school. This sample represents a theoretically salient sample as the literature points to the `differences' being most pronounced in the upper levels of mathematics education. The analysis clearly highlights the double-bind within which girls find themselves in the mathematics classroom. The apparent equality of opportunity and non-sexism is counteracted by the positioning of girls as hard-working but without natural flair in mathematics. The characteristics that make it possible to achieve in mathematics are ascribed to males. The resistance to this powerful `disciplinary technology' is the invoking of the feminist discourse, which was done by some of the females in the study. It appears that there are very real barriers to girls' participation and achievement in mathematics. These barriers lie within the power relations and discourses/knowledges surrounding gender issues and mathematics education.

LIST OF FIGURES

CONTENTS