

Ways of knowing
of student and beginning mathematics teachers
and their relevance to becoming
a teacher working for change

by

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Synopsis

I begin the thesis with an action research account of an intervention with respect to gender on a mathematics Post Graduate Certificate in Education (PGCE) course at a northern university in 1989-90. Two years after the intervention, I visited in their schools three of the students (now teachers) who had been involved and I interviewed each of them there, with a view to finding out what impact, if any, this intervention had had on their beliefs, understandings, commitments and practice. In the light of this experience, I sought out three teachers who had followed the course and who I had heard were working for change. I conducted several interviews with each of them. I constructed a model of the ways of knowing of (new) teachers of mathematics and linked one epistemology, that based on the authority of self and reason, to an emancipatory curriculum and to critical mathematics education. I have considered, briefly, the implications for initial teacher education.

The research was conducted and this thesis is written as a *praxis*-orientated inquiry and both have been influenced by feminism, critical theory and postmodern tendencies. In this sense, the thesis itself is a research experiment.

*for hannah
and colin*

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With Patti Lather (1991, pxiii), I too thank 'the goddess of word processing with whom all things are possible'.

I thank my mother for my feminism and my hope of a better world.

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Introduction

The Riddle



Seamus Heaney
The Haw Lantern

It is a truism that change is never easy. This thesis is much concerned with change. It is concerned with how initial teacher education might change the educational practices of beginning teachers. It is concerned with whether or not individuals change significantly between initial training and becoming a teacher. It is concerned with how epistemological frameworks permit or deny the possibility of change in what we know and how we know it. It is concerned with what it means to work for change within the context of mathematics education in schools. It is concerned with change in what we understand by educational

research and change in how we might go about it. And, embedded in it, is a story of change in me.

Moreover, the interest in change does not simply spring from detached, intellectual curiosity but is wedded to a commitment to finding out 'how to turn critical thought into emancipatory action' (Lather 1991, pxv). Change is not comfortable. In particular, when working for change within education

[t]here is a lot to undo, both at the level of the individual and at the level of the school. And undoing habits, taking away the paths we are used to walking down, leaves us feeling disorientated and vulnerable. (Rudduck 1994, p127f)

However, a personal commitment to change has informed every part of this work, even when I have 'contribute[d] to dominance in spite of [my] liberatory intentions' (Lather 1991, p15), and, if it is to be understood, it must be read within this context. As Sandra Acker has it,

[t]hrough scholarship and reflection we come to understand the levers of our lives. But we cannot but try to challenge and control them too. (Acker 1989b, p19)

An overview of the empirical research

The research reported upon in this thesis began with a concern with the implementation and evaluation of a component of a Post Graduate Certificate of Education course (hereafter PGCE) during the years 1989 to 1993 at a northern University. (See Figure 1: Timetable of the research for an overview.) The students (later teachers) involved were some of those following the Mathematics (Later Years) course and the component dealt with the provision of equal educational opportunities for girls and boys. The research began while the students were at the University and subsequently followed a small number of them into school. These moments of their lives seemed particularly worthy of study because

Figure 1

Timetable of the research

Academic year	Activity
1989-90	phase 1: action research project with cohort I
1990-91	equal opportunities group with students from cohort II end of year interviews with students from cohort II reading about research methodology
1991-92	written contact made with cohort I phase 2: two day school visits and interviews involving teachers from cohort I
1992-93	reading about teacher socialization abortive written contact with cohort II analysis of phase 2 interviews reading about epistemology reading about radical teaching
1993-94	phase 3: one day school visits and extended interviews involving teachers from cohorts I, III and IV one day school visit and brief interview involving teacher from cohort II brief written responses from teachers from cohorts I and II
1994-95	model constructed afterword and commentary solicited from phase III teachers final research report written

Timetable of the research

we have little information about how beginning mathematics teachers strike a balance between authoritarianism and problem solving or how their conceptions influence the defining of that balance. The transition between pre-service and in-service experiences can provide a strategic research site for obtaining insights into shifts of priorities and the tension that exists between a teacher's precious idealism and a milieu of classroom life that affects the teacher in uncertain ways. (Cooney 1985, p335)

As the research progressed, the focus both widened and narrowed. I became increasingly interested in the *more general* question of what attributes are characteristic of teachers who are working for change, not only in seeking to provide equal opportunities with respect to gender but in striving generally for social justice and an emancipatory curriculum. The *more specific* question related to understanding the epistemological perspectives of new teachers and how those perspectives foster or work against an engagement with critical mathematics education. Both of these changes of focus grew out of the early phases of the research and the reason for their emergence and their validity for and relevance to the research are dealt with at the relevant points in the text which follows. Thus the research passed through several phases with respect to the definition of what I was investigating.

Equally, there were several phases of what I have called 'data collection' although that term is problematized in my research methodology: it is these 'data collection' phases to which I refer by capitalizing as Phase one, Phase two and Phase three. The first phase of data collection, undertaken within an action research paradigm (see, for example, Altrichter 1993), was intended to assess the impact of an intervention strategy on the students' perceptions and on their practices as they completed their year in initial teacher training. At that stage, did they consider that their professional responsibilities involved a commitment to providing equal opportunities for girls and boys? Had their attitudes and perspectives appeared to them to have evolved during their time on the course? Did they intend to act to mitigate bias when they become practising mathematics teachers?

Phase two was designed to explore whether or not the attitudes to equal opportunities displayed by the students at the end of their course proved robust as they moved into the world of work and also what consequences, if any, those attitudes and practical insights had for their classrooms. When investigating the attitudes of teachers in school towards the provision of equal opportunities, Pratt had discovered that 'many teachers were unhappy at the dissonance between their beliefs and their practice' (Pratt 1985, p34). Was the same gap, I asked, between what they believed and what they did evident for these students? Was there continuity between themselves on the course and themselves at work? Had any changes apparently resulting from the intervention been stable? If so, what was the extent of their impact on the new teachers' classroom practices? In the context of equal opportunities and mathematics, had the students continued to develop professionally or had they stagnated?

After the completion of this stage of data collection, I began a more thorough review of the literature relating to teacher socialization and became dissatisfied with the prevalent model of discontinuity and change between the individual as student and that same individual subsequently as teacher. The dissatisfaction arose both from considering evidence internal to the literature and also from a generalized understanding that one's pedagogy is part of one's world view and, as such, not lightly given up or exchanged. Reflection on this, combined with the experience of analysing and presenting the Phase two data through the device of constructing portrayals of the three students-becoming-teachers involved, led to a desire in Phase three to investigate the world views of a small number of ex-students whom I perceived as being teachers working for change. Consequent upon this third stage of data collection and dialectically interacting with its analysis, I constructed a model of teachers' ways of knowing which is intended to inform our understanding of what it means to embrace an emancipatory epistemology, particularly with reference to the mathematics classroom. I have used the data from Phase three to vivify (Lather 1991, p91) this model. This is the centre, the heart of the thesis and is commented upon in the *Afterword and Commentary*.

I conclude the thesis by considering the implications of the research for the initial education of teachers. I draw out the principles which need to inform our practice if we are to contribute to the development of teachers committed to critical mathematics education. In particular, I raise questions about the current alterations to the initial training of teachers which are intended to make it much more school-based and competency driven and about the rhetoric accompanying these developments. I note the need for self-reflexivity and dialogue in the teacher education curriculum and discuss the role of subject studies. Finally, brief suggestions are made for further research, including suggestions for action research into practical ways of implementing an emancipatory initial teacher education curriculum.

A different story: contributions to methodology

Throughout the research, in addition to developments in the focus of the research and in the nature and type of data collection, my participation in the research process has itself demanded the extension, deepening and rethinking of considerations of research methodology. In this sense, it has been a very personal journey for me, enormously rewarding and overpoweringly oppressive by turns, and one from which I emerge much changed. (See Figure 2: New paradigm research for comment.) I regard this thesis as the tale of that journey, a perspective also experienced and described by Susan Weil.

This thesis represents an attempt to document the journey of the research on different levels, as well as its outcomes. My engagement in data collection and analysis, and my interactions with different people along the way (through reading and direct encounter) have generated both struggles and breakthroughs in my own thinking and understanding. ... How do I do justice to the journey? How do I chart the obstacles and breakthroughs I have experienced along the way? How do I convey the extent to which the research itself gave rise not only to fresh perspectives on old dilemmas and questions, but to new perspectives altogether? (Weil 1989, p25f)

These two elements - the understanding of the thesis as the construction of a narrative of a journey coupled with the developments in my thinking, influenced by post-modernism, of what

is involved in such a task - have had a profound effect not only on the research process but also on this artefact itself. Firstly, it has meant that I have not followed in its entirety the anticipated structure of a doctoral thesis although I have retained linearity and simplicity of structure - 'telling a tale'.

Thesis construction which demands that literature review, theory, method and 'findings' be written as discrete 'chapters-in-tandem' is certainly at odds with imperatives emanating from contemporary social theory. The contemporary educational researcher is being exhorted to address more thoroughly than ever before the relationship between the way the researcher theorises the 'knowable' and the logic of her methodology and research practices ... However, the traditional form for articulating theory, method and 'findings/results' ... fails to signal the embeddedness of theory in the entire research task, or to make evident the extent to which the research ought to be generative of theory rather than merely 'objective findings'. Depicting theory as a tidy point of embarkation and 'results-as-findings' as a convenient point of disembarkation misconstrues the reflexive nature of *educational* enquiry and the epistemological assumptions within which it locates itself. (McWilliam 1993, p202)

Although the structure of this thesis is linear and is the telling of a tale, the journey itself involved 'a dialectical process of engagement with the world' (Rowan 1981, p98). (See Rowan (1981) for an evocative description of the research cycle and personal participation in it.)

Secondly, there has been the effect on the writing itself. In my attempt within the thesis (very partially) to subvert the academic discourse of which it is itself a part, I acknowledge my sympathies with the intention

to keep things in process, to disrupt, to keep the system in play, to set up procedures to continuously demystify the realities we create, to fight the tendency for our categories to congeal. (Lather 1991, p13)

Through this self-reflexive way of writing, through limited aspects of my methodology and research methods and through the *Afterword and commentary*, I have sought, in some small part, to retain an emancipatory thrust to the research. I have sought, in other words, to contribute to an answer to Patti Lather's 'central question':

What would a sociological project look like that was not a technology of regulation and surveillance? (Lather 1991, p15)

You, the reader, and I are participating in an academic practice which is suffused with issues of power and dominance. I want, therefore, for us repeatedly to be unsettled. I do not believe that we should participate comfortably, unreflectingly in this practice even though, since I have chosen to engage in it, I clearly believe it is worthwhile. Whilst engaging in it, therefore, I wish continuously to acknowledge and live the reality of that power and dominance. I explore below the contribution which ways of writing which are alternative to standard forms of academic discourse can make to this project. At the risk of drowning the reader in a sea of jargon, the thesis is written as an emancipatory, postpositivist, praxis-orientated inquiry, influenced(?), flavoured (?) by deconstructivist, postmodern notions (cf Lather 1991, p7). I cannot take myself seriously in writing such a sentence: I caution the reader to think (seriously) before doing so.

The influence of methodology on writing: the personal voice

The idea of *voice* was one that began to make itself felt fairly early on in the research. I was much influenced by the writing of Phillida Salmon (Salmon 1992) and was fortunate enough to attend a seminar which she ran on the task of writing one's doctoral thesis. She suggested that we write as though to a friend and I have kept this image in my mind. There are sound reasons for this stylistic device.

When personal values and personal assumptions towards a topic are honestly acknowledged, subjectivity, previously blind, becomes self-aware and self-critical. (Salmon 1992, p71)

As will become apparent in the description of my research methodology which I come to in a later chapter, I am committed to the view that the research cannot be separated from the researcher and, therefore, for me to give an honest account involves writing myself into the text (see, for example, p49, Chapter 3 and p104, Chapter 5). Such a view often accompanies a feminist perspective on research. It is found, for example, in Cynthia Cockburn's writing about men's resistance to sex equality in organisations.

This then is a reading of social situations and relationships based on careful study of practices in four organizations and accounts of their intentions, experiences and feelings by women and men who work in them or are members of them. But it is only one reading, of many that are notionally possible. It is specific to my own subject position: as a white middle-class heterosexual woman operating in an academic mode, age fifty-five, mother of two adult daughters. A very different reading would have been produced by, for instance, a young Asian woman, a senior white male manager, a black male trade unionist - and so on. None of these standpoints can be seen today as producing the 'truth'. But all can perhaps be the basis for respectful negotiation on the question of what the world is like. (Cockburn 1991, p13f)

If, then, who 'one' is has repercussions for the 'truth' of the research and therefore how it should be read, writing in such a way as to invite the reader to know one seems to make sense. An epistemology that recognises that all knowledge is inherently perspectival is consistent with the decision to use the first person in writing and

explicitness about who I am as a person in relation to the processes and outcomes of the study, offers a sounder starting point for establishing trustworthiness. (Weil 1989, p19)

Further, such a way of writing attempts to undermine the hierarchy and elitism endemic in academic discourse. Adrienne Rich offers examples of writing, taken from an academic context, which speak with a personal voice and use the personal pronoun 'I' (Rich 1980, p143f). She offers such text as an exemplification of a pedagogic style which is 'more

dialogic, more exploratory, less given to pseudo-objectivity, ... by nature antihierarchical' (Rich 1980, p143f)

The voice which interrupts

This thesis is a narrative text of a journey. As such, it might seem appropriate to write an uninterrupted account, a simple 'story' emanating from a single voice. This, however, gives little opportunity for expressing the self-reflexivity which offers the possibility of unsettling dominance. Speaking with multiple voices is congruent with this aim. Madeleine Grumet advocates a triad of voices.

Let our songs have three parts, situation, narrative, and interpretation. The first, situation, acknowledges that we tell our story as a speech event that involves the social, cultural and political relations in and to which we speak. Narrative, or narratives as I prefer, invites all the specificity, presence and power that the symbolic and semiotic registers of our speaking can provide. An interpretation provides another voice, a reflexive and more distant one, the exterior voice-over ... What is essential is that all three voices usher from one speaker and that each becomes a location through which the other is heard. None is privileged. (Grumet 1990, p281f)

This suggests to me the separating out of the three voices as in polyphonal singing, where each part is a distinctly articulated whole but gains its full meaning only when heard alongside the others. I considered adopting a stylistic device that would attempt to present distinct voices and to make explicit the self-reflexive process. I was impressed with the strategy used by Susan Weil in writing her thesis in which one voice comments upon another in order, she says, 'to keep my objective subjectivity visible for the reader, while allowing the 'story of the research' to unfold' (Weil 1989, p18). However, whilst being committed to the inclusion of Grumet's triad of voices, I felt that, in the writing I was producing, the three were inextricably interwoven. Where different parts of the text are offered as having different status (for example, throughout Chapter 11) or where the passage of time has meant that early writing is more appropriately quoted and commented upon than used directly (for example, p94,

Chapter 5), I have indicated this at the relevant point within the text and, for the reader, the narrative continues.

Influenced by post-modernism, however, I still wished to interrupt the narrative and render it problematic, to decline to accept entirely the established parameters, modestly to experiment with form. (See Lather 1991, especially p8-11, by which I was considerably influenced. Griffiths (1995) also considers the impact of post-modernist thinking on aspects of academic writing.)

Certainly Foucauldian awareness of the potentially oppressive role of ostensibly emancipatory forms of discourse must be heeded by those of us who purport to be working *with* and *for*, not *on* our students. (McWilliam 1993, p202)

I have therefore sought to include, though only at the margin, forms of text not usually associated with academic work. By the nature of the enterprise in which I am involved, producing an academic thesis, the writing demands 'a "plain-speaking" voice of reason' (Lather 1991, p10) when what I want to offer is '[p]rovisionality and undecidability, partisanship and overt politics' (Lather 1991, p10). I am aware too that

language may be the dumping ground for all sorts of misconceptions, illusions, fallacies, myths and errors. We have to distrust the whole of language. (Skovsmose 1994, p3)

Although generally the style of this thesis has much in common with academic discourse, including extensive participation in the 'reference-and-footnote games' (Van Maanen 1988, p26, quoted in Lather 1991, p8), and is designed largely to provoke conventional responses, I have tried in small part to subvert those responses by other devices: personal anecdote and autobiography (cf Acker 1994, p12-14, Weiner 1994, p10-26 and Adler et al 1994, p40-47), the literary use of quotations, jokes, the first person voice, the legitimacy of passion ('[p]assion is a disruption of conventional research etiquette' (Reinharz 1992, p259)), poetry, the third

person singular as female. I ask you, the reader, to play roles other than, and in addition to, that of being 'convinced' of my right to be the author/ity of truth, to be and to understand yourself as being an active participant in the construction of meaning.

I find myself, however in an ambiguous relation to these post-modernist concerns. Part of me identifies with '*A Fear that They Are Trying to Shut Us Up*' (Griffiths 1995, p227), a suspicious feeling that just when those who have been marginalized and silenced begin to speak up, we are told that everything is uncertain, that there is no speaking 'self'. I sympathise with the perspective voiced by women talking to Patti Lather for whom post-modernism 'represents in obtuse jargon what feminists had already formulated and serves to mark the panic of the de-centered white male intellectual' (Lather 1991, p162). I am currently pursuing a middle (and, in true post-modern spirit, contradictory!) position of using conventional academic forms largely to 'tell my story' whilst using other textual forms as commentary, trying, if possible, to find a way between self-reflexivity and self-indulgence.

Adrienne Rich writes with the androcentricity of academia in mind but similar observations could be made from other marginal sites.

[Creating a woman centred university] does not and need not mean that the entire masculine apparatus of masculine intellectual achievement should be scrapped ... Some of the structures will be seen to be unhealthy for human occupation even while their grandeur in its own day can be appreciated; like old and condemned buildings, we may want to photograph these for posterity and tear them down; some may be reconstructed along different lines; some we may continue to live and use.
(Rich 1980, p141)

By way of example, consider the 'reference-and-footnote game' cited above. It is possible to regard this 'game' as part of a combative exercise where the writer tries to outwit the academic gatekeepers; or to display knowledgability and erudition like a peacock; or to out-reference the opposition. However, and equally, references can be seen as the hand of a friend who

leads you; an acknowledgement of and respect for those to whom one owes a debt; a sharing of what has made one; an encouragement to multiplicity.

'Finding my voice'

Finally, this brief chapter must include an acknowledgement of the process of 'finding a voice'. My supervisor and friend, Leone Burton, has said to her students that, as the work of each individual progresses, so each will discover a voice with which to speak. (See Belenky et al 1986 for a very full elaboration of this metaphor.) Such an unfolding, I believe, is deep in the heart of conducting research along the lines and within the paradigm(s) I have adopted, although I do not by this wish to imply either that it is a once-and-for-all occurrence or that I was always silent/silenced previously. Whilst agreeing with Lather that empowerment entails 'analysing ideas about the causes of powerlessness, recognising systematic oppressive forces, and acting both individually and collectively to change the conditions of our lives' (Lather 1991, p4), I also believe that the personal and inter-personal *feeling* of empowerment enables that analysis, recognition and, most tellingly, action to take place. If I am to act, I need the 'I' to be 'ubiquitously present, in all its instability and vulnerability' (Bordo and Moussa 1993, p132): having a voice is not separate from this. For me, then, the process of finding my voice is interwoven with my capacities for emancipatory action.

It is also a fearful experience. The fear I experience is like that described by Minnie Bruce Pratt when, despite the impossibility of sustaining 'the pernicious fiction that a person could negate the accidents of individual existence and speak with a purely philosophical voice' (Bordo and Moussa 1993, p132), she dares to speak anyway and to interact with 'difference'.

When I am trying to understand myself in relation to folks different from me ... I get afraid; when I feel my racing heart, breath, the tightening of my skin around me, literally defenses (*sic*) to protect my narrow circle, I try to say to myself: ... Yes, that fear is there, but I will try to be at the edge between my fear and outside, on the edge at my skin, listening, asking what new thing will I hear, will I see, will I let myself feel, beyond the

fear. (Pratt 1984, p18, quoted in Bordo and Moussa 1993, p132)

Finding my voice is not separable from being able to be open to see and to hear and to feel new things. Some of those new things have found their way here.

Considerations of Methodology

In Broken Images



Robert Graves

(Reprinted from Susin Weil, unpublished PhD thesis, University of London)

I'm definitely an agriculturalist at heart - I'd much rather have a firm theory to 'test' out than trying to get the data to speak to me!

(Letter to my supervisor, January 1994)

I introduced the first draft of this chapter by writing, 'I shall set out [here] the theoretical perspectives which informed the choice of research design for my enquiry'. It is indicative of my changing view of the research that this no longer seems appropriate. The words 'choice of design' do not seem adequately to capture the 'interactive, developmental, non-linear, "messy" process' (personal communication, Kerry Cripps, July 1995) in which I was involved. When I embarked on the work, I already had an (informal) understanding of what sort of research I was going to be conducting and knew, in some very general sense, what sort of methods I intended to employ. This made me uncomfortable when I first began to try to come to grips with the literature on methodology. I felt potentially guilty of 'bad faith': surely I should be entering the theoretical debate with an open mind and only after judging each methodological perspective on its own theoretical merits should I commit myself to a methodology and then methods for the research. As I found my way around the literature, however, I came to see the whole research enterprise as *praxis*, 'a form of reasoning informed by action which, in a process of reflection on its character and consequences, is reflexively changed' (Weiner 1994, p121).

I begin the chapter by 'clearing the ground' of some of the ideas (perhaps less dominant now but still in some sense retaining an unexamined orthodoxy) taken to support the view that educational research should be conducted along the same lines as research into the natural sciences, within the context of those theories and concepts traditionally perceived as underpinning such research (though increasingly now called into question). I then consider the insights offered by a variety of approaches, those of ethnography and the interpretive paradigm, of action research and of democratic methodology and of research conducted by feminists. Finally I shall consider some of the problems and possibilities of these methodologies and note that, with 'the loss of positivism's theoretic hegemony' (Lather 1991, p6), we are living in a 'climate in which gusts of intellectual opinion obliterate old lines of demarcation without providing new parameters for our work' (McWilliam 1993, p203). We are currently experiencing the 'post-paradigmatic diaspora' (Caputo 1987, p262, quoted in Lather 1991, p7).

What it is not

I shall begin, then, by trying briefly to delineate some of the things that the research methodology of this thesis is not. The methodology which I have employed does not fall within what has been called elsewhere the 'agricultural-botany' paradigm where performance is assessed by reference to some pre-specified criteria and it is the researcher's job to examine whether or not the outcome meets the required standard.

Students - rather like plant crops - are given pre-tests (the seedlings are weighed or measured) and then submitted to different experiences (treatment conditions). Subsequently, after a period of time, their attainment (growth or yield) is measured to indicate the relative efficiency of the methods (fertilisers) used. (Partlett and Hamilton 1972, p7)

Research studies operating within this paradigm seek to create one specific category of data, that is, numerical data which can be subjected to statistical analysis; other more subjective, intuitive, small-scale and local data have no place. This means that, even operating within the particular intellectual orthodoxy of which the paradigm is a part, there are very real difficulties in attempting to use this methodology for evaluating curriculum innovation. There are two aspects of such research to which I want to draw attention: first, the fact that it needs to operate on a large scale and, second, the fact that it supposes the applicability of a before-and-after approach, where the experiment is not 'interfered with' during its progress.

Firstly, then, I consider the need to operate on a large scale. Within the educational setting there are always a very large number of uncontrolled variables, variables which it would certainly be impractical and artificial (and also probably unethical) to seek to control. Studies therefore need to be large scale so that the sample size will allow for these parameters to be randomised but, setting aside the expense in time and resources that such an approach entails,

it is also the case that almost always evaluation is attempted, sensibly, *before* large scale implementation of changes rather than after.

Secondly, there is the before-and-after aspect of this approach. It is clearly unsuitable for the sort of continuing work in which I was engaged. Initially, I was investigating the effect of an intervention (on promoting gender equality) in a PGCE programme on which I was contemporaneously teaching and, throughout the research, I remained actively involved either in continuing to evaluate changes in that programme or in trying to meet the in-service needs of the research participants or both. The 'agricultural-botanical' approach assumes that there will be no change during the period in which the innovation is being studied and yet in the work being described here there was obviously a continuous feedback mechanism between implementation, observation, evaluation and re-implementation, a 'classic' exemplification of the action-research cycle (see, for example, Altrichter 1993, p49) which is discussed in greater detail below. It would simply not have been ethical nor would it have led to a more informed assessment had I not developed my practice in line with what I was discovering as I went along (nor, surely, would it have been possible). The data available are much richer precisely because changes were made on the basis of insights gained: the result is a greater degree of complexity in the data which makes them more difficult to interpret but, it is to be hoped, less superficial. I share 'the paradoxical view that field study data are strong data which are difficult to organise, while test data are weak data susceptible to organisation' (Hamilton et al 1977, p101).

It is also worth considering the implications, both moral and practical, of the 'agricultural-botanical' model when applied to people in an educational setting. Describing agricultural research, Lawrence Stenhouse has written,

Statistically significant preferences for one treatment as opposed to another generally meant that in a substantial minority of cases - as many as 40% it could be - the treatment which showed better overall was in fact worse. (Stenhouse 1980, p3)

Neglecting the effect on the minority may be practical commonsense in the botanical sphere (although even here such methods are perhaps not as fashionable as they were) but it seems a grossly inadequate response to data in the educational field. If, for example, our curriculum innovation had what was regarded as a deleterious effect on four out of ten of our students, there would be little sense in calling it a success and 'applying' it wholesale to subsequent cohorts. In addition, large samples and statistical generalisations must overlook local variations and unusual happenings; these may be vital elements in the process of *understanding* (and therefore having insights into improving) the effects of the innovation, a point which will be developed further below.

All of the above are what might be called practical considerations and can stand happily within the 'applied science' paradigm. There are more fundamental reasons of an at least partly philosophical nature that also meant the paradigm had no 'fit' for the research. This subject has been considered at length elsewhere (see, for example, Carr and Kemmis 1986, especially p51-81). In its purist form, this view of educational research is an exemplification of the positivist approach to scientific enquiry, a view which has been increasingly under attack even within the field of the natural sciences (Popper 1963, Kuhn 1970, Rose 1994). It is now widely accepted that scientific paradigms structure observations, that observations are made within the theoretical framework and perceptions of the paradigm, although the meaning and implication of this contention are hotly debated (Lakatos and Musgrave 1970, Atkins 1994, Collins 1994, Dawkins 1994). Positivism posits neutral observations leading to 'objective' knowledge.

[It] advocates the search for universal laws ... 'Facts' are assumed to exist external to the researcher, waiting to be discovered. The researcher is seen as an objective, apolitical and value-free being, who works at a necessary distance from the 'object' of study. (Griffin 1985, p100)

It asserts that such independent observations are possible and, what is more, that the act of observation can be so constructed as to eliminate the effect of the observer, a view currently under challenge even within that most pure of the natural sciences, physics (see, for example, Zukav 1980 for a popular account of some of the difficulties in the positivist position). The positivist position embraces an epistemology with which I felt out of sympathy and one which seems increasingly difficult to justify. (For a full discussion of an alternative epistemology, see, for example, the first chapter of Bhaskar 1989.) As the research progressed epistemological issues loomed larger and larger: later chapters in the thesis discuss them in some depth.

Although not germane to this research project, I note in passing that this is not to say that there is no useful place for quantitative research as such within the field of educational research. Quantitative research is not necessarily embedded in a positivist philosophy and may offer appropriate research techniques for the investigation of some questions (Griffin 1985, p99f). As Erica McWilliam notes when discussing epistemology after positivism

... *postrationalism* does not reject out of hand the methodologies of positivism, but moves beyond the boundaries positivism set itself for producing and articulating knowledge. (McWilliam 1993, p203)

An example of some quantitative research which was able powerfully to confirm and further illuminate teachers' understanding of their classroom experiences (despite the fact that the recommendations for practice from the research team might not resonate with them) was that conducted at Chelsea College, London into children's understanding of mathematics (Hart 1981).

There are also particular reasons which render the positivist approach inapposite for *educational* research. This is to do with its supposed separation of means and ends, the supposition that one can set an educational aim (for example, to raise student teachers'

awareness of how girls in school are at present systematically disadvantaged) and then freely survey all available methods for achieving this end (including, for example, methods which undermine the perceptions and confidence of women student teachers). Most often within an educational context it is simply not possible to separate means and ends like this. Again, if an end is to create reflective, critical individuals, then it is both logically and morally impossible to achieve this by means of a charismatic, demagogic style (except, of course, by this being experienced as repugnant and therefore rejected!) even if such a method generates behaviour which appears to stem from a critical and reflective individual. Participation in the educational process is itself also part of the product.

The prevalent effective theoretical challenges to positivism, however, have meant that the hegemonic sway of narrowly quantitative methods has been reduced.

For decades the voice-over of educational research and discourse was dominated by quantitative measures of learning and schooling. Statistical analyses that obscure individual experience have given ground in the last decade to qualitative studies employing history, literature, anthropology, and journalism to convey a subject's sense of educational experience. (Grumet 1990, p279)

If positivism as an epistemology and statistical data and analysis were not appropriate, I asked myself, what might I learn from other research paradigms?

Ethnography and the interpretive paradigm

The first alternative paradigm which informed the educational research process, ethnography, developed out of anthropological enquiry and participant observation research in sociology. Ethnographic studies of schooling are part of a broader tradition of ethnographic work within social anthropology, adapted from this tradition to meet the practical and theoretical needs of educational enquiry. 'Ethnography by definition is descriptive' (Woods 1985, p52) and that description is not intended simply to be of behavioural aspects of the object of study. It is

verbal rather than statistical and is to be 'thick description', a notion deriving from Gilbert Ryle (quoted in Geertz 1973, p6), which

aims at describing the meaning or significance of behaviour as it occurs in a cultural network saturated with meaning... The meaning of a wink... is entirely different from a description of an eyelid closure... The splash in the ocean in Breughel's painting, *The Fall of Icarus*, can be critically described only if one knows the story of Icarus. (Eisner 1975, p97)

That human behaviour consists of actions, that is, behaviour with *meaning for the actors*, is central to the ethnographic paradigm, it being the responsibility of the researcher, at least in the first instance, to capture and portray those meanings as best she may. This is not understood as independent, 'objective' data since what are called data are really 'our own constructions of other people's constructions of what they... are up to' (Geertz 1973, p9). In this sense, the very notion of 'data collection' seems to carry with it inappropriate connotations of a rejected, positivist methodology.

In designing my research I decided to use interviews and also small pieces of writing to attempt to elicit from the students-becoming-teachers the meaning for them of both their learning at college and their experience of becoming teachers. An important aspect of the evaluation of the work we did on the course was the assessment of whether or not there had been a change in the *attitudes* that the students had about equal opportunities issues and about their professional responsibility to provide them for the schoolgirls and boys in their care. It was *the students'* meanings which were needed to provide understanding of their understandings and therefore their positionings within the culture of schooling. (In part on the course and more substantially subsequently, I also wanted to find out about their classroom practice. This involved *their* perceptions but also my own.)

Another aspect of ethnography and interpretive research that illuminated the approach I took was that such studies are essentially eclectic and the researcher considers herself free to adapt

and use a variety of methods depending on the circumstances of the enquiry and what are perceived to be the telling research questions: 'the problem defines the methods used, not vice versa' (Parlett and Hamilton, 1972 p13). These may initially be very broad, with the ethnographer adopting a 'catch what they can' approach (Edwards and Furlong 1978, p57-58, quoted in Herbert 1989, p41) and acting as

a sort of tea strainer, who may exhibit much decisiveness about the interpretation of the tea leaves, but who has less impact on the amount and blend of the brew that is poured onto her/him. (Davies 1985, p84)

After the initial action research project of Phase one, where the methods were devised very much as we went along and the methodology was considered largely after the work with the students was over, I decided to participate in group meetings with the next cohort of students and, in Phase two, to follow up the ex-students into schools. (The experience of and recorded data from these meetings did not, in the finish, contribute directly to the research but I have retained some references to them because they threw up methodological considerations and they contributed to my personal development as a teacher and as a researcher in, I believe, both conscious and unconscious ways.) At this stage in the research, I needed to act in the spirit of a fieldwork researcher (at least initially), that is I needed to be able to

act pragmatically, having not been constrained to articulate either a specific problem or a specific technique in advance of the investigation. (Burgess 1985, p4)

It was my intention to make the work genuinely exploratory and consequently the pre-selected categories of, for example, a systematic observer were not likely to be helpful. In the ethnographic tradition, I expected largely to construct categories with which to analyse the data *following* at least the initial stages of data collection. It seems that this would have been a feature of the research whatever my particular involvement with it, since the plan was as much to uncover research questions as to establish 'answers'. Given the fact that I was

plunged into the research project immediately upon starting a new job and without any background in the theory of research methods, it was, I suggest, inevitable. This is not to say that I was a *tabula rasa*, interacting 'innocently' with the data and only devising my theory through that interaction with it. Inevitably, I would from the beginning have a framework, albeit unarticulated, which I brought to the research which would structure in both deep and surface ways the data I would collect. It is in response to this understanding that writing myself into the research is required for trustworthiness and validity.

It is also worth emphasising separately what I hoped would be the outcome of my research. I was not looking to uncover (let alone 'prove') a law, neither one governing human behaviour in general nor, in particular, one governing the understanding and practice of equal opportunities of students-becoming-teachers through their induction and socialisation into schooling. In this respect also I was working within the ethnographic and interpretive paradigm. Ethnography is not 'an experimental science in search of law but an interpretative one in search of meaning' (Geertz 1973, p5). I did not set out with an hypothesis which I wished to check against the data I could uncover but rather to develop an understanding that might help illuminate a small part of our working life. I support the view that 'the main emphasis [of ethnography] is on discovery rather than testing of theory' (Woods 1985, p51) and this certainly indicates what I saw myself as attempting to accomplish. My colleagues and I had adopted an intervention strategy with respect to the provision of equal opportunities for girls and boys in the students' initial teacher training. I wanted to find out as much as I could about what impact, if any, that strategy had had on their subsequent practice and understandings as teachers. My intention was that, by so doing, I would be able to *shed light on*, or, 'taking touch rather than sight as [my] organising metaphor' (Griffiths 1995, p222), improve *the feeling for* how new teachers conceptualise education in general and the provision of equal opportunities in particular. I would not be *testing* an already established theory (neither one of mine nor that of someone else) but would be seeking to elaborate a theory on the basis of the ethnographic data. As the research developed, I began to articulate a theory

about the ways of knowing of beginning teachers and, in Phase three, that articulated theory and the new data reciprocally influenced one another.

There are two different approaches to the role of the observer in field work found in the literature both of which were relevant at different stages in the research. There are those researchers who, whilst acknowledging that the presence of a researcher in the field of study will inevitably influence what is happening there, nevertheless strive to minimise the impact they are having and participate only because they 'cannot think of another way of observing that social setting that is of interest' (Collins 1984, p57). Something of this role matched part of how I worked in Phase two of the research when I attempted to understand the specific school settings in which my ex-students were employed, by, for example, observing departmental meetings or spending some time simply 'listening in' to the general flow of 'chit-chat' or particular conversations in the staffroom. At other times, however, for example within the group meetings which I set up with the second cohort of students, I would be attempting to be a fully active 'participant observer', not seeking 'to minimise interaction ... but to maximise it ... participation [being] central, irreplaceable and, indeed the essence of the method' (Collins 1984, p60).

Ethnographic studies of schooling have typically committed the researcher to a substantial involvement in the life of one particular school over time (Hargreaves 1967, Lacey 1970, Willis 1977, Ball 1981, Burgess 1983). Clearly this was not an appropriate method for me because I wanted to follow the students into each of the schools in which they were working as teachers new to the profession: I was interested in the development of the students where the school was one variable. (It would, incidentally, also not be practical given the fact that my research was not full-time.) I was making an ethnographic study of a particular group of students widespread in their current locations and so I needed to engage in 'condensed fieldwork' (Walker 1978, p209), a practice not without difficulties in theoretical justification and one which 'can sound like ethnography on the dole' (Rudduck 1993, p14). It is questionable how much of the underlying nature of classical field work remains when the

'living alongside' element is removed but some of the important features discussed above remain and the epistemological grounding is shared.

Action research

The second strand contributing to the development of my thinking about the research project was the idea of the action research process, currently a paradigm used, discussed and reported on in association with the idea of teacher-as-researcher (see, for example, Norris 1977, Hustler et al 1986, Association of Teachers of Mathematics 1987). The initial, funded stage of the research was described as an action research project and many of the characteristics of action research have also continued to feature throughout.

Wilfrid Carr and Stephen Kemmis provide a useful definition of action research which brings out many of the central characteristics. They describe it as being

simply a form of self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own practices, their understanding of these practices, and the situations in which the practices are carried out. (Carr and Kemmis 1986, p162)

The initial project and my subsequent work were designed to have the characteristics of being focused on improvement of our practice and of being undertaken by practitioner(s). We were to be involved in the classic action research cycle of reflection, planning, implementation and evaluation leading to reflection in turn informing planning and so on.

A characteristic feature of traditional empirical research is its personal and institutional separation of reflection and action ... Action research opts against this methodological separation. (Altrichter 1993, p48f)

The intention was not simply to understand what we *have done* but to use this understanding to control and direct what we *shall do*, not simply to understand our world but to change it. In this sense it echoed basic elements of the action research process.

Action research is also commonly associated with *collaborative* participation; different stages of the research would incorporate this characteristic to a greater or lesser extent and in markedly different ways. The first, joint phase of the project was designed to generate extensive collaboration amongst the lecturer practitioners leading to the development of an informed and shared discourse where each of us had the same chance, unconstrained by domination, to put forward ideas, to formulate intentions, to call things into question, to argue for or against suggestions, explanations, decisions, interpretations, to express feelings, attitudes, hopes and fears (see, for example, the discussion of Jurgen Habermas' work in McCarthy 1975, pxvii, quoted in Carr and Kemmis 1986, p143). The research in which we were engaged met, within a Higher Education context, the definition of being

research into their schools and classrooms by teachers who are committed to improving their practice through the process of self-reflection and collaborative action ... [in which] the language and the truth tests of practitioners are employed to identify and eliminate the distortions and coercions which prevent free speech, open communication and equal access to knowledge. (Gibson 1986, p162)

Consequently there would open up the possibility of supportive, critical, shared reflection and of just and democratic decision making *within* the group of practitioners. In this first phase of the research, however, there was no attempt to involve the students as members of the action research process. In this sense they were the 'objects' of study rather than 'actors' in the research.

During the next stage of the research, the empowering collaboration amongst colleagues continued only informally and at a distance. An attempt was made instead to involve (some)

of the students themselves in the action research process. By setting up a regular group meeting, the intention was to augment the scope of the action research process, to enlarge the range of the participants to the shared discourse, to make the students themselves participant researchers in the search for understandings of the process of students-becoming-teachers and the consequences for the provision of equal opportunities for boys and girls in schools. (In practice, these high hopes were not realised.) In turn, it was hoped that the impact of the action research would contribute to their development as reflective practitioners (Schon 1983).

However, in the data collection in schools in Phase two of the research, neither of these forms of group collaboration was available. In addition, in this phase, I was in a real sense not investigating my own practice and understandings directly but only at one stage removed. I would be attempting initially to gain knowledge of and insight into the practices and understandings of my ex-students and only subsequently to use these in turn to illuminate and change my (our) own practice. I would here be moving further away from an approximation to an action research model with its implicit possibilities of equality and empowerment and participatory control. If I wished to retain for the research an emancipatory interest it would also need to be informed by democratic and feminist perspectives.

Democratic methodology and the research of feminists

By democratic methodology I understand that cluster of ideas emanating from the Centre for Applied Research in Education at the University of East Anglia under Lawrence Stenhouse (see, for example, Norris 1977). I do not refer to 'feminist methodology', since it is part of the essence of a feminist approach that there is no one way of researching (see, for example, Harding 1987, p188), but in general terms my research design was influenced by those principles and practices that inform the research work of feminists.

A concept central to both democratic research and research conducted by feminists is the issue of who *owns* the research and, connected to this, *for whom* the research is undertaken. The

first and perhaps most obvious place where these questions arise is in considering data collection. In democratic research and commonly in research conducted by feminists, the participants are in control of any data collected: this means that confidentiality must be assured and that any use which is made of the data is negotiated with them, including, ultimately, the researcher accepting that the participant may withdraw completely or partially from the research. This is partly for ethical reasons: 'people own the facts of their lives and should be able to control the use that is made of them in research' (Walker 1978, p214). However, it also has the consequence that, because meaning has to be negotiated, the possibilities of misunderstanding and therefore misconstruing the data are reduced. Returning data to the participants for checking should contribute to the elimination of gross error and recycling emerging analysis and conclusions back through them should contribute to 'face validity' (Lather 1986, p78). Another clear consequence of this methodological stance is, of course, that the data-collection cannot be in any sense covert.

I foresaw that these ideas would inform most of my practice in all three stages of the research, perhaps most fundamentally in recording and interpreting the group meetings I had with the second cohort, but also in all my direct dealings with the students-becoming-teachers. I discuss in some detail the issues raised and decisions made about interviewing elsewhere (see Chapter 4), but let me record here that I intended to regard all interview data collected with the students-becoming-teachers as belonging strictly with the participants. However, this turned out not to be the simple matter that I had foreseen. Much of the interview material was only recorded in my personal notebooks, largely unintelligible to any other reader. Other material was gleaned from tape recordings which were never, or never fully, transcribed. Both with notebook and tape sources, often I decided to include material only after a very considerable time lapse (as much as four years later) when in many cases I had lost contact with the participants. This was, therefore, one of the ways in which I did not meet my own expectation of and commitment to democratic research. Partly as a result of becoming aware of this failure as the research progressed (but also influenced by the nature of the data and the form of analysis I was using), I did transcribe from the interviews in Phase three all of the

material that I perceived as having any relevance to the research (Appendix 11) and returned these to the participants for comment.

I also found myself in an unforeseen and intractable dilemma with the portraits that I later constructed on the basis of the Phase two school visits and interviews. Although I intended to return to each of the teachers involved the story that I had told about that individual, in the finish I only returned the two more positive ones. There were some minor practical considerations involved but these could have been overcome. Mostly, I think, I was motivated by amoral squeamishness about confronting someone I knew with a partially unflattering picture of themselves. In addition, my actions feel both unethical - the individual is patronized and also has no chance to defend herself - and ethical - given the direction in which the research was going, I would not be asking her to participate further and would not realistically have the resources to work through the potential damage and offence to a shared perspective, were it possible to do so. This falls far short of meeting a commitment to democratic research even though I believe that the portrait will only be used to argue for changes in the teacher education curriculum designed to make it more liberatory.

Throughout, I worked hard to retain a clear perception of the relative power of the researcher and the researched, especially of the interviewer and the interviewed (Finch 1984). Although I might strive to operate within a democratic and feminist mode, I share the view that

[i]t is possible to break down hierarchies ... within an atmosphere of ... trust and personal commitment. But the researcher must never suffer the illusion that total equality can be achieved. She must acknowledge the power relationship in which she finally determines what is recorded and what is not, and in which she must assume ultimate responsibility. (Witcher 1985, p103)

I remained clear that what appeared in the records and what 'counted' as data would reflect my own concerns and understandings. In addition, I now understand that inviting 'member

checks', whilst being a basic necessity for democratic research, contributes in only a very small way to redressing the power imbalance between the researcher and the researched. The participants remain very much the *objects* of the researcher's craft unless the researcher and the researched are one. Inevitably, it is finally the writer's categories, concepts, constructs and so on which frame and shape the work and it is the writer's story which is told. It is with 'suspicion of the intellectual who both objectifies and speaks for others' (Lather 1991, p15) and to offer an interruption to this relation of dominance that I have included the *Afterword and commentary*.

Where I incorporated written data (for example, background information supplied by schools, questionnaires from students) and where I collected data from interviews with, for example, headteachers, I intended to offer complete confidentiality but neither final control nor negotiated meaning. This was partly for practical reasons (many more students gave me written feedback than I could hope to interview, negotiating meaning with school hierarchies would be, at best, peripheral to the area of study) but it was also because I did not feel that the same ethical issues were raised. In this culture, writing is considered a much more public act than speaking and I did not think that students would feel loss of good faith on my part by having their written remarks reported and interpreted; printed information from schools is intended to stand or fall on its own; and the research was not 'getting inside' the understandings of headteachers about the socialisation of their probationary staff, but rather it included trying to see the public statements of those headteachers as they might be experienced by the ex-students.

Issues around the collecting of data were likely to be the most pertinent to my enquiry because, as the participants left the course, they would be losing touch with each other (and, perhaps, me) and would also typically be engaged in demanding full-time work which would provide little opportunity for direct, on-going involvement. At the beginning, when I thought the research was going to be about addressing equal opportunities issues in initial teacher

education (rather than about coming to understand how it is possible to be a teacher working for change), I also anticipated that

[the research's] on-going nature centres on new cohorts of students which means that it is going to become increasingly peripheral, although I hope still of interest, to my ex-students in their working lives. (personal notes, December 1992)

However, given the change in the direction of the research and the participants' generous engagement with it, I no longer believe this to be the case. Nevertheless, any sense of their sharing control of the research as a whole as opposed to having control over the data remained unrealistic. Similarly, an element commonly found in democratic research, that of the research itself acting upon the participants to develop their thinking, awareness, understanding and so on, was not deliberately present for any of the participants in the original design. (I now understand, which I then did not, that the very act of participating in, for example, semi-structured interviewing, because it provokes reflection, leaves the interviewee changed. Those I contacted frequently said how rewarding the process was for them and how much they felt they had gained from it.) Participant development, then, might have been a hoped for by-product but was not initially an aim of the research (except to some extent with the group meetings); participant development was not an intention. I now regard this as both naive and undemocratic.

Another consequence of a democratic relationship between the participants and the researcher is that openness is required on the part of the latter. This was a crucial element in my relationships with my students. There was no sense in which I could, or should, seek to hide my own commitment to and understandings of the issue of providing equal opportunities for girls and boys in school. It was part of my professional duty to work with the students on these issues and I would have considered it improper to attempt to handle value-laden and political issues without declaring my own bias. Although it may be the case that 'attempts to bury the values on which educational decisions are made have become habitual' (Powell and

Solity 1990, p72), it is intellectual bad faith to suppose that something as deeply political as how a society reproduces its values in its young, that is, in part, education, could be approached in a value-free way (Maxwell 1988, Ernest 1989b, 1991). I have values of my own (for example, I am committed to free state education which attempts to offer genuinely equal opportunities to all) that inform my educational practice and I am also committed to a view of education that seeks to promote critical and independent thought. Necessarily therefore I must declare my own bias so that students can move towards developing their own views with an explicit awareness of the values and other factors that underpin them. Since this was going to be true of my pedagogy, I needed a research methodology that acknowledged and built on this.

These considerations apply to both democratic research and research conducted by feminists. Were there additional insights to be used in designing my research that related specifically to the perspective of feminists? It is certainly the case that the research was informed by such perspectives at a philosophical level, particularly with respect to the epistemological view which I was striving to comprehend, articulate and endorse. Much of this links with the earlier sections on the ethnographic paradigm but it goes further. There are structural reasons why it is difficult fully to grasp and express feminist world views.

Perhaps patriarchy's greatest psychological weapon is simply its universality and longevity. A referent hardly exists with which it may be contrasted ... or by which it might be refuted. While the same might be said of class, patriarchy has a still more tenacious or powerful hold through its successful habit of passing itself off as nature. (Millet 1970, p58, quoted in Rich 1980, p77)

This is as true of the assumptions underlying our school educational system (see, for example, Payne 1989, Scott 1989, Spender 1989) as it is of the research milieu, where

the very language, theories, models and ways of 'doing rationality' are recognised as inextricably bound up with the

dominant male culture of the university environment. (Davies 1985, p82)

Many of the issues about the purpose, subject and method of research that is distinctly feminist relate to research of, by and for women. In this study, although myself a woman, I was working throughout with both women and men and was intending the research to be for both female and male colleagues and students. Thus far, many of the specifically feminist approaches to research were marginal to the work I was doing. However, it is also the case that, especially when I followed up the students into the wider world of the schools in which they were working, I expected to see them confronted with sexist values and behaviour as well as, I hoped, the influence of those committed to providing equal opportunities. I felt I needed to bring, as clearly as possible, a feminist perspective to bear on what was happening both accurately to see it and also to begin to describe and understand it; and this, naturally, needed to be a declared part of the research. I subscribed to the view that I was investigating an essentially political issue and in such a context to portray myself as being outside the political framework, as being independent of and uninvolved in the issues, as having no active opinions about what I saw, would be simply a masquerade: anonymity was not only not possible, it was also not desirable.

I also believed that

[i]t is politically value-laden research processes that are producing the more complete and less distorted social analyses ... Scientific knowledge-seeking is supposed to be value-neutral, objective, dispassionate, disinterested, and so forth ... Science's method is supposed to protect the results of the research from the social values of the researchers. And yet it is obvious to all that many claims which clearly have been generated through research guided by feminist concerns, nevertheless appear more plausible (better supported, more reliable, less false, more likely to be confirmed by evidence, etc.) than the beliefs they replace. (Harding 1987, p182)

I hoped to make a small contribution to such an analysis.

The part of the research in which I was most specifically indebted to the research practice of feminists was in the work relating to the group meetings. I was, in the end, unable to make these meetings work for me as a research tool although they contributed to my development as a teacher and as a researcher. In addition, they raised issues of methodological principle. It therefore seems appropriate to consider them here although they will not, of course, feature in the empirical phases of the research.

I knew of no closely related use of group meetings as a research technique. I was familiar with the use of group meetings by women for confronting mutedness, for unlocking knowledge and experience, for coming to an awareness of the 'assumptions in which we are all drenched' (Rich 1980, p35). (See, for example, Oakley 1985, p76f.) I felt that I was moving into fairly uncharted waters. Had it been available at the time, the ideas and techniques described in Clark (1993) might have been useful in informing my practice. I had read of Carrie Herbert's adaptation of the technique in her school based research into the sexual harassment of schoolgirls (Herbert 1989, especially p57ff); and, like her, I had doubts about whether I would be able to resolve some of the dilemmas of using such an approach. Of some difficulties I was aware before I began. I was, for example, the Subject Leader for the course that the students were following. I was therefore in a strictly hierarchical position over them, including being a significant assessor of their progress. We would be very disparate in terms of age, social background, educational experience and, probably, sexuality. Most importantly we would almost certainly be female and male. Nevertheless, I decided to include the group meeting as one element in designing my research; it could not, I felt, fail to be rewarding and might provide useful insights into the student experience.

I therefore went ahead and discussed the form, time, purpose and so on of the group meetings with the first cohort during the last week of their course and was guided to some extent by their advice. I decided to offer a group meeting once a fortnight during the course, suggesting that it could be a source of additional support for the students and intending, at least initially, to strive to keep a practical focus. I prepared a short description of what I intended (see

Appendix 17) and presented this to the new cohort of mathematics PGCE students during their first week of attendance at the University. I decided that, whatever happened within the group, unless it did not even come into being, I would keep a personal diary throughout this stage of the research. The diary might include reflections about the nature and purposes of the group and of the overall conduct of the research but would also include accounts of my feelings, my hopes and fears - distant shades of Bronislaw Malinowski (1967)! I have been very glad of this decision as such jottings help to reconstruct the personal journey involved in the research.

What I attempted had something in common with self-support groups in that I tried to create an egalitarian and non-hierarchical context for the students to explore sensitive issues in depth. I myself intended to contribute things that had happened to me and issues of current concern to me, seeking to devolve power and create an atmosphere of reciprocity. Experiences, I hoped, could be described in a shared supportive environment. It was different from a self-support group in a number of respects however. Although I thought that I would also be able to use the group to share experiences and to work jointly on trying to understand them, I was, of course, there in a different role from the students. I was not one of their peers and, although I was facing equal opportunities issues in my own teaching and professional life as a lecturer, my position was one of comparative experience and security when contrasted with theirs as students and student teachers. Inevitably and in their view appropriately, they regarded me as an 'expert' on professional matters and so my role retained much of the teacher: I was expected to offer structure, to make connections, to draw threads together, to help generalisations to emerge. This undermined the extent to which the meetings provided a full and reflective voice for the students.

Another difference stemmed from the fact that self-support groups usually come into being in response to expressed need by the participants and with no ulterior purpose or specific end in view. I intended to record and analyse what happened within the longer term perspective of the research and the students' understanding and awareness of this was an element in how we

all interpreted the function and functioning of the group. I had other (declared) purposes than the shared ones. We did not have a fully shared agenda.

In addition, as expected, only some of the students volunteered to be members of the group and yet I remained tutor to and available to them all. I was deeply anxious about the ways the volunteers and I would relate to the rest of the cohort. Would the creation of the group be divisive? Would those who had not joined in therefore see themselves as not prioritising equal opportunities issues? Would those who had volunteered see themselves or be seen by others as untypical and as emphasising one particular aspect of the course perhaps at the expense of others? These anxieties had a profound effect on the extent to which I allowed relationships of intimacy to develop within the group. Because I was so concerned not to establish, in any sense, an 'in-group', I failed to create the sort of atmosphere in which we, as group members, might have become vulnerable to one another. Without such vulnerability and intimacy, it was of course to be expected that real shared personal insight would not develop. It was this, more than anything else, which militated against the effectiveness of the group meetings in terms of the research.

I am doubtful of the extent to which I understood clearly the function of the group meetings as a research device and to what degree I had a sound intellectual grasp of their research purpose. There is theoretical and practical work to be done in developing our understanding of emancipatory research methods not least those involving group enquiry. I am left with many, currently unresolved, questions. What is the significance of the other roles the group participants play for each other, for example, teacher/student? Is it particularly significant if those other roles are part of a hierarchical structure? Is it possible to bring to the group setting any sense at all of equality if, outside the group, relations of dominance exist between the members? What is the impact of a perceived difference in knowledge base between the participants, and especially between the researcher(s) and the rest? How is interviewing a group different from a group conversation? How else might the group task be described/analysed? If the researcher(s) have an agenda of enquiry, in what sense, if at all, can

the agenda be understood as democratically negotiated if not every member of the group sees themselves as a researcher? What is the significance of how and by whom the group is instigated? Do the *feelings* of the researcher(s) offer any information? Does a group setting offer any protection against over disclosure? Or, conversely, does the group setting put pressure on the members to disclose more than they otherwise would? Is this pressure illegitimate? Who decides? What methods of recording are legitimate or helpful or appropriate? These are some of the questions we might take as a starting point for further enquiry and reflection.

Feminism also offered me a justification for researching an area in which I was deeply involved.

A feminist methodology ... requires ... that the mythology of 'hygienic' research with its accompanying mystification of the researcher and the researched as objective instruments of data production be replaced by the recognition that personal involvement is more than dangerous bias - it is the condition under which people come to know each other and to admit others into their lives. (Oakley 1981, p58)

I was clearly concerned with the students-becoming-teachers' concerns; perhaps my involvement would enable them to recognise and speak of some of the truths of their situations.

Issues of validity

Although I felt fairly happy in practice with this rather eclectic range of methodological influences, it must be said that, as with other methodologies, there are unresolved theoretical problems about the research paradigm(s) I was adopting. Many of those engaged in ethnographic, 'case-study' research, for example, who do not doubt the essential purpose and value of ethnographic work, have nevertheless been aware of the need for more work to be done on its theoretical base and the details of what constitutes legitimate and informative

practice (see, for example, Delamont and Hamilton 1984, Atkinson and Delamont 1985, Hammersley 1986a, Lather 1986).

It is, of course, important to characterise these difficulties *within* the relevant epistemological paradigm: issues, for example, of validity and generalisability need to be satisfactorily addressed but not necessarily by invoking a notion of 'science'. Martyn Hammersley, discussing the work of Herbert Blumer, suggests that

on the one hand, social phenomena cannot be understood without taking account of subjective as well as objective factors; yet, at present, *we have no way of capturing subjective factors that meet the requirements of science*. (Hammersley 1989, p4, my italics)

However, it is not clear that we should accept this imperative. Rather, since within the ethnographic approach 'the use of interpretative human insight and skills is, indeed, encouraged rather than discouraged' (Hamilton et al 1977, p 18), the educational researcher has perhaps more in common with, for example, psychiatrists and historians, by whom such methods are taken for granted, than with physical scientists. The tests for the worth of the research are therefore not those of 'objectivity' and 'truth' in the sense of factual data uncontaminated by the researcher but rather whether or not the data are accurate, fair and relevant and the report is regarded as useful, intelligible, revealing.

Through the methods of data collection used (described in Chapter 4) I sought to ensure that the evidence offered was accessible to critical analysis and to triangulation (Stenhouse 1980, p4). Because I saw the data as essentially 'contaminated', I have included myself - my values, my purposes, aspects of my biography (see, for example, p49, Chapter 3) - in the account of the research so that my 'own position in the web of power/knowledge/desire' (Walkerdine 1990, p196) can be, to some extent, shared. I am sympathetic to Shulamit Reinharz's perspective.

I, for one, feel most satisfied by a stance that acknowledges the researcher's position right up front, and that does not think of objectivity and subjectivity as warring with each other, but rather as serving each other. I have feminist distrust for research reports that include no statement about the researcher's experience. Reading such reports, I feel that the researcher is hiding from me or does not know how important personal experience is. Such reports seem woefully incomplete and even dishonest. (Reinharz 1992, p263)

I wished to be faithful to my own experience and not to be disabled by it but also to strive to avoid making my experience hegemonic (see Bordo and Moussa 1993 for a discussion). In addition, I do not represent myself as approaching the data with an unknowing mind, where theory only results from saturation in the data, because my pre-existing understandings would structure all aspects of the data collection. I have tried therefore to make those understandings explicit to enable the text to be read critically. I have attempted to obey the stricture that

... evidence will be deeply contaminated by the values of those that are submitting the evidence. It is not possible to eradicate the bias, therefore authors should declare their bias. (Powell and Solity 1990, p76)

In addition, I do not claim to offer a 'typical' or representative case or selection of cases - 'So I should believe that all white whales are bad?' (Stake 1972, p160) - but this does not mean that I have abandoned the hope of generalisability. Rather I have 'only shifted the *locus of responsibility* for generalisations' (Macdonald 1977, p54, my italics) to the reader: the nature of the 'truth' of what I offer is as of a story or a metaphor and the account is tested by the extent to which it is *recognised* (Walkerdine 1990, p196) by the reader. By studying experience at the micro level, I am trying to illuminate how oppression or resistance are 'lived'. I am attempting to tell a reasoned and reasonable story about what I am reporting but it is possible that my perceptions are false. The reader has to ask if the story is powerful or convincing or illuminating; she has to ask if it seems authentic to her, if it accords with her

need, for example, to have a coherence, a wholeness and be one in which the information relates to the story and *vice versa*, in which the data are relevant to the theory and the theory is relevant to the data. It will be possible to debate whether or not there is internal consistency and to assess the laxity or otherwise of the relationships between conceptual structures and observations. Thus a critical reading in a shared discourse is realistic.

However, I offer two last 'words of warning' to myself and to the reader. Firstly, I have a deep involvement in the area I was investigating and 'it would hardly be a fish who discovered the existence of water' (Kluckholm quoted in Davies 1985, p85); and secondly, I suspect that Clifford Geertz is right in saying

Cultural analysis ... is a strange science ... in which to get somewhere with the matter in hand is to intensify the suspicion, both your own and that of others, that you are not quite getting it right. (Geertz 1973, p29)

I only hope that at least some of the time when I am not getting it quite right it is indeed because I am getting somewhere!

Background to the intervention

I rose early, played on the piano, and painted during the time I could spare in the daylight hours, but I sat up very late reading Euclid. The servants, however, told my mother "It was no wonder the stock of candles was soon exhausted, for Miss Mary sat up reading till a very late hour"; whereupon an order was given to take away my candle as soon as I was in bed. I had, however, already gone through the first six books of Euclid, and now I was thrown on my memory, which I exercised by beginning at the first book, and demonstrating in my mind a certain number of problems every night, till I could nearly go through the whole. My father came home for a short time, and, somehow or other, finding out what I was about, said to my mother, "Peg, we must put a stop to this, or we shall have Mary in a strait jacket one of these days".

(Mary Somerville, *Personal Recollections, from Early Life to Old Age*, p54, 1874)

Had our friend Mrs Somerville been married to La Place, or some other mathematician, we should never have heard of her work. She would have merged it with her husband's, and passed it off as his.

(Letter of Charles Lyell, 23 August 1831 published in Lyell 1881, p322)

I have perseverance and intelligence but no genius, that spark from heaven is not granted to the sex, we are of the earth.

(Mary Somerville, notes for an autobiography, published in Patterson 1983, p87)

In this chapter I consider the background to the action research intervention project with which this research started. I outline the European Commission's initiative and then give a brief overview of the thinking which informed the project of which I was a part, contextualising that thinking by reference to a review of the literature. The review covers the literature on equal opportunities with respect to gender and schooling in general and also draws on the literature on gender and mathematics in particular.

Origins of the action research project

The intervention strategy came into being as part of an action research project funded by the European Commission. The Commission was concerned that women are under represented both in the labour market (Commission of the European Communities 1984) and also in those parts of the education system that are seen as equipping young people for full participation in a world of work based increasingly on technology (Commission of the European Communities 1983). Demographic changes mean that a shortage of skilled entrants to the labour market is foreseen and the Commission wished to see a greater number of girls and women choosing non-traditional careers. The Council and the Ministers of Education of the European Community therefore agreed a resolution (reproduced in full in Appendix 16) which gave

their agreement to an action programme which will be implemented within the scope of constitutional possibilities and having regard to the economic, social and cultural context of each Member State, to the funds available and to their respective education systems. The measures envisaged under this programme are necessary in order to:

- (i) ensure equal opportunities for girls and boys for access to all forms of education and all types of training in order to enable each individual to develop his or her own aptitude to the full;

- (ii) enable boys and girls to make educational and career choices, in full knowledge of the facts and in good time, affording them the same possibilities as regards employment and economic independence;
- (iii) motivate girls and boys to make non-traditional choices and to follow courses leading to qualifications so that they may have access to a far more diversified range of jobs;
- (iv) encourage girls to participate as much as boys in new and expanding sectors, within both education and vocational training, such as the new information technologies and biotechnology.

(Commission of the European Communities 1985, Resolution Section I)

Teacher education was seen as a key point at which intervention could be effective and the action programme involved

[i]ncluding the question and pedagogics of equal opportunity in teachers' initial and in-service training. Teachers' courses could for instance include the components needed to encourage girls to take up the natural sciences and mathematics, and information on the vocational opportunities offered by these disciplines. (Commission of the European Communities 1985, Resolution Section I, Subsection 5)

The Commission therefore funded a Europe wide initiative in teacher education of which the project in which I was involved was a part.

At the northern University involved in the project, the concerns of the Commission were shared but the project directors (and I) were also concerned, more widely than the

Commission, with issues of social justice. We did not have an articulated and shared theoretical standpoint about equal opportunities on which to base our intervention although we were aware of the considerable body of research evidence, which is reviewed below, that indicates that there are a number of systematic sites of disadvantage experienced within schooling and also reproduced by schooling, one of which is that of gender. (See, for example, Clarricoates 1978, Whyte et al 1985, Arnot and Weiner 1987, Spender 1989, Spender and Sarah 1989.) In the traditional classroom, women and girls have been rendered passive and silent (though often also silently resisting) both through the pedagogical style and through the way that knowledge itself is constructed and presented. It is necessary 'both to redefine the content and boundaries of knowledge, and to alter the teaching and learning contexts' (Green 1992, p96). We shared the view that girls are not simply disadvantaged by sex-role stereotyping and therefore that equality of opportunity will not be provided by eliminating socialisation into passivity and subservience. Rather we worked to the premise that they are oppressed and that the oppression is structural.

At this stage, in part inevitably given the nature of the funding for the initiative, we were focusing sharply on gender as a site of disadvantage. I was personally committed to fighting other inequalities and also knew that it can be unhelpful to separate one aspect of oppression from all others. Individual girls are also located by class, 'race', sexuality and so on and these locations interconnect and affect each other. An 'additive' model of oppression fails to capture the complexity of how these different locations inter-relate and how life is lived at any particular intersection. Class background, for example, will have a profound effect on how schooling is experienced by different girls (see, for example, Kessler et al 1985 and Walkerdine and Lucey 1989). Equally, over-generalisation has led to some girls being rendered invisible; for example, the experience of black schoolgirls has been marginalised.

Acknowledging the specificity of individual lives and the differences between differently located girls and women does not, however, make it impossible to speak. There are sufficient commonalities amongst girls in how schooling is experienced to allow some worthwhile generalised observations to be made, although none for which it is irrelevant to question whose experience it is that is the subject of the generalisation. I now turn to a review of what has been written about girls' experience of schooling.

Gender as a site of disadvantage: an overview of the literature

Traditionally, knowledge is constructed as impersonal and external; it is presented as being stratified into hierarchies and also as appropriately 'delivered' through an educational system which is itself stratified. Dale Spender points out that these two are linked: if students are encouraged not to rely on their own experience but to deny it and to accept in its place the knowledge and experience of experts, then the hierarchical structures are strengthened. In turn, existing patterns of inequality are strengthened.

Each division of education fits into a hierarchical frame and within each division knowledge is stratified ... Generally speaking one cannot go to secondary school unless one has been to primary school; one cannot go to university unless one has been to secondary school. And this is not necessarily because there is any logical progression, a fact to which both students and teachers will frequently testify. Students have been known to complain about the lack of continuity from one level of education to another and teachers have been known to declare to their new intake that the students must 'forget everything your teachers taught you in that last place': this applies even at university where it is not uncommon for lecturers to instruct their students that they must start from scratch for the knowledge and the methods of enquiry that they learnt in school are inadequate, if not wrong. Apart from contributing to the vulnerability of the student, this helps to enhance the superiority of the new institution and its staff. The

educational hierarchy is jealously guarded by many of the practitioners. (Spender 1980a, p45)

This stratification, the competitive hierarchies, the denial of personal knowledge, the lack of ownership, are all said to be antipathetic to the learning of women and girls (see, for example, Rich 1980, Spender and Sarah 1989, Spender 1989, Green 1992). (Much the same can be said about other disadvantaged groups - for example black and working class students - whose perspectives are not part of the existing cultural hegemony. See, for example, Freire 1972 and Giroux 1983.)

Attention is also drawn to what happens within the teaching and learning context itself. The language in which education is conducted (Spender 1980b) and the images offered in curriculum materials (Northam 1982) are both found to reinforce the subordinate position of girls and also contribute to their invisibility and absence from educational discourse. Barbara Licht and Carol Dweck (1983) have suggested that differences between girls and boys in achievement-related beliefs, and hence in the confidence brought to learning in the classroom, are provoked by differences in both the nature and frequency of positive and negative feedback from teachers in the classroom. They have offered evidence that boys and girls may provide different explanations and draw different implications from their successes and failures. In addition, systematic classroom observation in mixed classrooms reveals that small but significant differences with respect to student gender occur in the number of interactions that students have with their teachers (Leder 1990).

The talk by pupils is also found to be dominated by boys and there is systematic misperception of this dominance (Spender 1989, p56). As far as the male pupils are concerned, the ways in which this position of power is retained are not subtle. Teachers and researchers addressing this issue have sometimes been shocked by the extremity of the

boys' behaviour (see, for example, Times Educational Supplement 1985, quoted in Mahoney 1989, p157). 'That boys do not like girls, that they find them inferior and unworthy - and even despicable - is a conclusion hard to avoid when observing and documenting the behaviour of boys towards girls in school' (Spender 1989, p63). Mairtin Mac an Ghaill (1994) found that '[t]here was much evidence of the constant pressure and surveillance that the young women were under' (Mac an Ghaill 1994, p131) in the school in which he conducted his research; he records the girls' descriptions of the boys' offensive behaviour (see, for example, p132). Sexual language is used to intimidate and humiliate girls (Lees 1987, Draper 1993, p53f) and sexual violence and the threat of sexual violence are not uncommon (Kelly 1989, Mahoney 1989).

Typically, though not inevitably (see, for example, Cornbleet and Libovitch 1983, Rudduck 1994, p107), the response of girls is found to be not one of open protest but of 'withdrawal in a variety of unostentatious ways' (Spender 1980c, p152). This remains true however they resolve the dilemma 'of deciding whether to opt for reduced attainment, and gain popularity ... or whether to opt for maximal achievement and disapproval (and the threat within the prevailing ideology of a lonely and unattractive existence' (Spender 1980c, p151). (See Figure 3: Active and adventurous.)

On a personal note, I remember vividly the oppressive experience of being mocked for 'talking about ideas' in mixed groups at the youth club of which I was a member. Attending a girls' selective school, I was not subjected directly to this pressure daily in the classroom by my peers. I also remember vividly the understanding and subsequent amelioration of the conflict and confusion - though not the pain - attendant on this experience by having my choice, similar to that suggested by Dale Spender above, clearly spelt out to me by my mother. Valerie Walkerdine has written of the practices which fail

Figure 3

I am active, adventurous, aggressive,
assertive, curious, energetic, enterprising
frank, independent and inventive



Needless to say, this hasn't
won me many friends.

(Cartoon by Rona Chadwick, available from Cath Tate Cards, London)

Active and adventurous

to engage with the contradiction and pain produced through the act of splitting - of being positioned like a boy and like a girl and having to remain 'sane'. A denial of the reality of difference means that the girl must bear the burden of her anxiety herself. It is literally not spoken. She is told that she can be successful and yet the painful recognition that is actually likely to result from the fear of loss of one or the other (her femininity, her success, or both) is a failure to be either ... a recognition of struggle, conflict, difficulty and pain might actually serve to aid such girls. (Walkerdine 1985, p225)

There is a range of responses from teachers to the boys' strategies for establishing and maintaining dominance. At worst, male teachers may actively take part in similar sexual harassment of the girls in their classrooms (see the last section of Herbert 1989 and Mac an Ghaill 1994, p125-133). More commonly, 'misogynous male teacher discursive practices [act] as highly effective academic and disciplinary mechanisms in the policing of masculine boundaries' (Mac an Ghaill 1994, p125). Typically, the girls 'invisibility' strategy is effective and teachers comment that

the girls did not make any impression on them, it took a long time to learn the names of the girls, it was easier to learn the names of boys, the girls merged into a mass and were more difficult to see apart, there was nothing distinctive about them. (Spender 1989, p68)

The girls become relatively anonymous, faceless and unknown. Julia Stanley found that many of the words used to describe quiet girls are highly pejorative:

...'mouses', 'puddings' and 'boringly well-behaved girls', even contrasting them unfavourably with the 'more rewarding'

tough lads who dominate classes by their bad behaviour and constant attention seeking. Girls' behaviour has been defined as a problem by reference to the masculine 'norm', even though in the case of the quiet schoolgirls it is they who are performing in exactly the way required of them by parents and teachers, and the boys who are out of step. (Stanley 1986, p46)

They provide a negative background for the boys' success.

There is, in addition, the phenomenon of teachers judging the intellectual and work-related behaviour of boys and girls differently so that girls are put into the position of 'being successful but not succeeding' (Walden and Walkerdine 1985, p82). Katherine Clarricoates (1978) has noted that it is possible for girls to demonstrate their competence and for this to be dismissed as not signifying genuine ability. If boys ask intelligent questions it is regarded as being because they are able; the same behaviour in girls shows that they understand what is expected (Clarricoates 1978, p161). Further evidence of differential judgement exercised in the evaluation of performance is found in the well known and much replicated research of Philip Goldberg (1968). Presented with texts identical save in the sex of the name of the persons purported to have produced the work, evaluators and markers consistently rate the work of the supposedly male writers higher than that of the female.

Disadvantage and mathematics

The above discussion has focused on the issue of gender within the education experience generally. There has been considerable additional investigation of unequal opportunities with respect to gender specifically focused on girls and mathematics and it is to this that I now turn. I note in passing that there is some debate about whether, essentially, this should be a particular focus for concern. It has been suggested that mathematics is a male

fantasy searching for control, that the 'path to rationality, displayed best in mathematics, is a path to omnipotent mastery over a calculable universe' (Walkerdine 1990, p23), and as such is not something to which women are particularly concerned to aspire. In contrast to this, it is pointed out that mathematics is currently a key entry qualification to positions of leadership in a technological world. Indeed, as Dale Spender mischievously points out, this could be exactly why girls are constructed as being

... 'naturally'
Not very good at maths and science
While these are required
Of leaders.

... Tomorrow,
If weaving and cake making
Are considered very important
And those who want to get on in the world
Need them as entry qualification
Because they sort those who are capable
From those who are not.
Girls, it seems
Will not.
They will be 'naturally'
Not very good at weaving and cake making
When they are required
For leaders. (Spender 1980a, p 128f)

I do not consider the question of what 'counts' as mathematics unproblematic nor do I believe that professional mathematicians should have a privileged right to settle the matter. (For a discussion of these issues, see, for example, Verhage 1990, Ernest 1991, Harris 1991, Restivo 1992.) Nevertheless, for me, having myself a love of mathematics for its own sake as an aspect of human experience and perceiving also that it acts as a critical filter within existing social organisations, the under participation by girls and women is a cause for concern. Reflecting on her schooldays, Margaret Drabble said

I dropped mathematics at 12, through some freak in the syllabus ... I cannot deny that I dropped maths with a sigh of relief, for I had always loathed it, always felt uncomprehending even while getting tolerable marks, didn't like subjects I wasn't good at, and had no notion of this subject's appeal or significance.

The reason, I imagine, was that, like most girls, I had been badly taught from the beginning: I am not really as innumerate as I pretend, and suspect there is little wrong with the basic equipment but I shall never know.

... And that effectively, though I did not appreciate it at the time, closed most careers, and half of culture to me for ever. (The Guardian, 5 August 1975, quoted in Evans 1989, p204)

For her, as for many, both the pleasures and the purposes of mathematics have been lost: she regrets both its absence as a mode of cultural understanding and also as the passport to participation in many of our social institutions. Her regret is mine.

There is substantial research evidence about the mathematical performance of girls in school and their lower attainment and participation historically in public examination systems. (For information relating to the British scene see, for example, Shuard 1982, Isaacson 1988. For a more international perspective see, for example, Hanna, Kundiger and Larouche 1990.) There is debate about how much the under achievement is constructed by the observer rather than 'real' (see Walkerdine 1989) and there is evidence that in Britain the gap in performance in public examinations at sixteen is closing (Department for Education 1993, p10f); but the under participation in mathematics as soon as 'opting out' is permitted is clear cut. (For a recent summary of the European position see Wilson 1991a, p 206-210.)

A wide range of theories and conjectures has been offered in explanation of this under achievement and/or under participation. Some still look to biologically determined differences (eg in the debate about spatial ability and its conjectured link with mathematics, some authors posit a genetic cause linked to verbal and non-verbal intelligence and brain lateralisation (discussed in Walkerdine 1989, p 8-9)) which theories are worth mentioning not for their plausibility but to indicate just how persistent such beliefs are. (See Figure 4: 'and to demonstrate the biological differences ...'.)

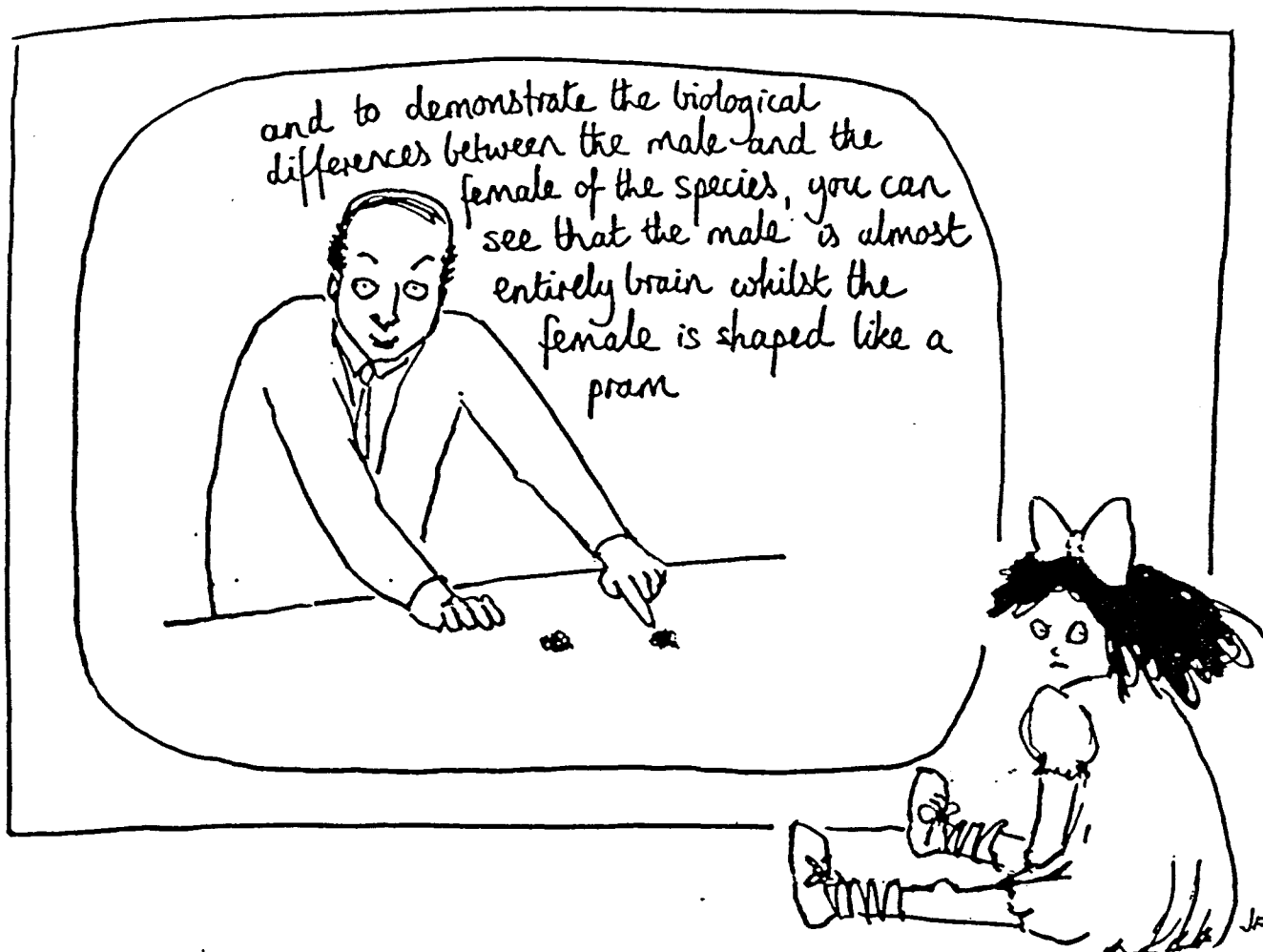
Gilah Leder (1986) concludes from her historical review that

there is considerable historical evidence to indicate that many females valued exposure to mathematics, readily mastered its contents ... and used the acquired skills most effectively within the bounds set by contemporary society. (Leder 1986, p81)

She goes on to point out that an 'unwillingness to pay the price extracted from those who conspicuously contravene cultural norms' (Leder 1986, p83) may be a key feature in explaining the lower mathematical performance of girls after the beginning of adolescence and their under representation amongst the highest mathematical attainers: they are simply reluctant to succeed in the face of the discomfort, guilt and doubts about their femininity at best and the unpopularity and ostracism at worst that may follow success.

A similar theme is pursued by Zelda Isaacson (1989) who has drawn attention to the social pressure brought to bear on schoolgirls to make them conform to a sex-stereotypical role in which there is no place for notable success in mathematics, such roles being ' "chosen" because of a system of rewards and approvals which act as inducements and which are so powerful that they come to be a kind of coercion' (Isaacson 1989, p188). She also uses the idea of 'double conformity' (Delamont 1978, p140 quoted in Isaacson 1989, p191) to

Figure 4



(Cartoon by Jacky Fleming, *Be a bloody train driver*)

'and to demonstrate the biological differences ...'

express the dilemma of girls in school: if they are to succeed, they have to conform at the same time to two sets of standards or expectations which are mutually inconsistent, that of being a girl and that of being a mathematician.

Rosalinde Scott-Hodgetts (1986) suggests that girls tend to conform to the serialist model of thinking offered to them by their teachers in the primary school and that this disadvantages them mathematically with respect to boys who are more likely to think holistically and to have a versatile range of thinking strategies available. She also notes that 'the level of uncertainty at which individuals are happy to work is a distinguishing characteristic between serialists and holists' (Scott-Hodgetts 1986, p74). It is true that the capacity to handle uncertainty, an idea linked to the notion of 'challenge', is an essential requirement for doing mathematics effectively, but it is profoundly affected by the social and pedagogical context in which the mathematics is produced and this Scott-Hodgetts does not discuss.

The concept of 'autonomous learning behaviours' is employed by Elizabeth Fennema and Penelope Petersen in their explanation of sex-related differences in mathematics.

Autonomous learning behaviours are developed over a period of years and are learned as one is allowed, forced, or expected to do them. Greater participation in autonomous learning behaviours leads to greater development of autonomous learning behaviours which in turn leads to better performance on high cognitive level tasks. (Fennema and Peterson 1985, p309)

They believe that both the internal motivational beliefs of boys and their external classroom experiences are likely to promote autonomous learning behaviours in boys rather than in girls. However the issue of 'autonomous learning behaviours' is not in itself

unproblematic. Leone Burton (1989) describes a group of girls she observed who displayed the autonomous learning characteristics of independence, persistence, choice and successful achievement but did so in the context of proximity and approval, both supposedly functions of dependency rather than autonomy. In this case, 'the autonomy was a function of group rather than individualised action' (Burton 1989, p182).

There is also considerable evidence that teacher beliefs about females, males and mathematics have a detrimental effect on the learning of mathematics by females (Fennema 1990). John Pratt (1985) noted in his research into teacher attitudes that, although there was strong and near complete agreement that teachers should not stereotype school subjects, nevertheless

[t]he attitudes of maths teachers suggest that girls' reluctance to study that subject ... is unlikely to be recognised as a matter of concern by these teachers. (Pratt 1985, p33)

Finally, and offering insights linked to many of the above, there are those who look explicitly at the nature of the mathematics curriculum and the prevailing culture in specifically mathematics classrooms and find both relatively uncongenial for girls. Considering first the overt curriculum, it is noted that 'many more women than men see mathematics as neither relevant to their interests and experiences nor useful to them in their future lives and careers' (Barnes and Coupland 1990, p73). (See also Open University 1986, p52f.) In addition, the 'packaging' of mathematics is typically similar to that found by Alison Kelly (1985) in science classrooms - female images rarely occur and when they do they are often ridiculous; experiences and interests which are characteristic of boys but unusual in girls are taken for granted, ie the 'cultural capital' (Bourdieu 1977, quoted and discussed in Giroux 1983, p88f) of the boys accumulates; and where the

mathematics is applied it is to things rather than people. (In contrast to this, see the 'packaging' of calculus undertaken by Mary Barnes and Mary Coupland (1990, p74f) and the Cabbage material published by SMILE nd.) It has also been suggested that the subjective meaning of mathematics may be of central significance.

Maybe there are different approaches to mathematics, different ways to experience mathematics as meaningful, and different aspects of mathematics that make or do not make sense, and maybe mainly those ways are ignored and those aspects are unemphasised in the mathematics classroom that make females rather than males feel uncomfortable because of a lack of meaning. To turn away from mathematics in this view would be a decision of females who make fruitless efforts to create meaning out of what is going on. They would not be victims of gender-role expectations; they would like to live in worlds that make sense. (Jungwirth 1993, p141f)

There is also the prevailing culture in mathematics classrooms and prevalent teaching and learning styles to consider. Mary Barnes and Mary Coupland (1990) note that

[t]he teaching methods used in mathematics can also create barriers to women's participation. We know that women express much less preference than men for competitive or individualistic approaches to learning and a greater preference for a co-operative mode ... The traditional style of mathematics teaching is authoritarian and teacher-centred, and tends to encourage a competitive atmosphere ... the more reticent and less confident are disadvantaged. There is an abundance of research results showing that women are more likely to come into [this] category. (Barnes and Coupland 1990, p74)

A mathematics classroom in which girls might thrive is likely to be one in which learning takes place through interaction and co-operation, where group work and discussion are

encouraged and validated, where experience, activities and ideas are shared, where individuals' contributions are welcomed and where creative and imaginative thinking is valued (Isaacson 1990, Marr and Helme 1990). Such mathematics classrooms are rare. (See Downes 1994 for a more common experience.) Nevertheless there is now a great deal of experience which shows that they are possible and that 'providing girls with opportunities for learning mathematics in congenial and appropriate conditions will help to ensure that *all* pupils will be able to reach their potential as individuals' (Department of Education and Science 1989a, p29, my emphasis); and, at the anecdotal level, all my teaching experience has led me to the conclusion that 'what's good for girls is good for people'.

Background summary

In summary, these then provided the background to the intervention strategy. First and at a practical level, funding was available through the European Commission because of its (possibly short term) commitment, brought about by demographic changes, to the advancement of women. Second, we believed that girls are systematically disadvantaged within schooling and for reasons of social justice wished to work to change this. In addition, I and my colleagues in mathematics education at the University were concerned about the particular disadvantage suffered by girls in the learning of mathematics. Third, we believed that changes in schooling are possible and that such changes can alter the opportunities available to girls. Last, we believed that by implementing changes in the programme of initial teacher education with which we were involved there was a worthwhile chance that the course would 'better [enable] students to promote equality of opportunity, not just on their teaching practice but when they had entered the profession' (Coldron and Boulton 1991, p530). These last two beliefs - that teachers can change what happens in schools and that their initial teacher education can have an impact on whether or not they do so - we more or less took for granted. In what ways and to what extent

they prove to be justified became important questions for me later in the research, at the time when I was reflecting on the three students-becoming-teachers who took part in the first phase and when I was constructing and considering the implications of the model of ways of knowing.

Methods of data collection

... feminists have used all existing methods and invented some new ones as well. Instead of orthodoxy, feminist research practices must be recognised as a plurality.

Feminism is a perspective not a method.

(Shulamit Reinharz, *Feminist Methods in Social Research*, p4 and p240)

In this chapter I shall describe the methods that I decided to use for data collection in the various phases of the project. (Data collection is additionally discussed at the beginning of Chapter 11, p215 - 218. Methods of data analysis are discussed at the relevant points within the research narrative, that is, Chapter 7, p131ff and Chapter 11, p214f.) The methods were semi-structured interviews, longitudinal interviews, students' writing for a variety of purposes, observational data from schools and written data from schools. I have also included in the thesis an *Afterword and Commentary* as a postscript, a coda to the research. This was created from a group discussion with three key participants which I video-recorded.

Data collection: an overview

There were three distinct aspects to the data collection, each of which overlapped the others at least partially with respect to time. There was, first, the work of implementing and evaluating the equal opportunities component as part of the course during the time

that the students were enrolled in the University. Here, the first mathematics cohort (1989 to 1990) was involved in an action research project. The implementation was monitored, recorded and evaluated internally in some detail and this forms the first main section of the report of the work, that is, Phase one. (For a report of the project overall as it affected the whole cohort see Boulton and Coldron 1990.) The data collection for this part of the research was undertaken from September 1989 to July 1990.

The second phase of the research involved following up three students from this mathematics cohort after they had left the course and begun their careers as teachers in schools. The students were visited, observed teaching and interviewed in school; other data about the school and the department were obtained by collecting written information provided by the school (prospectuses, policies etc.), by spending two days participating as far as possible in the life of the school and, if they were willing, by interviewing other members of the school staff. These school visits and the associated interviewing took place during the summer term in 1992.

For the data collection for Phase three, I contacted three teachers whom I believed to be teachers working for change. They had been members of three different mathematics cohorts - 1989/90, 1991/92, 1992/93 - and were working in schools local to the University. One of them had been involved in Phase one and Phase two. I visited the two new to the research in their schools and interviewed all three of them on more than one occasion, mostly at their homes.

The principal technique of data production and collection which I used throughout each phase of the project was that of interviewing. This varied from the semi-structured interviews which formed part of the initial action research project (and which were

appropriate for interviewing, for example, heads of department in the Phase two) to the extended interviewing I carried out in Phase three with the teachers working for change.

The Phase one data analysis was within an action research paradigm. (See Chapter 2 for a discussion.) All the Phase two data were used to construct a 'portrayal' (Macdonald 1977) of the individual student-becoming-teachers. (See Chapter 7, p131ff for a discussion.) For each person there was a variety of sources of data which permitted triangulation (Stenhouse 1980, p4). The separate sources of data were not returned to the individuals for verification but the intention was that the portraits be re-presented where appropriate for comment and verification or amendment. In practice, only two of the three portraits were returned to the participants (see Chapter 2, p31). In Phase three, the data were used differently, this time to vivify a theory concerning ways of knowing. Verification was sought by member checks on edited transcript data and by inviting the research participants to engage with the analysis. Their response was recorded and is presented as an epilogue to the thesis.

Semi-structured interviews

In the first phase, the interviews with a sample of the students with whom I had been working were conducted by other members of the action research team, that is, colleagues of mine who were little known or unknown to the students. (I interviewed other students who were part of the wider cohort and unknown to me.) There was a fairly clear agenda for the interviews. In the first place, our expectations were that we would collect data from the students relating to how, if at all, they considered that their attitudes towards, awareness of and understanding of equal opportunities issues with respect to gender and education had developed during the course. Secondly, we would seek to discover what aspects of the course they thought had influenced them, both positively and negatively, in their opinions and perspectives and, thirdly, we would be asking them to make

connections between any purported attitude shift and their practice in the classroom. We decided that a semi-structured interview with a random sample of the cohort adjusted so that men and women were represented according to their numbers overall would be the most appropriate method of data collection.

The question schedule for the interviews is included in Appendix 2. All of the interviews were taped and transcribed and the tape transcripts of the various subject cohorts were returned to the appropriate subject tutors. The transcripts of the interviews with students in the mathematics cohort were then analysed by me. (See Chapter 5.)

The school-based, semi-structured interviews in Phase two with heads of departments and head teachers or their deputies were not tape recorded. I considered that the presence of the tape recorder would be more likely than the taking of notes initially to inhibit them and, because they would be busy people inserting the interview with me into a corner of their day, I would probably not have the time to build up any sort of relationship with them. In practice I was happy with this decision: the taking of notes seemed to create enough concentration and focus for the interviewees without too much interference. I had a schedule of questions (Appendix 8) which I approached flexibly and I did not provide it in advance. They knew I wanted to talk to them about initial teacher education and its relevance or otherwise to work in school but that was all (Appendix 7).

Longitudinal interviews

In contrast to this, the interviewing I carried out during Phase two with the students-becoming-teachers in their place of work was much less focused and more personal. It was less focused because I was seeking, in a short space of time, to uncover as much as I could not only about their current attitude to and awareness of equal opportunities issues but also about, for example, their experiences in school, their perceptions of those

experiences, how they understood them, what they thought had contributed to their initial socialisation as teachers. The range of experiences to which they had been exposed and the characteristics of the school culture of which they found themselves a part were likely to be very different in different departments and in different schools. For example, the ethos of the school, how divided or united the staff seemed to be, how new teachers were explicitly and implicitly inducted were all likely to be important factors in the story of their development as beginning teachers. More importantly, I conjectured at this stage, the relative significance of these factors was also likely to vary considerably so a more exploratory and open-ended, conversational style of approach to the interviews seemed appropriate.

Open-ended interview research explores people's views of reality and allows the researcher to generate theory.
(Reinharz 1992, p18)

I hoped to find out why and in what way there had been changes in their perceptions of the PGCE course and the equal opportunities elements within it and also of their own attitudes and understandings of equal opportunities issues. I hoped also to find out what effect, if any, the work we had done with them had had on their practice. Some of this might be forthcoming in response to a fairly direct approach from me but much would depend on the extent to which I was able to create a space in which they could reconstruct part of their lives. People's lives become fragmented by the institutions of which they are a part and the process of remembering and retelling may enable them to uncover things of which they are initially unaware.

The approach with the students-becoming teachers would have some things in common with that of story telling. The information I was seeking would not necessarily be available to them in 'answer-size pieces' (Graham 1984, p113) but I would be seeking to

provide 'a vehicle through which individuals can build up and communicate the complexity of their lives' (Graham 1984, p119). Story telling does not place the limits of the release of information strictly within the control of the researcher but is chosen in an attempt to record the experiences of the interviewee as they are lived and perceived. It is an overt form of data collection and what is included and what excluded from the narrative is known to and determined by the narrator. It is intended to create a vehicle for the narrator to rebuild and communicate aspects of the complexity of their experience. It allows for both *explanation* and *expression* (Reason and Hawkins 1988, p79), for both denotative and connotative thinking to be represented.

This is not to claim that the *retelling* of that experience is the same thing as the experience itself. Retelling is retrospective and involves both the researched and the researcher in smoothing out edges, giving neat accounts, presenting a single self, experiencing the story through and in response to the research question(s). I find myself echoing the words of Britzman.

The narratives of lived experience - the story, or what is told, and the discourse, or what structures how a story is told - are always selective, partial, and in tension. The contradiction is that while the ethnographic narrative pushes the reader to accept the story ... as a unitary whole, characterised by a beginning, a middle, and an end, the theoretical perspectives I employ work to disrupt the myth of the seamless narrative and the omnipresent narrator. (Britzman 1991, p13)

My retelling of their retelling is thus to be read as essentially contingent.

It was also important for me to conduct the interviews in such a way as to allow people to offer information and reflections *on their own initiative*. I was seeking to observe and

understand part of a complex phenomenon (the integration of ex-students into the teaching profession) and expected to find that

interviewees' unsolicited responses frequently alert the interviewer to consider the subject under discussion in a new light and in the context central to the person interviewed. (Simons 1977, p118)

I needed these illuminations to shape and inform my theory.

In all interviewing but more particularly in those approaches that impose less external structure, the skills of the interviewer are subtle and central and not necessarily intellectual. 'The critical skills for interviewing are perhaps psychological mobility and emotional intelligence' (Walker 1978, p214), skills I would need if I hoped to encourage people to uncover truths about their professional lives. I would be seeking to establish intimacy: on a personal level, I did not find this easy. I felt uncomfortable with the asymmetry of the relationship. I tried, as it were, to revisit my own life from new angles, endeavouring to find an intimate point of contact with each student-becoming-teacher, to offer each something of myself. This remained a concern throughout most of the research, only being somewhat reduced in the final stages during the creation of the *Afterword and Commentary* when I felt the balance of exposure and risk had shifted so that we were all vulnerable.

I would not be following some aspects of the traditional code of behaviour associated with interviewing as a component of sociological enquiry. I could not be perceived by the ex-student interviewees as being an uncontaminated data-collecting instrument: in addition I anticipated that my experience would be in accord with that described by Ann Oakley where my advice, reflections, opinions, knowledge and experience would be sought for

deliberately by my interviewees. She makes the point with great vividness when writing about her research with first-time pregnant women when she considers the practical application of some of the strategies recommended in the textbooks.

For example, these advise that such questions as 'Which hole does the baby come out of?' 'Does an epidural ever paralyse women?' and 'Why is it dangerous to leave a small baby alone in the house?' should be met with such responses from the interviewer as 'I guess I haven't thought enough about it to give a good answer right now,' or 'a head-shaking gesture which suggests "that's a hard one" '... Also recommended is laughing off the request with the remark that 'my job at the moment is to get opinions, not to have them'. (Oakley 1981, p48)

She continues

I had found ... that an attitude of refusing to answer questions or offer any kind of personal feedback was not helpful in terms of the traditional goal of promoting 'rapport'. A different role, that could be termed 'no intimacy without reciprocity' seemed especially important in longitudinal in-depth interviewing ... the interviewees definition of the interview is important: (Oakley 1981, p49)

The attitudes and skills I would need would be different from those required in conducting a structured survey. Helen Simons offers guidance that 'one of the most common errors in open-ended interviewing is failing to listen ... a second related error is seeking closure too soon' (Simons 1977, p119). Crucial to the process would be my ability or otherwise to maintain a real commitment to and involvement with what the new teachers were saying without 'short circuiting' the development of their theories with theories of my own. Robert White writes convincingly about this in his forward to William Perry's *Forms of Intellectual and Ethical Development in the College Years*. Failure results when

[we] have skimmed on the first step in scientific method - scrupulous observation - and are simply working with bad data ... The student subjects in this research felt that their thoughts about themselves and their world were of absorbing interest to the listener, that he became deeply involved in following them, that he would listen forever as they fumbled and backtracked and slowly discovered what they wanted to say, that he took them seriously and viewed them with respect ... The sincerity of what the students said, which is obvious in the protocols, was possible only because of the sincerity of the listener. (White 1970, pvif)

I would be seeking to develop this personal involvement and trust: '[t]he normal way of life is not one full of openness and exposure' (Stake 1977, p107) and I would not be 'the one revealing my stories, fears, and vulnerabilities' (Britzman 1991, p16)

For the Phase two longitudinal interviews, towards the end of the two day sessions in school, I interviewed the ex-students for approximately an hour each. In each case the interview was taped but I also took extensive notes throughout the interviews. In part, of course, this was to cover the case when the technical apparatus failed me but other considerations were also involved. In discussing the decision of how to record interviews, Rob Walker (1985, p109f) reproduces the summary table of Barry MacDonald and Jack Sanger (1982) which considers comprehensively the characteristics, strengths and weaknesses of tape recording and note taking in data generation, processing and reporting. Walker contends that

the comparison reveals that tape recording and note taking emerge not simply as alternative techniques for achieving similar ends, but as really quite different ways of going about doing research. (Walker 1985, p99)

However, my experience does not accord with this. In some cases it may be that, by using tape recording and note taking, some of the weaknesses of both methods obtain. For example, in considering the effectiveness of each method for data generation, 'machine phobia' is cited as a weakness of tape recording whilst 'interviewee deference to recording task constrains natural discourse' is cited as a weakness of note taking. However, much of Walker's analysis suggests to me that the two methods can offer complementary rather than conflicting characteristics. For example, data generation is also discussed under the heading of validity and here we find that 'stimulus as well as response recorded' is a strength of tape recording and 'interviewer uses knowledge and skills to cross-check, represent other viewpoints, challenge testimony' is a strength of note taking.

My note taking was intended to help structure the interviews as they progressed. This contribution to establishing the coherence of the interview is valuable in all interviewing but has particular importance within a less structured context. I had some background questions or remarks to which I could refer (Appendix 8) if the interviewee did not talk spontaneously about the areas that concerned me but I wanted the interviewees to be able to shape the interview themselves. By taking notes to which I could refer as the interview progressed, I hoped to be able to help the new teachers make connections between different aspects of the story they were telling, to draw out, for example, apparent contradictions between what was said in one context and what was said in another, so that they could perhaps resolve the various fragments of their experience. In addition, the tape recorded Phase two interviews would not be transcribed: the note taking would be useful initially in providing an overview of the material. Following the interviews, I listened several times to the tapes. This enabled me to correct any errors, to include any important material I had missed and to transcribe particularly significant passages for quotation.

Each story from the students-becoming-teachers, I conjectured, would be different and it would only be at a later stage, after most if not all of the data collection had occurred, that I expected the essential themes to emerge. I expected some 'progressive focusing' (Parlett and Hamilton 1972, p15) to occur but through a relatively homogeneous period of data collection. However, I initially interviewed three of the first cohort during the summer of 1992 and was not able to follow up any of the other ex-students at this time. These three had been the only ones to reply promptly enough for me to contact them and arrange to visit them while the schools were still in session. Subsequently my other commitments would not allow me to visit other students-becoming-teachers from either the first or second cohorts until the following spring and summer and so there was an extended period available for 'soaking' myself in the data, reflecting at length upon it and beginning some analysis. Unintentionally (but I believe valuably) this provided me with two separate phases in the research, Phase two and Phase three, the analysis of the former informing the nature and direction of the latter, serving to clarify my thinking about the area of research and allowing me to redirect the work.

There were some differences in practice between longitudinal interviews in the two phases. The interviews in Phase three were longer than in Phase two (in each case involving several hours of interviewing) and more focused: I knew at this stage much more clearly the areas I wanted to explore with the teachers concerned. I had a lengthy, detailed schedule for the interviews (Appendix 10) and, wherever possible, I sent this to the teachers before the interview took place. I tried to interview them at home not just at work. Almost all the material was tape recorded and I transcribed the vast majority of it, including everything that I thought might have any relevance to the research. There were two reasons for this. First, I expected to approach the resulting data in a different way from Phase two. I had a clearer idea about what I was looking for in Phase three and expected to analyse the data by seeking out material relating to emerging themes rather

than in constructing individual portraits. Second, I was also very much aware that I was not succeeding in my intention of treating the participants as *subjects* rather than *objects*. I conjectured that getting the data out of my (illegible) note book and into the public domain, as it were, might help. I edited the transcripts as I went along and also afterwards, for example deleting repetitions unless these appeared to me to have some meaning. The transcripts, then, are not verbatim records but rather purport to be an accurate *account* of the interview (but see the *Afterword and commentary* for a contrary reaction). They were returned to the teachers for verification and are included as Appendix 11 for the reader. You are invited to use them as a 'point of leverage' (Lincoln and Guba 1985, p359) from which to test my interpretation: I attempt thus to provide 'an opportunity to judge the extent of bias of the inquirer' (Lincoln and Guba 1985, p359). (Further information about Phase three data collection is given in Chapter 11, p215 - 218.)

Students' writing

Another source of data would be the students' responses to questionnaires and other requests for written reflection during their time at the University and after and also some aspects of their written work for the course. Some of these data would be explicitly generated for the purpose of the research. Others would derive from material generated for other reasons. Most use of written material occurred in Phase one with some supplementing the main research in Phase three. The written sources of data available for the first cohort were fourfold and are described in the following paragraphs. The written data used in Phase three were obtained from replies to a questionnaire (Appendix 13) which I sent in 1994 to teachers from the first two cohorts whom I had not visited and for whom I still had contact addresses.

Teaching practice files

During Phase one, without specifying any particular purpose, I invited the students in the first cohort to lend me their first teaching practice files and initially five out of fourteen responded. I did not seek to increase the response because I considered that the initial group of students providing the data were a realistic sample of the cohort, unexceptional in terms of their apparent commitment to equal opportunities and in their overall competence although containing an over-representation of the women in the group (three out of five women, two out of nine men). I scrutinised the files with the intention of discovering the extent to which the students had used equal opportunities criteria in their planning and in their evaluation. I also attempted to monitor for bias, insensitivity, positive images and learning styles both the resources they devised themselves and also the ones they used which had been produced elsewhere.

Teaching practice questionnaire

During the holiday separating the end of teaching practice from the beginning of term two, the students were asked to fill in a questionnaire relating to their experiences in schools (see Appendix 3). They were asked both to report and reflect on equal opportunities and their teaching practice experience and also to look forward to the coming term. It was hoped that these would prove to be a rich source of data since they were designed to invite a discursive response. All students were asked to fill them in as part of the course and thirteen out of fourteen did so. The questionnaires were not anonymous and the students were told that the results would inform the research as well as contributing to the course.

Draft timetables

A further source of written data from this cohort was provided by the first session of their professional studies course in term two when I negotiated with the students the course

programme for the rest of the term. (For a full description of the reasons for this and the processes involved, see Povey 1992). They were asked to decide what they wanted the programme to cover and how they would prioritise the items with respect both to importance and also to time allocation. All the students were involved and, working in groups, they produced four draft timetables (see Appendix 5). This exercise, undertaken for other purposes, enabled me to see what place at this stage they awarded equal opportunities issues in their course design.

Assessment category

The fourth source of written data relating to the first cohort was generated immediately before their final teaching practice in the third term. The students were asked to write down some specific examples of classroom practice or other aspects of behaviour in school that they thought should merit a *Very high* mark in the equal opportunities assessment category and similarly for a *Very low* mark. It was hoped that this would provide a picture of their current outlook and also that it might be possible to compare and contrast their responses with earlier data. Again, the responses were not anonymous and the students were told that the results would inform the research as well as contributing to the course.

Observational data from schools

During my two days in the schools of the new teachers, I would expect to spend the time when I was not interviewing collecting a variety of forms of observational data. I would be able to observe the ex-student at work in the classroom, associating with colleagues and generally partaking in the life of the school. I would spend most of my time simply accompanying the teacher, shadowing them at their work and observing and recording what occurred, talking to the teacher when the opportunity presented itself and making notes. I would be attempting to understand the specific school settings in which my ex-

students were employed, perhaps, for example, observing departmental meetings or spending some time simply 'listening in' to the general flow of 'chit-chat' or particular conversations in the staffroom.

I would take as extensive notes as I could during the day either, if possible and appropriate, as things actually occurred or privately as soon afterwards as was practical. I would also set aside time in the evening of each day for going over my notes to establish their coherence while the events were fresh in my mind and supplementing them with additional material which I had not had the time and opportunity to record during the day. I wrote at the time

... always allow time immediately after the interview to make notes about context, general impression etc and to run the tape and annotate with remembered non-verbal cues etc. I need eg a long hand record of the general flow of events annotated with explanatory comments; a diary with dates of events etc plus incidents and quotable quotes; a record of interpretative asides/insights generated during the research investigation. (personal notes, December 1990)

These data would be central to my description of the school. I would be attempting, in an abbreviated way, to capture the 'ethos' (Rutter et al 1979) of the school, the concept of ethos being 'a way of thinking about schools as social organisations ... [since] a structural description reflects, but is insufficient to capture, the spirit of the educational system, the school, the classroom, or the teacher' (Powell and Solity 1990, p65). In practice this raised some ethical difficulties for me. When I was in school observing school life, I felt connected to what was happening. I recorded only what was publicly presented to me as a visitor. When I came to write up and present the data, however, I felt distinctly voyeuristic. Apart from the three students-becoming-teachers, there was no realistic way in which I could return the data to the protagonists, no way they could 'own' the data in

which they figured. I ask myself, as a democrat and a feminist, if it is ethical to include such observations in my research report: I have done so but the issue is for me unresolved.

Written data from the school

From each school I visited I obtained as much data as I could about how the school interpreted and presented itself in the documents it produced. As a minimum I hoped to obtain school policy statements if such existed, departmental policy statements and codes of practice and, perhaps most importantly, prospectuses which the school produced for parents. These last I felt would give me a good guide to what was deemed publicly acceptable rhetoric about the school. I conjectured that one of the elements that makes the process of the socialisation of teachers into their profession most complex and confusing is the gap between what is said and what is, in practice, sought after, done and condoned.

Martin Powell and Jonathan Solity suggest that, in general, the influences on teachers are not 'open, understandable, and non-manipulative' (Powell and Solity 1990, p6) and that, on the contrary, 'a great deal of energy is spent hiding one's own views, and, more, critically, the values and other factors that underpin them' (Powell and Solity 1990, p4). They use a powerful image to evoke the situation.

The game is played like a game of radio-controlled boats on a park pond. All the discussion is at the surface, while underneath the water, powerful nuclear submarines manoeuvre round each other looking for an opportunity to strike. (Powell and Solity 1990, p76)

If they are right, then the school documents might be the boats on the surface and the 'condensed fieldwork' (Walker 1978, p209) might give some clues as to the presence, whereabouts and nature of the nuclear submarines!

Video taped discussion

I used a video taped discussion as the final contribution to the data collection. I was prompted to this 'coda' (Lather 1991, p162) by my concern about the extent to which, in my research practice, I had compromised on my commitment to democratic methods, this happening as a result of both unforeseen practical difficulties and also failure of nerve.

Lying on the beach, I read *Getting Smart: Feminist Research and Pedagogy with/in the Postmodern* by Patti Lather (1991), after I had constructed the model of teachers' ways of knowing (see Chapter 9) and after I had used the data from Phase three to exemplify that model (see Chapter 11). It reinforced my sense that I had made the participants *objects* of my study, that they might be construed as agents in their own classrooms but that, within the research, both at the level of theory and also with respect to vulnerability and risk, there was no reciprocity.

I wanted a device which would allow them some authority in the research. I also wanted one which, they having exposed themselves to me, would expose me to them in like manner. I believed that finding such a strategy would make for better research: it would be more democratic and the process of my construing my experiences would be more open both to myself and to you, the reader. I decided to invite the three teachers working for change to meet each other and to discuss with me the three chapters to which, directly and indirectly, they had made a major contribution - Chapters 9, 10 and 11. (The letter I sent is reproduced in Appendix 14.) I decided to invite them to meet each other and to talk together in an attempt to shift the power balance in our relationships from me towards them. I decided to video *and* audio record the discussion because the research device was, for me, deeply experimental and I had no firm preconception of what the data gathered would be like nor how I was going to be able to construct the *Afterword and commentary* without once again simply and only incorporating the participants in *my* text,

without it too becoming only a part of 'the technology of surveillance and normalization' (Lather 1991, p139).

To my delight, all three teachers agreed and thus began a most exciting and threatening time for me. What I began to realise as soon as they replied was that this device was also likely to increase the 'catalytic validity' (Lather 1986) of the research. The process was felt just as much as 'challenging, very challenging' (telephone conversation with Matthew) by the participants as it was by me. I believe that for others, as for me, 'being at the edge between [our] fear and outside, on the edge at [our] skin' (Pratt 1984, p18, quoted in Bordo and Moussa 1993, p132) opens up the possibility of new knowledge.

Phase one: the action research project

In this chapter I describe the action research project which was the starting point for the work which led to this thesis and offer an evaluation of it.

Context and organisation of the project

The PGCE course at the northern University involved is divided into three elements: an Applied Education element which looks at educational issues which span both subject specialism (and, at the relevant time, age phase); a Professional Studies element which looks at educational theory and practice within a subject and age specific context; and a school based element involving both school experience and teaching practice. In the year 1988 to 1989, prior to my involvement, the European Commission had funded Phase 1 of an action research project into the provision of work on providing equal opportunities with respect to gender with the students across the whole cohort within the Applied Education element of the course. (For a full report of this stage of the work, see Coldron and Boulton 1989 and, for some interesting insights into its history, see Coldron and Boulton 1991.)

At the stage at which I joined the course team, the research and the University (September 1989), funding had been secured to extend the action research to cover the implementation of an equal opportunities element within the subject specific Professional Studies element of the course. The action research project directors recognised the importance of the students' consideration of equal opportunities not only in the Applied Education element of the course but also in the subject specific Professional Studies element since it is this latter element that students generally regard as being more relevant to their needs and closer to the centre of their

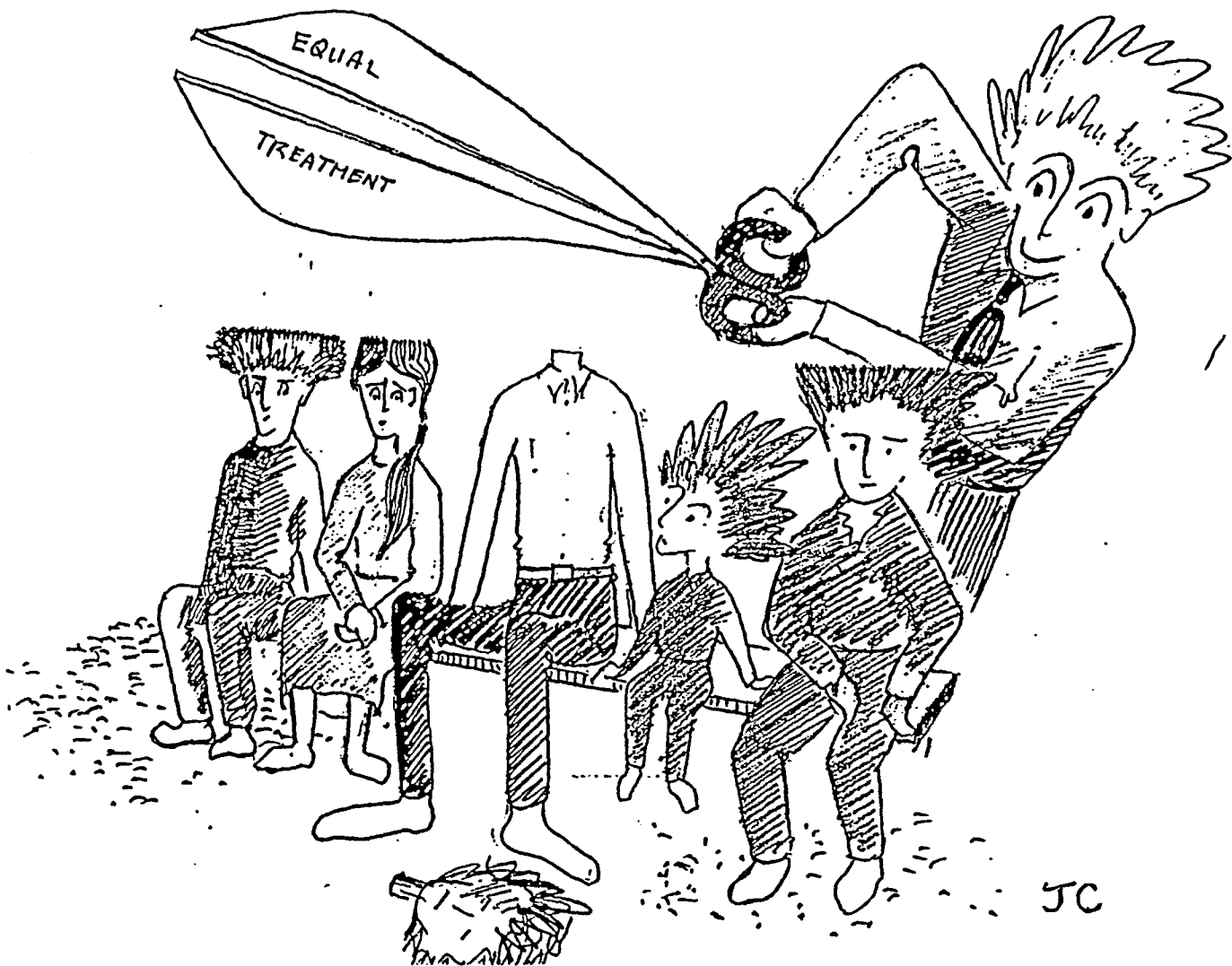
concerns (Skelton and Hanson 1989). In addition, the mathematics course team considered that there were particular issues relating directly to girls and mathematics. Appropriate work on equal opportunities was already being undertaken within the mathematics course but involvement in the project was to focus, monitor, extend and evaluate it. This therefore created the context and the task for my initial involvement in the work. (For a fuller report of the work with mathematics students, see Povey and Johnson 1991.)

At that time, the wider political context of the British education system was such as possibly to encourage and at least to permit work on enhancing equal opportunities in mathematics with respect to gender. Mathematics teachers had been recommended to address the issue by representatives of central government (see, for example, Department of Education and Science 1985, p38). Her Majesty's Inspectors had undertaken an investigation into the learning experiences of girls in mathematics classrooms in schools and, finding that 'schools vary considerably in their ability to enable girls to fulfil their mathematical potential' (Department of Education and Science 1989a, para 8.4), had identified and recommended a number of suggestions for good practice. They noted that aspects both of whole school policies and of individual departments contributed to such good practice but so too did the actions of individual teachers. Clearly, it was therefore assumed, both within the profession and by the representatives of central government, there were consequences for initial teacher education (Department of Education and Science 1989b, para s 6.2 and 6.3).

Fundamental to the project was, of course, the question: to what concept of equal opportunities were we working? (See Figure 5: Equal treatment.) In fact this was not really fully discussed either within the mathematics team or within the wider group which was comprised of the Applied Education colleagues and representatives from the other subject areas. However, writing in 1990, I felt able to say

We hold the view that working to provide equal opportunities for girls and boys is part of the professional responsibilities of a teacher and therefore that awareness of and attention to gender

Figure 5



(Cartoon by John Coldron)

Equal treatment

issues is, in a real sense, a non-negotiable aspect of the course curriculum. (Povey and Johnson 1991, p4)

Thus far, we expected and met no real opposition. Where we anticipated there was likely to be conflict was, firstly, in whether and to what extent systematic sites of disadvantage exist for some of the pupils in our schools - in other words is there really a problem? - and, secondly, in what constitutes unequal provision and what is the role, if any, of positive action.

The course team for the mathematics component comprised three members of staff. We met three times before and just after the beginning of the course to generate ideas for taught sessions relating to the project, to allocate tasks, to offer feedback on planning and to finalise details. Each meeting was about an hour long and was followed by more detailed work, preparation of resources and so on. Subsequently we met once every two months to review progress and to discuss evaluation. These meetings were supplemented by meetings of the whole project team which I attended regularly and which became useful as we reached the stage of addressing the issues of evaluation and worthwhileness. In addition we met the external evaluator from time to time, which meetings without fail led to stimulating and thought-provoking debate: this in turn led to reappraisal, reinvigoration and deeper insights into our work.

The target group in mathematics was fourteen students following two different PGCE courses. Those with a substantial amount of mathematics in their first degree were following the conventional one year course. In this group there were three women and two men. For the others in the group, two women and seven men, who had the equivalent of one year's mathematical studies in their first degree, it was the second year of a two year course. During their first year, they had spent most of their time studying mathematics in classes taught by, amongst others, the tutors working with them in the second year. This meant that they had experienced for themselves as learners of mathematics some of the teaching and learning styles being advocated on the PGCE course. It also meant that, typically, they had a wider academic

training than the one year people, involving at least some contact with the arts or humanities; I conjecture that consequently they were also, typically, further along William Perry's stages of intellectual development (Perry 1970), mathematicians perhaps being one of the last groups to give up an absolutist understanding of the nature of knowledge. This idea is explored further in Chapter 12. (Also in the group for some of the time were two students following a science PGCE with mathematics as a subsidiary subject. These were not included fully in the data collection although the little that is available will be reported. At the time, having a simple view of the nature of the data I was collecting and being influenced by the prevalent 'agricultural' paradigm of research (Partlett and Hamilton 1972, p7), I thought that their different experience would 'muddy' the picture; now it seems to me that this would not have mattered at all and might in fact have been useful.)

Aims and strategy

Writing in 1990 about our intentions we reported

Within the mathematics component of the PGCE course our aims were threefold. In the first place, we sought to increase our students' awareness that girls' underparticipation and underachievement in mathematics are an issue and that working to provide equal opportunities for girls and boys is part of the professional responsibilities of a teacher. Our other aims flowed from this. These were to create some understanding of what contributes to that underparticipation and underachievement and to consider to what extent the underachievement is perceived rather than real; and to help the students develop for themselves strategies to promote achievement, to mitigate bias, etc. (Povey and Johnson 1991, p4)

We decided to have particular activities, tasks, readings, classes and so on which addressed the issue specifically and explicitly and also, alongside this, to attempt to ensure that the associated themes and ideas permeated all the work undertaken (Jones and Street-Porter 1989).

Although our involvement in the project was only confirmed in September, we decided to concentrate into the first half of the first term most of the sessions which addressed the issue directly. Although this allowed little time for planning, we thought that we would be able to monitor the effectiveness or otherwise of our work during the students' first teaching practice, the structure of the course and the timetable for reporting on the project (report submitted in June) preventing the use of the second teaching practice for evaluation purposes. The structure of the course is given in Figure 6: Course structure in 1989-1990.

Figure 6

Term 1	Weeks 1-8	College work with one day each week in schools
	Weeks 9-13	First teaching practice
Term 2	Weeks 14-26	College work with one day each week in schools
Term 3	Weeks 27-36	Second teaching practice

Course structure in 1989-1990

Implementation

The implementation began in the first session of the Professional Studies component of the course which was spent working on a variety of mathematical questions. You are invited to look at Figure 7: Agenda setting exercise before continuing. The overall purpose of the session was to set clearly before the students that view of the nature of learning and doing mathematics which was held by the course team. Included amongst the activities was the agenda setting exercise which purported to be a logical puzzle but was in fact included to highlight stereotype-driven thinking. The intention here was to put equal opportunities firmly on the agenda of the course.

Figure 7

PLACE THE FIVE CARDS IN ORDER
SO THAT THE STORY MAKES SENSE

The cards contain the following sentences:

- He was wheeled into the operating theatre.
- The surgeon cried out, "But that is my son!"
- After the accident, the man who was driving the car was killed.
- His son was badly injured.
- The child was rushed to hospital.

Agenda setting exercise

Also in the first week of the course, the students were asked to reflect on where they located their own success and failure in mathematics, and to consider what they felt about their own qualities as mathematicians. This was done partly through discussion and also through the use of a questionnaire (see Appendix 6) adapted from *Girls into Mathematics*, Open University 1986. The purpose of the activity was two-fold: they were asked to consider whether or not there were gender related differences amongst themselves in their responses and also to think about adapting the activity for use in school. (Here I cannot let the opportunity pass to share an anecdote with the reader. The students were asked to 'Circle the statements which are true about you (mathematically)' from a given list. Unusually for our students, one of them, Sandra, had graduated with first class honours in mathematics from Cambridge University. She circled 'I work hard at maths' and rejected 'I find maths easy' and 'I am successful at maths'.)

A personal profiling component had been introduced into the course that year and as part of the same session as the awareness questionnaire they were asked to complete the first section of their personal profiles. This included a section asking them to reflect on their awareness of equal opportunities issues. In the following week, they had individual tutorials with their personal Professional Studies tutor lasting approximately half an hour during the course of which they were asked to talk about this section of the profile. By taking notes, we recorded this information from the first tutorial session with the intention of inviting them to reflect on this at the end of the second term so that they could recognise and evaluate any changes and developments in their thoughts and attitudes.

During weeks three and four of the course, the students were asked to do some directed reading of research findings in the area of girls and mathematics (Royal Society 1986; Scott-Hodgetts 1986; Shuard 1986; Spender 1986; Sutherland and Hoyles 1988; Walden and Walkerdine 1985, chapter 6) and some of them then led small group seminars on the topic. It was hoped that students would thus broaden their awareness of and knowledge about professional opinion and debate, would reflect upon their own thinking and would exchange

views. By asking them to be responsible for the debate, we hoped to reduce the extent to which they might dismiss aspects of the issue. It was conjectured that it might be easier to take on difficult and challenging ideas if these were presented by their peers rather than by their tutors.

There were three specific inputs in week seven, the last full week in college before their first teaching practice. The first centred on the question of monitoring what is happening in a resource-based classroom. Various strategies were discussed and some use made of ideas from *Girls into Mathematics*, Open University 1986. All but two of the students would be working in pairs for part of their first teaching practice. Each student decided what they would most like to have monitored about their own classroom and then, with their partner, devised an exercise to achieve this.

The students also spent some time thinking about the practical strategies they might use to avoid sexism, both by themselves and by the pupils in their classrooms, and to promote confidence in girls. This was a small group activity and intended to relate directly to the impending teaching practice. They volunteered consideration of basic administrative details (for example, how names are ordered in the register), the tendency for boys to monopolise teacher time and attention, bias or affirmation in materials, classroom organisation, teaching style and the quality as well as the quantity of interactions between teachers and students.

On the form which would be used to record the end of practice assessment by both the school and the student's tutor, there was a section (see Figure 8: Extract from the teaching practice form) asking for appraisal of equal opportunities aspects of their work. They were asked to discuss the criteria which should be used in assessing their performance under this category of the teaching practice report form and to expand the form accordingly. The tutors agreed that the assessment on the impending teaching practice would be by these criteria and that this would be reviewed in the following term.

Figure 8

PROFILE CATEGORY	CRITERIA FOR HIGH RATINGS	Very High	High	Average	Low	Very Low	CRITERIA FOR LOW RATINGS
EQUAL OPPORTUNITIES	Student effectively promotes equality of opportunities in the classroom						Student shows little or no awareness of EO issues and these are not addressed in classroom practice

Extract from teaching practice report form

We decided to involve the students directly in planning the section of the taught course which would last throughout the second term. Initially this was not associated explicitly in our own thinking with the issue of equal opportunities. We were thinking simply in terms of the students having a sense of ownership over that part of the course for which we were responsible. We invited the students, before they departed for their vacation, to 'brainstorm' what they thought they would like to work on during the central term. No discussion or comment was invited at this stage and the students were asked to reflect during their time away from college on the list they had generated and to think about priorities, emphases and time allocation. I was responsible for the first session after the holiday and we began with an informal discussion, taking the list as a starting point. The students and I spoke in favour of or against suggestions and teased out as fully as possible the intentions behind the ideas expressed. My role as tutor was important here in helping each student to express their felt needs in a way which was coherent and understood by the others. I also contributed my own ideas to the debate. The students then made groups of four and, with a blank copy of the term's timetable in front of them, planned what they wanted. I took away the results and amalgamated them into a complete programme which I then displayed for the students' approval showing the connections to the four originals (see Appendix 5). Because all of the students had been involved in negotiating the timetable, it was difficult for them subsequently to disassociate themselves from the work however uncomfortable it became. When individuals felt alienated from the programme content they nevertheless perceived it as

originating from their peers rather than from us which made it harder to opt for a passive response. (For a fuller discussion, see Povey 1992).

Throughout the second term we addressed gender issues through permeation. Much of this, of course, was incidental, unplanned and unrecorded but I offer one or two examples. In sessions devoted to aspects of classroom management we again looked at practical strategies for promoting the achievement of girls and for combating sexism, both our own and that of the school students. Also, when considering creating resources, one of the things we discussed was counteracting the invisibility of women and people from ethnic minorities in materials used in the classroom; the students worked on a number of tasks which included finding a piece of mathematics which had been done by a female mathematician. A further example was the session on the use of micro-computers in the mathematics classroom when gender implications were discussed.

Before they set out on their final teaching practice in the third term we looked again at the teaching practice form. The students were asked to write down some specific examples of what would merit a *Very high* mark in the equal opportunities assessment category and similarly for a *Very low* mark. We asked the students to work in pairs chosen at random and then to justify their conclusions to another pair.

In addition to the specific planned activities outlined above and the commitment to the theme permeating the course, there were two other important aspects of the implementation, both of which relate to the 'hidden' curriculum of teacher education (Mardle and Walker 1980, Leonard 1989). First, the course team of three included two women mathematics educators. It seems likely that this would have had an influence on how the students perceived the Professional Studies part of the course generally and how they experienced the gender work in particular. We might also be seen as role models by the women students. Second, we tried throughout to exemplify good equal opportunities practice in the way we ourselves worked and to make this explicit to students. Throughout the course, we made use of collaborative

group work; we sought to inculcate an attitude of mutual respect and support amongst the students; within the constraints of the course, wherever we could, we encouraged the students to negotiate their assessment; we declined to adopt the role of 'expert' in the sense of knowing the 'right' answers and so on. Neither of these aspects of the 'hidden' curriculum was generated by the action research project itself but, naturally, they were both fundamental to its implementation. Diana Leonard has written that initial teacher education has failed to work effectively on gender issues because content only is addressed: processes remain 'higher education's fundamentally conservative teaching and learning practices - and it is these practices which are the main source of the generally elitist and male-dominated influence of universities and polytechnics' (Leonard 1989, p26). I suggest that many of those conservative practices were challenged by the mathematics team.

Evaluation: an overview

In the rest of this chapter I record the evaluation of the action research project which we made at the time. This means that, for most of the chapter, I look at and evaluate the work of the project *within its own terms*. I conclude with some self-reflexive remarks which indicate subsequent developments in my thinking as I moved from this Phase one starting point further into the research. I wondered whether to quote this evaluation rather than to present it in the voice of the thesis but decided against it. The evaluation was simple but careful and honest and generally, within its limitations, I am happy to stand by it. Where statements need qualifying, I have made appropriate comments within the text.

We collected a variety of observational data but throughout we placed considerable emphasis on what the students themselves thought, attempting to include 'the perspective of the researched as well as the researcher, and ... awarding status within the research to those perspectives' (Witcher 1985, p95). Much of the data does not record directly the students' attitudes and opinions; rather are those inferred from their responses to practical tasks. I conducted the initial analysis of the data and then had this checked by the two other colleagues working on the Professional Studies component of the course.

Details of the methodology and the organisation of the data collection are described elsewhere (Chapters 2 and 4); for easy reference they are repeated here in brief in Figure 9: Evaluation material for the action research project.

Figure 9

Written data	Files from their first teaching practice	5/14 students
	Questionnaire relating to their experiences in school during the first teaching practice	13/14 students
	Draft timetables for term two	14/14 students
	Results of <i>Very high, Very low</i> exercise	14/14 students
Interview data	Tutorials	5/14 students
	Semi-structured interviews	3/14 students

Evaluation material for the action research project

The students' view of the emphasis on gender issues

One of the questions that concerned us in our evaluation was this: what did the students feel about the time we had spent and the importance we had attached to gender issues? Had the emphasis we had placed on the issue been accepted by them or did they reject our sense of priorities; and was this then, in turn, a cause of alienation from the issue itself? I had three sources of data available which I used to try to answer this question: the students' written responses to the teaching practice questionnaire completed at the end of the first term; the contributions they made to designing the taught component for the Professional Studies aspect of the course at the beginning of the second term; and the responses from the small sample interviewed at the end of the course.

The questionnaire had asked them *What further input on gender issues would you like to see in Maths?* Despite our emphasis on gender in the first term (or because of it?), surprisingly nine out of thirteen students made positive suggestions for further input and only one student, Andy, wrote 'None'. (Throughout the thesis I have used pseudonyms for the individuals involved. The participants are listed in Appendix 1 along with an indication of the nature of their participation.) Those replying positively made a wide variety of suggestions, many mentioning a 'practical approach' and including references to resources, computers, discussion in the classroom, ideas for lessons, 'how to' and so on, but not to the exclusion of more debate, information and reflection especially in the light of their new-found experience. (Appendix 4 gives a full list of the responses.) At the time I found this response surprising and pleasing and it made me feel that the students were taking the issue seriously and were professionally engaged by it. Looking again at the data I considered my reaction to have been justified: the replies are surprisingly mature for students at the end of their first term. I therefore checked to see which students had written what in case two year students were over represented. They were not.

The second set of data I used to evaluate their response was derived from material collected during the same period, material which was not overtly connected with equal opportunities issues. These data were the recommendations for their course programme that resulted from the students' participation in the planning exercise. These also seemed to indicate that they had valued the input in the first term and saw its relevance to life in the classroom, echoing and supporting the questionnaire data. The students requested a further twelve to fifteen hours on equal opportunities issues, including race and differential attainment, and again emphasising classroom strategies. (The draft timetables form Appendix 5).

At the end of the course, a similar impression was given of commitment to equal opportunities issues. All the mathematics students interviewed were very positive about this aspect of the subject-related method course. When asked about the emphasis, one said

... we've certainly done quite a lot in Maths, sort of EO has gone right the way through ... [it has been] specifically useful because we've dealt with ways of actually coping with it as it arises in the classroom. (Joanna)

This student also valued the work in the Applied Education component, saying

... you need to be able to see what is happening in other disciplines, I mean you can get very sort of narrow-minded along your own particular road ... you need a broad perspective. (Joanna)

Another reflected

... it's more than I expected when I went on the course but I think it's been about right ... because in Maths we actually asked for a bit more which we've had so there has been negotiation about the course anyway. (Sandra)

Another who particularly valued the permeation of the issue through his studies remarked

... it's an aspect which is important to devote more time to, yes. (John)

However, in very real contrast to this, the interviewee who was following the combined mathematics and science course was

... heartily sick of equal opportunities ... sick of hearing it ... er ... preached at me in a way. (Mavis)

although later in the interview she said

I think what we did was OK... I'm ambivalent about it, you know I can see in the future in my career it's going to be important ... (Mavis)

In response to this I wrote at the time

It seems likely that there were particular difficulties arising out of the combined course: when the complete cohort of sixteen students was asked (for other purposes) to evaluate the taught course, both students following the combined course felt that there had been too much emphasis on gender issues but seventy-nine per cent of the others were happy with their experience. This underlines the need for close liaison across the PGCE which was difficult to achieve at the planning stage due to the timescale of the project. (personal notes, January 1991)

This seems now too simple and perhaps with hindsight not altogether honest. I knew from other conversations that this student was very angry about *something*: she had railed against those she saw as advocating that the only worthwhile thing for a woman to do was to have an independent career; she felt that the right of a woman to enjoy being the mother of children and to work at this fulltime was being despised and denied. There certainly *were* problems of communication and overlap on the course (bad enough that we have now eliminated this course route) but there was more to her protest than that. Writing more than four years later, I now also conjecture that other issues to do with world view, ways of knowing, the process curriculum and so on were fundamentally different between the mathematics tutors and the science tutors and this led, at best, to confusion and, more likely, to alienation and cynicism because we did not explicitly address these matters with those students. In the light of my further research, I believe that, in the initial evaluation, I grossly underestimated the importance of these factors in the student's experience.

Evaluation relating to teaching practice

It appeared then that most if not all of the students were regarding as legitimate a concern with equal opportunities. A central question for us was the extent to which this attitude informed their work in classrooms on teaching practice. Was the university work being translated at all into classroom behaviour? Here the results were uneven. I looked first at the

evidence obtained from scrutinising teaching practice files and then considered the students' self-assessment in their replies to the teaching practice questionnaire.

Only five files were available for scrutiny: my impression was that the files provided a reasonable reflection of the cohort but, unfortunately, I did not seek to validate this by, for example, discussing the sample with my colleagues. I considered first the use made of resources. One student, Sandra, had put together a most imaginative collection of examples on the theme of circles. She invoked a very wide range of contexts most of which were those traditionally associated with female interests including biscuit making, lampshades, knitting, coffee tables and so on. Such examples constituted half of the total of forty-six with a further third using neutral contexts. However, another student, John, who was very alert to the possibility of offering positive images in the resources he produced himself, continued at times to use the school's materials (the School Mathematics Project 11-16 books) without modification or comment: for example, he used an exercise on division from the textbook despite the fact that none of the examples could be construed as relating to a traditionally female context, the breakdown being over half male and the rest neutral. Yet another student, Kevin, felt able to produce a worksheet which began, *Alfred thinks he can run twice as far as Patricia can run and walk in 5 minutes*, and, although the claim turned out to be false, he was nevertheless considerably speedier than she. The worksheet continued, *Bert and Angela are both going to Northam from Ellingborough. Bert takes his car and Angela catches the bus*. Some students, then, some (or most) of the time were reflecting an awareness of gender stereotyping and the need for positive images in the material they produced and used. Some were not.

The other material from their teaching practice files that I used as data were their aims and evaluations. Four out of the five students did include equal opportunities considerations explicitly in their aims and three out of the four then addressed these aims or other aspects of equal opportunities in their reflections upon the lessons, sometimes with considerable sensitivity and insight. John, for example, included 'working cooperatively' in his aims and

reflected that there might be a gender dimension to be considered. Sandra included equal opportunities considerations in nearly all her lesson plans and often reflected on them in her evaluations, sometimes focusing on the time and attention the girls were receiving, at other times attending to details of the materials. She wrote, for example, 'I'm afraid all the [toy] models were boy orientated as I realised afterwards - as I had acquired them from my son' and 'It was interesting that the figure in the problem looking at the tree was usually referred to as "him" giving me an opportunity to emphasise it could be a woman'. The fifth student, Kevin, however, made no reference at all in any of his aims or evaluations to equal opportunities issues.

In completing the teaching practice questionnaire (see Appendix 3), the students were asked to list the criteria they used to evaluate themselves with respect to equal opportunities and then to judge their own teaching practice performance against these criteria. The most common criterion (included by four out of five students) related to their use of time in the classroom. More than half of them felt that they had shared their time and attention equally between boys and girls although, worryingly in the light of research findings with which they were familiar, they offered no evidence for this other than their own impressions. Those who judged themselves to have spent more time with the boys despite their intentions to the contrary both remarked on the demands they had experienced in the classroom.

... I spent more time with the boys due to their disruptive and 'playful' behaviour. (Mary)

... sometimes I felt that I gave more individual attention to the boys when asked questions as they were often more insistent. (Carol)

Only one student mentioned the monitoring exercise here. (For a discussion about this, see below.)

Unfortunately time circumstances did not allow monitoring activity to be carried out. However tutor did note that I made a conscious effort to see everyone in class. (Mick)

It is clear that for most of the students we had failed to convey the ease with which it is possible to gain mistaken impressions in this field (Spender 1989, p56).

Two other criteria were used by large numbers of students. Nearly two thirds of the students included matters related to resources used by them in the classroom. Not surprisingly, perhaps, a high proportion of these felt they had been successful in eliminating bias, using non-sexist language and so on. Once students have decided to address this issue, it is not too difficult for them to monitor themselves effectively within their own understandings and they have considerable control over the resources they choose to use. The third most common criterion, mentioned by nearly half the students, related to teaching styles. These students showed an awareness of the fact that different pupils may have different learning preferences (see, for example, the research discussed in Open University 1986, section 3.3) but they felt that they had had considerable difficulty in translating this awareness into effective classroom practice.

Associated with their work in schools were the awareness raising activities we had suggested they use while on teaching practice. Here the results were disappointing. The attitude questionnaire, or something similar, had been used by only two students and the monitoring exercise by three, although a further three indicated that they thought it would have been valuable had not practical difficulties intervened. Those who were monitored found the experience worthwhile and attempted to amend their practice in the light of what they discovered. I do not believe that I took sufficient note of this finding at this stage in the course. I believed that fairly simple amendments to our practice as course tutors would make both activities viable for most of the students in future years. I now believe that, if we *could* accomplish such viability, we would have helped those students a great deal who wished to move from strategic compliance with the unequal *status quo* to redefinition of the situation

and its constraints (see Lacey 1977). Changing practice is complex, hard and elusive: an essential component is enabling the *pupils themselves* also to redefine the situation of schooling and the classroom. As Elizabeth Sarah has pointed out, even where teachers enter the classroom with a commitment to change,

it is the students themselves who make this difficult, or even impossible, because they have learned their different socially sanctioned roles and their classroom behaviour makes different demands upon the teacher. (Sarah 1980, p160)

Activities like the monitoring exercise if it involves school students (see Inner London Education Authority Learning Resources Branch 1986) and the attitude questionnaire if it is followed up and discussed (see Open University 1986, p72) allow first steps to be taken in this process.

Overall, there was clear evidence, then, that some of the classroom practice of some of students was being affected by aspects of the taught course and many were attempting to include reflection on gender issues in their evaluations.

Was student awareness of equal opportunities issues increased?

As well as evaluating the extent to which the students regarded equal opportunities as a legitimate professional concern, we also wanted to find out what they thought the issues involved were. Here I again used the teaching practice questionnaire (see Appendix 3). The responses from many students were impressive, given the fact that the questionnaires were completed relatively early in the course, and showed variety, sensitivity and insight. Specific examples of sexism observed on teaching practice were offered by nearly three quarters of students and included those relating to the physical environment,

classrooms [were] bleak and disorganised - gave the impression that Maths is cold, hard (ie not soft) and unattractive (Sandra)

to staffing and staff relationships,

at an INSET day one senior member of the male Maths staff implied (jokingly?) that he didn't want any more female members of staff in the department (Mary)

sexist jokes in the staff room (Bob)

generally a male feel about the department - male head and deputy [head of department], [the] only full-time woman maths teacher opted out of nearly everything ... (Sandra)

quite a few sexist remarks made in the staffroom (Mick)

to resources and their allocation,

some of the problems in the SMP textbooks were geared in my opinion towards boys - particularly problems involving analysis of football results (Carol)

mostly boys came to use the computers at lunchtime ... (Sandra)

to the use of language,

... several boys called a robot 'he'. I challenged the assumption and [we] ... did make an attempt to talk through attitudes and stereotypes (John)

and to expectations of and relationships with pupils,

distribution of girls in sets a little suspect ... (Pete)

keeping control of classes by shouting at them (Pete)

allocation of jobs - "I need some strong boys to move some chairs in the assembly hall" (Mick)

in a lesson on curve stitching, a teacher advised me to let the girls have the coloured pencils rather than the boys, since the girls would be more likely to want to colour in their patterns. The boys could be left with the more challenging task of designing their own patterns (Richard)

All but two of the students were able to detail ways in which they had attempted to mitigate sexism in mathematics lessons. In addition to those already discussed above (under the criteria they were using for self-evaluation), they here mentioned 'unofficial' class discussion in response to remarks from pupils, not praising girls on the basis of the neatness of their work and mounting displays to make the mathematics environment more attractive. Again, all but two of the students were also able to isolate specific ways in which they felt themselves to be more conscious of issues relating to gender and mathematics now that they had been on teaching practice. These included their own use of language, girls' lack of confidence in and feeling for the relevance of the subject, the difficulties of dealing with demands from the boys and forgetting quiet girls, and the under-representation of girls in 'A' level mathematics classes.

A study of the students' responses a term later to the request to write down some specific examples of classroom practice or other aspects of behaviour in schools that would merit a *Very high* or a *Very low* mark in the equal opportunities assessment category confirmed the impressions gained from the questionnaire. All the issues mentioned above were included and, in addition, several more, including access to computers, seating positions in the classroom, awareness of current initiatives and the need to integrate equal opportunities into lesson plans. Inspection of the interview material also indicated that students had a wide and varied range of ideas about positive actions that they could, and thought they would, be taking when they started teaching.

On the basis of this data, we felt we could say that, across the group as a whole, a wide variety of issues surrounding equal opportunities and mathematics had been noted and their implications for classroom practice accepted. The emphasis in our evaluation was almost

entirely concerned with practice and declared attitudes towards practice. We did not record and, typically, did not even ask them to share with us deeper understandings about inequality. We did, however, want to know to what extent, if at all, they felt that their ideas had changed during their time with us. There were two sources of information to inspect: this question was addressed during the interviews and, for a further five of the mathematics students, I had information from their profiling tutorials. All of these eight students considered that they were significantly more aware of gender issues than they had been when they started the course, especially in so far as those issues related to education. A typical response was

... if I think about it objectively, [my awareness of gender issues in education before the course was] towards the lower end of the scale ... I'm certainly a lot more aware than I was although ... you know it's so easy to slip into the old jargon ... but ... I'm consciously trying ... I don't think I've changed my underlying values of what I think equal opportunities is, I think I've just become more aware of how I do or don't put it into practice.
(Joanna)

The students' experience was of significantly greater awareness of equal opportunities issues with respect to education, perhaps involving mild attitude shift, but, unsurprisingly, very largely for most incorporated within their existing value system (see Coldron 1992 for a discussion).

Overall evaluation of the course

Finally, we were also concerned to establish which aspects of the work we had done together were perceived by the students as being useful and effective. Here we were able to obtain data from the small sample of our students who were interviewed. All of the mathematics students mentioned and appreciated the reading that they had been asked to do but they laid particular emphasis on the sessions which had addressed practical issues in the classroom. One of the students commented on the session devoted to the research articles.

I think there was this low point in Maths during the first term and I think perhaps there should have been a rather more

imaginative approach to it at that point and perhaps a more practical approach then because I think we've appreciated that practical approach later on. (Sandra)

Clearly we had made the mistake for her of not embedding our theoretical understandings in our personal concerns for action. We certainly needed both to establish that there is a problem of under representation and under achievement in public examinations by girls and also to have an initial look at possible causes but this needed to be linked directly to students' immediate concerns. Many made effective links for themselves.

I think, yes ... little bits of information coming ... and some of the reading I've done around that ... also going on teaching practice and actually becoming aware of what actually goes on in the classroom, how boys and girls react to one another. (John)

The students perceived the issue as permeating all aspects of the taught course. For example,

I found the [mathematics] staff were quite aware and ... it was a kind of underlying, understanding awareness of gender issues ... we didn't stop after a week and say 'Right now we're going to do equal opportunities', there was that sort of thread running through ... [it] pervades almost everything we do. (John)

To put this last comment in perspective, however, inspection of the tutors' comments in the teaching practice files revealed a quite different picture. Of the five files available for inspection, only two contained any tutor reference *whatsoever* to the issue of equal opportunities. How and why had this discrepancy occurred? It seems likely that the significant difference was the degree of planning involved (Skelton and Hanson 1989). The three staff working on the taught subject-related method course had regular, if relatively infrequent, meetings to plan this work and also contact with the larger project team to describe and explain it. However the work of supervising students on teaching practice (and in some cases this was done by the *same* staff) was undertaken in isolation and without

planning. Permeation slips away if it is not planned, so powerful is the prevailing and taken-for-granted way of being in the world.

Two other features of the course were mentioned by the students, neither of which was pursued and elaborated at the time but both of which gain greater significance in the light of my further research. Both relate to aspects other than those to do with content and its structuring. The first concerns trust within the group and between students and tutors and the opportunity this provides for sharing ideas and experimenting with new ways of thinking.

... it's nice to come into a supportive atmosphere which I've definitely felt in the maths department ... it wasn't the struggle to talk about these ideas ... as it is in a lot of other situations where people are going to be negative about those kinds of things. (John)

The support from tutors and peers was for some a crucial feature of the space which allowed the development and ownership of ideas (Belenky et al 1986).

The second relates to passion and to the fact that we offered our perspective as being just that. Personal involvement and participation were key features, the individual tutorials being highly valued, and the clear commitment of the staff, which is sometimes said to be an alienating factor, here seemed to have the opposite effect.

... obviously our tutors [had strong opinions in this area], I think there's been a very strong influence there and ... the fact that we've got ... two women teaching us and their kind of positive feelings about it. (Sandra)

Although we all acknowledged at the time that the *process* aspects of the curriculum were central to the student experience (see, for example, the conclusion to our report (Povey and Johnson 1991, p26) reprinted in Appendix 18), further research has led me to believe that we underestimated its importance in our description, in our monitoring and in our evaluation. In

the data we collected from the mathematics cohort and in the overall project data collection via semi-structured interview (see Appendix 2 for schedule) and, therefore, in our evaluation at the time, aspects of process were under represented. We did not notice, for example, that, despite the fact that we had not thought to include any questions in the semi-structured interview designed to elicit reflections by the students on process issues, more comments were volunteered by them about process issues than about specific content. I believe, with the mathematics cohort, that our pedagogy reflected our commitment to the importance of process more than did our research. We had a conviction that process issues were central to equal opportunities work but did not articulate what this meant sufficiently in reporting our work; nor, I suspect, were we sufficiently explicit about our own pedagogy with the students.

There are a number of reasons for this, one of which relates to my personal work history. I had only recently joined the University, almost all my previous experience having been in working with teachers who were committed - both in their classrooms and in meeting their own in-service needs - to personal involvement, participation, ownership of ideas and so on. I therefore took this as the norm and was insufficiently aware that it could not be taken for granted. Indeed it was probably also harder for me to articulate what was involved: perhaps this was one of those cases where it is not sensible to ask a fish to describe water (Kluckholm quoted in Davies 1985, p85)! In addition I was unused to the task of helping adults learn how to teach children mathematics. Like all my colleagues, I had had no training for the job: all my previous classroom experience was in teaching mathematics rather than in 'teaching teaching' and I had not incorporated much consciously reflexive practice into my sessions with the students. New to higher education, I was also naive about the students' ways of knowing, only gradually discovering more students than I had anticipated whose thinking echoed William Perry's dualists (Perry 1970).

Despite these criticisms, the overall positive evaluation of the action research project is valid within the stated constraints. Unlike much of the practice observed elsewhere by the Equal Opportunities Commission, the situation, during the project year and on that course, was not

one of 'benign apathy' nor the approach 'reactive and incoherent' (Equal Opportunities Commission 1989, p7). We wrote in the report

The project has established that, through a combination of specific inputs and permeation, it is possible significantly to effect the perspectives and attitudes of post-graduate students in initial teacher training. Overwhelmingly, the evidence is that the students have accepted the view that their professional responsibilities involve a commitment to providing equal educational opportunities for girls and boys whether or not this comes 'naturally'; that they feel their attitudes and perspectives have changed during their time on the course whether or not they have been wholeheartedly in favour of the considerable emphasis placed on gender issues; and that they currently intend to act to mitigate bias when they become practising teachers.

What is, of course, not clear nor could it be at the time of writing, is firstly, will these views stay with them as they move into their first teaching posts and, secondly, will they be able to translate this outlook into effective working practices. (Povey and Johnson 1991, p25)

We claimed to have done something different on the course and I consider that this claim was, overall, justified. It remained to be seen whether or not any developments in attitude were *stable* and also whether or not we had *done enough* to affect practice given the nature of the schools into which the students would be moving. It would be no comfort to us as initial teacher educators if, as it were, we had 'done our bit' but had failed to equip the students for the unsympathetic environments in which they were likely to find themselves. It was these questions and the attempt to begin to answer them which led to the main body of the research reported in this thesis.

Teacher socialization

In this chapter I shall look at the notion of socialization as it applies to teachers and review the 'conventional' understanding of what happens to new entrants to the profession. I shall then look in some depth at the work of Colin Lacey whose *The Socialization of Teachers* offers a starting point for a deeper analysis. Finally, I shall try to draw out some of the factors which the literature suggests may significantly influence the development of beginning teachers. In terms of the personal history of the research, the bulk of the reading and analysis for this chapter took place after the Phase two data collection but before its analysis. At an informal level, therefore, I was already influenced by those experiences as I wrote the chapter. In turn, my experience of writing this chapter shaped my analysis of the Phase two data. The three events - visiting the students-becoming-teachers in school, writing this literature review of teacher socialization, 'portraying' (Macdonald 1977) the students-becoming-teachers - occurred as a temporal sequence but affected each other dialectically. The later editing of this chapter and the next, *Stories of/about three new teachers*, operated recursively.

What is socialization?

Socialization into a group is the process whereby a person imbibes the values, attitudes, beliefs, interests, knowledge and practices - the culture - of the group and comes to share the taken-for-granted, commonsense assumptions of that group. Teacher socialization, then, can be described as the process by which new members of the profession gradually acquire, have confirmed, become accustomed to 'a common set of interests, to certain ways of looking at the world, of interpreting the world and obtaining a world view - in short, a teacher perspective'

(Lacey 1977, p14). The beginning teacher 'becomes socialized into a professional culture with certain goals, shared values and standards of conduct' (Calderhead 1992b).

This process is neither as passive nor as wholesale as that definition implies. For example, the world view will apply to those situations where the person identifies herself as a teacher and will not necessarily carry over into other situations. Equally, aspects of that culture may already be familiar to a new entrant and may not require the assimilation of a significantly different outlook; indeed, with entrants to the teaching profession, some such familiarity is more likely than not. In addition, teachers themselves, including those who are just beginning, play a part in constructing those theories, values and norms which socialize them. Also, there are multiple and sometimes conflicting and contradictory elements in the culture of what it is to be a teacher and these also vary with place and time: the profession is internally differentiated. Lastly, this process of socialization, like others, is a site of 'contestation and struggle' (Walkerdine 1990, p109): the positions provided never quite fit. The socialisation - 'the imposition of fictional identities' (Walkerdine 1990, p109) - does not wholly 'work' and this failure, although painful, opens up what is possible. These themes will emerge more fully as I consider below some of the research relating to this partial, varied and incomplete process.

The 'conventional' view

Much of the early work on the socialization of teachers produced during the nineteen sixties and seventies portrays the entrants to the teaching profession as passive recipients of an existing culture, 'empty vessels' who are simply filled up first by the teacher trainer and then by experienced staff in school, and also as inherently conservative, submerged by the tidal impact of their initiation and content to be so. Kenneth Zeichner and Robert Tabachnick, writing in 1985, say

It is conventional to think of beginning teachers as vulnerable and unformed. They are expected to be unable to resist pressures to conform to institutional norms for teacher

behaviour. Willingly or unwillingly, beginning teachers are seen to be cajoled and moulded into shapes acceptable within their schools. (Zeichner and Tabachnick 1985, p1)

Investigating teacher recruitment in the United States of America, Lortie failed to find *any* people entering the teaching profession who were critical of conventional practice: '[i]f they do exist they must be very scarce' (Lortie 1975, p46, quoted in Cole 1985, p93).

Coupled with this, a view is presented that there is a major discontinuity between teachers as they are in training and the teachers they become when they take up posts in school.

The present evidence is that initial teacher socialization is traumatic, involving deep changes in self and perspectives. (Sikes et al 1985, p12)

Teachers are seen as becoming more authoritarian and custodial in their approach to school students, significantly influenced by their professional evaluators and 'the power of collegiate expectations' (Ball and Goodson 1985a, p14). They are portrayed as more conventional and less progressive in their teaching perspectives and less happy and idealistic at the end of their first year than at the beginning, victims of 'reality shock' (Zeichner and Tabachnick 1985, p2). Summarising previous research, Lacey notes the common consent that the 'attitudes of beginning teachers undergo dramatic change as they establish themselves in the profession, away from the liberal ideas of their student days towards the traditional patterns in many schools' (Lacey 1977, p48). Even in a context in which a clear case study example to the contrary is offered, the question of 'why the preservice education fails to survive the shock of transition from university to ... school' (Corcoran 1981, p19) is accepted and its premises not problematized.

The beginning teacher, then, is seen as being acted upon rather than acting and this has

tended to produce a crudely stereotypical assessment of the teacher. Thus conforming, moderately successful

schoolchildren who have found their schooling congenial choose to become teachers. During training they are persuaded to discuss liberal conceptions of education which they reproduce (with a merely instrumental motivation) in some of their academic work. Meanwhile, the hidden curriculum of training reinforces the conservative assumptions with which students entered, in the probationary year survival in the classroom is achieved on the basis of familiar pragmatic recipes (often learnt while still a pupil) and the emerging teacher soon joins maturer colleagues in the dismissal of liberal theory as irrelevant to the daily practice of teaching: the scene is set for a career of unreflective conservatism. (Cole 1985, p90)

This analysis has a tenacious hold on perceptions of the beginning teacher and is even experienced as 'natural'. Pat Sikes, for example, writes

New, enthusiastic workers in any occupation pose a threat to the *status quo*. In order to avoid being shown up and made to work harder, re-examine methods, etc. the older workers socialise the tyros into their ways and put pressure on them to conform. This happens in schools just as it does in factories ... (Sikes 1985, p39)

Equally, the result is accepted, that is,

... even when students acquire radical or progressive values at college, they lose them once they face the practical realities of the classroom and staffroom. Practising teachers notoriously see college work as trendy, inappropriate, inapplicable and best forgotten. (Leonard 1989, p26)

This view is put forward even when the premise - that higher education institutions propound liberal values - is challenged (Leonard 1989).

In summary, then, we have a picture of a reasonably homogeneous socialization of beginning teachers who, either vulnerable and unformed and/or trapped in conservative biographies, play no part in the process of their induction and are unable to resist pressure to conform; teacher education is a short term agent of liberalization but its effects are soon wiped out by becoming

a teacher. The analysis is obviously felt to have explanatory force but, if accepted in its entirety, would make innovation impossible. Many schools and much of the curriculum may be relatively unchanged from, at least, one generation to the next. However it is equally true that many schools are very different from those of thirty years ago. You have only to read, for example, the 'critical incidents' of Lynda Measor's older teachers (Measor 1985) to realise some of those changes: schools are still hostile environments for some of their pupils and staff, but the violent and brutalising incidents described by Measor no longer occur. Most inner city schools are just not like that any more.

(In passing it is worth noting that this seems to me to be a problem with some of the *generalised* results of life cycle research into teachers' lives: it is likely that there will be some general patterns in the lives of all teachers *qua* teachers, but, if we accept that schools and schooling change, then the experiences of one generation of beginning, middle career and retired teachers will not be the same as that of the next.

The problem with this sort of life cycle analysis is that the determining factor responsible for teacher lived experience - age - becomes a universal, biogenic essence which asocially naturalizes the life cycle in a manner similar to elementary textbook descriptions of the life cycle of biological organisms. (Riseborough and Poppleton 1991, p328)

There needs to be recognition of the particular factors of the historical context through which that generation has lived those teaching lives.)

Many initiatives for change in England (perhaps unlike some other countries) have come from and been developed by the work of practising teachers, *not least because of the pressure, persistence and vision of the newer ones among them*, rather than being externally imposed by outside agencies (see, for example, the SMILE project, London and Cornbleet and Libovitch 1983). This suggests that change is possible and that new teachers can be significantly instrumental in bringing it about. Colin Lacey's research with PGCE students from 1969 to

1973 suggested that all might not be as it seems: 'socialization is an incomplete and partial process and the limits of a social situation depend at least to some extent on the creativity and skill of the participants' (Lacey 1977, p29). It may be that Lacey, writing in the early seventies, was over sanguine about the possibilities for change. Equally, however, it is important that we, living under the 'new barbarism' (see Hobsbawn 1994 for a discussion), maintain a long enough historical perspective: however much some might like us to be, we are not back in the days of Mr Gradgrind. It is to Lacey's research that I now turn.

A redefinition of teacher socialization

Lacey wished to examine how induction into teaching comes about, what the process means to the individuals involved and what possibilities exist for those involved to gain some control over the process. He describes the student teachers as adopting, consciously or otherwise, 'social strategies', involving them in the selection of ideas and actions which they work through within the context of a specific situation. The term 'strategy' is chosen because it implies guiding and autonomous behaviour within the constraining social situation: 'the constraints of the situation and the *individual's purpose* within that situation must be taken into account' (Lacey 1977, p67).

Three categories of social strategy are delineated, the first two fitting in with the idea that socialization is the process by which the individual becomes 'the kind of person the situation demands' but the third challenging this idea and allowing the new teacher a partial role in constructing 'the kind of situation the person demands'. The first of his three categories is *strategic compliance*, in which individuals comply with the authority figures' definition of the situation and of the constraints, but retain private reservations about them, adapting themselves to the demands placed upon them but without accepting the values and norms that they represent. Secondly, there is *internalized adjustment*, in which the individual complies with the constraints and believes that the constraints of the situation are for the best, willingly adapting to the demands made and accommodating them both in their behaviour and also in their attitudes and values. Lastly, there is *strategic redefinition* of the situation in which the

demands and constraints are (partially) redefined by those who do not have the formal power to do so, in this case new teachers.

They achieve change by causing or enabling those with formal power to change their interpretation of what is happening in the situation. (Lacey 1977, p73)

Importantly, this last strategy is riskier than the other two, is seen as being much more dependent on the ability of the actor and may in the end be unsuccessful.

This conceptualization of socialization not just as internalized adjustment but as 'the adoption or creation of appropriate social strategies' (Lacey 1977, p96) allows the new teacher to be seen as an actor in the process of induction into the profession. Successful teacher socialization, then, *may* consist of adopting the theories, values, norms and practices already existing within the social situation in which the beginning teacher finds herself but may also, or instead, involve to a greater or lesser degree compliance to those attitudes, beliefs and behaviours without internal assent. Lacey recognises that the conscious use of strategic compliance shows 'the resilience and the sophistication of the individual faced with conflicting institutional pressures' (Lacey 1977, p75) and conjectures that it is in fact widespread. This links with the further characteristic which successful teacher socialization may have, that of the new teacher playing a part in restructuring the given culture of the institution.

Kenneth Zeichner and Robert Tabachnick, in their study of beginning teachers, found that all of them were engaged in all three strategies but that for each teacher there was a dominant strategy which characterized their experience (Zeichner and Tabachnick 1985, p12). Patricia Sikes, Lynda Measor and Peter Woods thought it worthwhile elaborating a fourth category, that of strategic compromise, which lies between internalized adjustment and strategic redefinition and contains elements of each: 'finding ways of adapting to the situation that allows room for their interests, while accepting some kind of modification of those interests' (Sikes, Measor and Woods 1985, p238).

As was noted above, strategic redefinition is riskier than the other two social strategies and, unsurprisingly, is less often attempted. Unlike the other two, it is not uncommon for it to be unsuccessful, which may in turn lead to an individual either leaving a particular institution or indeed the profession or coming to adopt internalized adjustment or strategic compliance as their generally preferred strategy. Zeichner and Tabachnick found many reasons why attempts at strategic redefinition either failed or succeeded.

Among these were the degree to which teaching perspectives were developed at the beginning of the year and the strength with which they were held, the 'coping skills' and political sensitivity of the teachers, the degree of contradiction between formal and informal school cultures, and the reactions of the pupils to the teachers. (Zeichner and Tabachnick 1985, p13)

I want to ask, then, with Lacey, 'Why, if strategic redefinition is rare, its implementation dangerous and its effects often local and short lived, should we be concerned with it as a possibility?' (Lacey 1977, p97). I find his answer convincing: if we are interested in the possibility of social change, we have to understand how it occurs, developing a 'sociology of the possible'. He notes that we often do not notice changes that have taken place because of the time scale within which, mostly, we live our lives. Sometimes fairly dramatic changes can happen quite quickly within particular contexts and Lacey links such rapidity with the notion of strategic compliance. He argues that if a majority of a school's staff is strategically complying with some aspect of established policy and practice rather than employing internal adjustment strategies, then, when an attempt is made to redefine the situation, change can be rapid, the issues that had perhaps been fought over often before becoming irrelevancies and the new situation quickly taking on the garments of the taken-for-granted. If he is right in this, then were I to find some of the new teachers who are the subjects of this study strategically complying with institutional practice not conducive to the provision of equal opportunities, it is at least conceivable that they might be (latent) agents for change in the future.

Another look at the transition from training to teaching

Lacey's research also has much to say about the transition from incoming student to trainee to new teacher. The main part of his study relates to the changes in the students during their training (corresponding to the action research part of this enquiry) and here he looks at three aspects of change: the student-teacher perceptions of their reasons for teaching, the importance they attach to various elements of the course and their general attitudes to teaching and education. (For his presentation of the results and a discussion, see Lacey 1977, p106-127.)

Lacey compares the reasons given by student teachers at the beginning of their course for taking up a career in teaching with those they gave at the end. They were offered a list of twenty items and asked to score the importance of each item. He found some significant increases over the year in those items which related to what might be described as teaching as a job - income, holidays and job security - and some significant decreases in items he describes as 'idealistic' - doing something creative, the challenge of the situation and using one's talents to the full. I find his use of the word 'idealistic' unhelpful here: these items are connected, certainly, with what is expected in terms of personal job satisfaction but idealism in teaching is usually used to connote altruism, for others rather than for the self, and these items, on the contrary, are focused on the anticipated benefits for the respondents. The change shows an increasing realism about what the job may offer the workers but does not tell us anything about the students' vision about what they want to achieve for the children in their care. (See Lacey 1977, p114f for a discussion.) The other cluster of items which shows a marked change is that relating to the child and the self where both items increase in importance during the year, the one referring to the increase in self-knowledge remarkably so, but Lacey, disappointingly, does not comment on this nor make use of it in his analysis.

The second set of data relates to the importance of various aspects of the course and how the perceptions of the students changed over the year. At the beginning and at the end, the items most directly related to the role of the teacher are ranked highest: learning about how to

impart an understanding of your subject, about the latest teaching methods and about the day-to-day running of schools. Also stable is the lowest ranking given to acquiring further subject knowledge. In the middle ranks there is a pattern of change. Learning about educational psychology, about the sociology of education and about theories and philosophies becomes less important and knowledge of oneself and of individual children gains in importance. Learning about educational administration also increases in importance.

I do not find Lacey's analysis of these data entirely convincing. He notes the students' commitment to 'practical' items and contrasts this with their rejection of 'theoretical' items. He suggests that their dedication to their subject 'insulates students from the new perspective of the so-called theoretical aspects of the course' (Lacey 1977, p110) and that the pressures of the classroom make some students 'apt to show deeply felt opposition to critical perspectives which originate outside teaching' (Lacey 1977, p110f). This perpetuates an unhelpful dichotomy between 'theory' and 'practice': experience suggests that what the students are looking for is *relevance*. If, for example, educational psychology does not help with coming to terms with what might be involved in 'imparting an understanding of your subject' nor does it contribute to 'learning about individual children', it is hardly surprising that its importance diminishes. Rather it is the case that, as Lacey earlier remarks, it has failed to achieve its promise: '[it does] not assist in the practical job of becoming a teacher in anything like the degree that was expected' (Lacey 1977, p108). The frustration and hostility quoted seem to relate to the absence of solutions rather than to 'theory' *per se*. He also notes (but again does not use in his analysis) that 'the most remarkable change is in those items relating to knowledge of the 'self and of individual children' (Lacey 1977, p110). Rather than a rejection of 'theory' in favour of 'practice', perhaps what we are seeing here is better described as a rejection of the decontextualized and the abstract in favour of the personal and experiential.

The final set of data relates to the development in the general attitudes of students to education and teaching. Lacey used five attitude measures: naturalism, radicalism,

tendermindedness, liberalism and progressivism (see Appendix 19 for his definitions). The measures had different antecedents and the results were generated in different ways but the overall pattern showed that the measures behaved very much alike, indicating a general intensification on the attitude scales during the PGCE. (For details of the measures and the results, see Lacey 1977, p59f and p111 - 113.) He suggests that the students do not yet feel part of the school system and that it is

the surviving 'distance' from the school system, the critical awareness of its shortcomings, that enables general 'radical' and 'progressive' attitudes to grow relatively unaffected by specific experiences and situationally relevant strategies. (Lacey 1977, p115)

He adopts what I have termed the 'conventional' expectation that it is 'unlikely that this development could continue in the following year as students move into and take up positions as full-time teachers within the school system' (Lacey 1977, p115), suggesting that this is linked with a shift in the 'displacement of blame' for problems in the classroom from a radical direction (blaming the 'system' or the school) to an establishment direction (blaming the child).

In order to assess whether or not this expectation is justified, I want to look at the results of Lacey's follow-up study on the attitudes of some of the students after one year of teaching. He presents the data in two different ways. First he considers the whole cohort taken together and averages results, looking for general trends and changes that influence them all. He shows that on the four attitude scales measured at the beginning of the course, at the end of the course and at the end of the first year of teaching, scores which had all increased during training revert to approximately their original level. This might be taken to indicate that his doubts about continued development quoted in the previous paragraph were well founded and that the 'conventional' view of the socialization of teachers is supported. However he also offers evidence about the *differentiating* experiences and responses of the ex-students, giving a picture of 'a group of people making choices and trying to control some aspects of their own development and the institutions in which they work' (Lacey 1977, p129) and this leads to a

different perspective. Here we are looking at the attitudinal movement of individuals as opposed to aggregated scores for the cohort and we find that *twice as many moved up* over the two year period as moved down. This seems to me to be a very important result (and insufficiently emphasized by Lacey) because it runs counter to the 'conventional' view, and calls into question Lacey's pessimism about continued growth. A hint is given as to why this might be so: one student is quoted as writing 'I am very disillusioned with progressive ideas on education and methods ...' (quoted in Lacey 1977, p133) but this student *throughout the two years* would have been classified as being in the least radical category. On the basis of Lacey's data, it seems at least likely that many or perhaps most of those teachers who see college work as 'trendy, inappropriate, inapplicable and best forgotten' (Leonard 1989, quoted above) were never convinced in the first place and make their stand not in rejection of a position they once held and were convinced by, albeit temporarily, but simply out of a *continuing* perspective.

Influences on beginning teachers

Various suggestions are made in the literature about what the significant influences are on beginning teachers, some stressing continuity and some change. Recurrent themes are personal history, pupils, school structures and the staffroom and colleagues.

Personal history

Continuity, sometimes found stretching back through initial teacher education and beyond into previous schooling, may also lead, from a different perspective, to a view of beginning teachers as recipients of rather than agents in their own socialization. Instead of seeing beginning teachers as 'prisoners of the present', some see them rather as 'prisoners of the past' (Zeichner and Tabachnick 1985, p4), trapped into a teaching perspective emanating solely from their own biographies and not making any substantial contribution to their own socialization into teaching. For example,

... teachers do not become re-socialized during their course of training nor in the 'reality' of the classroom since in essence this is a reality which they never left ... from primary school ... to

secondary school ... to university lecture ... continued exposure to [the hidden] curriculum, its practices and the commonsense assumptions by which it is rationalised, constitutes the core of teacher socialization (Mardle and Walker 1980, p103)

Memories of schooling will, of course, undoubtedly inform beginning teachers' perspectives.

Michael Petty and Donald Hogben found that

teachers, education students and non-education students hold common attitudes towards teaching ... attitudes towards teaching acquired in youth are held by everyone, including teachers. (Petty and Hogben 1980, p59)

Petty and Hogben maintain that beginning teachers' memories of what their own teachers did will be a central reference point in establishing initial classroom practice and that their attitudes will then quickly conform to those practices, illustrating the failure of formal teacher education to overcome what have been described as 'these early fantasies about teaching and teachers' (Zeichner, Tabachnick and Densmore 1987, p25). The picture painted is of teachers for whom their own schooling is the major influence on their practice, teachers who are uninterested in challenge, change or ideas.

There is something compelling about this unhappily deterministic model; it may have *something* to say about *some* teachers but it does not fit the strong, self-directed voices of some of Lacey's beginning teachers (Margaret B and Arabella S, for example, (Lacey 1977, p131 and 135f)) nor those inexperienced teachers interviewed more than a decade later who 'showed great interest in wider professional affairs, in curricular and pedagogic matters, and expressed a strong desire to participate in in-service opportunities' (Riseborough and Poppleton 1991, p323). Sikes, Measor and Woods stressed the importance of biography

... teachers are influenced by their past. They belong to, can draw upon and are influenced by a latent culture based on the experiences and observations of their pupilhood. To some extent partly because of habituation and the special sense of security the past offers, their perceptions and actions perpetuate

the order and norms they experienced as pupils - usually the order and norms of traditional authoritarianism. (Sikes, Measor and Woods 1985, 143)

However, they too found that

several of our teachers not only lived school lives which challenged many traditional practices, but also had very well worked out theories of the way education fitted into society structures. They had accordingly tried to develop strategies for change. (Sikes, Measor and Woods 1985, p119)

James Calderhead offers a flexible perspective on the influence of biography, pointing out that

teachers approach teaching with various ideas and images of what teachers' work is like based on their own individual past experiences, including previous work experience, experiences as a parent or childhood experiences of school ... This is often a metaphoric way of thinking about teaching. (Calderhead 1992a, p20)

Not a great deal is known about these metaphoric images, what they are, how they are created and quite how they inform the understanding by individuals of what it is to be a teacher.

However, it does not seem, on the face of it, that such images should necessarily constrain rather than free practitioners. Rather, recent studies indicate that 'conformity (to the past or present) is not the only outcome of induction' (Zeichner and Tabachnick 1985, p3 and see, for example, Cole 1985, Riseborough and Poppleton 1991).

Pupils

It has been suggested that pupils are regarded as the overwhelming source of legitimization by beginning teachers (Freibus 1977). (In his study, no mention is made of the gender of the pupils. The tone of the article and other research (for example, Spender 1980c, p152) suggests that, where it is true that beginning teachers are overwhelmingly influenced by the response of their students, it is likely to be the *male* pupils whose 'approval' is sought.) George

Riseborough accepts the notion that teachers become increasingly traditional, conservative and disillusioned as they 'settle in' to the profession and he also sees pupils as having a major influence on the socialization of teachers. First he characterises the teacher: 'the typical teacher moves from liberal, 'thinskinne'd', 'paedophile' to reactionary, callous misopaedist; from innervated, optimistic role-embracer to enervated, pessimistic, role-distancer' (Riseborough 1985, p243). This change, he writes, is a legitimate and rational response to their experiences in the classroom, 'a symptom of a teacher's lived experience of a wider societal contradiction mediated at the chalkface' (Riseborough 1985, p245). He suggests that schools are part of the repressive state apparatus of capitalism whose function it is to be 'pupil mincers': however, what happens in practice is that they become, at the same time, through the efforts of the children, effective 'teacher mincers'. The contradiction is that 'the more efficiently [the children] mince teachers, the more they ultimately ensure the efficacy of the pupil mincer' (Riseborough 1985, p262 and cf Willis 1977): Riseborough reminds us that the oppressed can contribute to their own oppression. He is particularly concerned with issues of class, making no mention of 'race' and gender nor of how the 'teacher mincer' may operate very differently in the hands of, say, black pupils or girls; but the contradiction is an element of the socialization of many teachers and will have implications, positive or negative, for how they view their responsibilities to offer equal opportunities to the students in their care.

Sikes, Measor and Woods also see the pupils as operating as a conservative force on beginning teachers.

Pupils' expectations concerning what constitutes a good and proper teacher ... make them one of the most potent forces for conservatism in education. Pupils expect teachers to teach, they expect them to know, to be experts ... expect[ing] teachers to transmit knowledge ... teachers feel that many pupils expect 'proper teachers' to be strict disciplinarians. (Sikes, Measor and Woods 1985, 170f)

Initially, Sikes, Measor and Woods use this analysis to reinforce without sufficient critique what I have termed the 'conventional' view of teacher socialization.

What this means is that pupils play a significant part in the process whereby the prospective libertarian, idealistic, critically aware teacher can become the authoritarian, disciplinarian, 'proper' teacher. (Sikes, Measor and Woods 1985, 173)

Later, however, they offer a more forward looking perspective.

Some current deviant behaviour may simply be an expression of [pupils] impacting against an outmoded role - that of the 'proper teacher' - founded on a system of honour and allegiance to inhuman structures and traditions. Teachers who resist this role, and insist on personal dignity, also recognise the personal dignity of pupils, rather than seeing them as faceless occupants of roles themselves. (Sikes, Measor and Woods 1985, p242f)

Jane Kenway, Sue Willis, Jill Blackmore and Leonie Rennie have drawn attention to the fact that pupils (in their research, particularly girls) *read and re-write* the pedagogies of their teachers (Kenway et al 1994) and they point out that any attempt to implement a liberatory curriculum must take cognisance of this. They suggest that often the approach to change has been authoritarian rather than emancipatory.

Generally it was believed that a good dose of information about alternatives or of critique or deconstruction would set [the pupils] right. (Kenway et al 1995, p18)

They suggest that insufficient attention has been paid to pleasure, nurturance, pain, blame, shame, risk, investment, fantasy and positionality (Kenway et al 1995, p24) and call for further empirical work to address these issues. They are not in stasis or advocating despair. They write specifically about girls and feminism but what they suggest applies more generally to working, with pupils, for change.

If we attend carefully, sensitively and respectfully to the subtleties of what girls think, feel, say and do in response to our feminist work in schools, then at one level, we can develop a strong sense about what we are doing right and what we are doing wrong; about what attracts them to feminism and what sparks their resistance ... Indeed, we can assess the extent to which we need to re-assess our own practices and re-educate ourselves. (Kenway et al 1995, p25)

Acceptance, then, that the response of pupils to them is a cornerstone in the structuring of teachers' feelings and cognitions permits but does not require the 'conventional' story of what happens to beginning teachers. (See Brown and McIntyre 1993 for an appreciation of the impact of pupil response on the practical intelligence and day-to-day conceptualizations of teachers.)

School structures

The context in which teachers work with its structural constraints and opportunities is considered by some to be the major influence in the socialization of teachers. Karl Jordell, in a study based on American, English, German and Scandinavian literature on teachers and teacher socialization, claims that it is the structure of the classroom itself which is the overriding influence upon teachers. He acknowledges the influence on teachers from pupils but concludes that 'the structural frames within which teaching takes place - time, resources, curriculum, textbooks, numbers of students, and so on - are more important influences' (Jordell 1987, p175), the teacher acquiring practice-generated theories as a result of exposure to the classroom.

Zeichner and Tabachnick (1985) placed weight on the *institutional norms* that their beginning students met, how these were mediated and how compliance was elicited and monitored. (Their study had considerable influence on how I set up the Phase two study of my students-becoming-teachers.) They found that, although there was usually one formal school culture in the schools they studied, 'there were several different and often conflicting versions of the informal school culture within a single school; one or more of these informal school cultures

were often in conflict with the officially sanctioned one' (Zeichner, Tabachnick and Densmore 1987, p54) and this allowed an opportunity for deviant behaviour. They too, however, whilst noting the key role played by the responses of the pupils, found that

the most pervasive and powerful factor in determining the level of institutional constraints in all of the schools was *technical control* exerted through the timing of instruction, the curriculum and curricular materials, and the architecture of the school. Technical control reached through the walls into every teacher's classroom. (Zeichner, Tabachnick and Densmore 1987, p54)

They regarded this as a significant aspect of the way the teachers were socialized into their work but also remarked

... as with any other form of attempted institutional control, technical control does not constitute an irresistible pressure for teacher conformity. Even beginning teachers can manage to avoid or redirect elements of technical control if they have personal goals and the political skills to realize these. (Zeichner, Tabachnick and Densmore 1987, p54)

Two of the four students in their study attempted strategic redefinition in their first teaching post (one successfully, the other not so), suggesting a rather different picture of induction from that of Jordell, where exposure to the classroom provokes changes in cognition and behaviour, quickly followed by the affective component of attitude change (Jordell 1987, p168) and there seems no possibility of strategic compliance, let alone strategic redefinition. It is, of course, important not to underestimate the power of the taken-for-granted. The structural context, including the institutionalized curriculum (the texts adopted, the system of assessment and so on) has a powerful influence on what happens in classrooms and is likely to lead the teacher 'to internalise a powerful set of constraints' (Ernest 1991, p291). The teacher seeking strategically to redefine the situation is likely to be trapped by at least some of the 'commonsense' of everyday school life, the internalised limits to the possible, even when there is no will to be so.

Sara Freedman, Jane Jackson and Katherine Boles (1982) also look at the structures and norms of the school as an institution. They write about what teaching does to teachers, based on the experience of being women elementary school teachers in Boston, USA, a little over ten years ago. They report that, while some teachers continue to grow intellectually and emotionally, some become stale and unimaginative or, sensing that they are about to become so, leave. They suggest that there are inherent barriers to teacher growth within the structure of schools: schools are institutions which 'create contradictory feelings and demand contradictory actions from teachers' (Freedman et al 1982, p3) and their structure prevents resolution. The contradictions highlighted are that schools are charged with the responsibility of preparing children for adulthood, including, apparently, developing the critical thinking necessary for democracy, and yet teachers are themselves treated as though they are not capable of mature thinking and are required increasingly to work in mechanical ways. Equally, schools have the task of developing the whole child and providing equal opportunities in a pluralist society, yet the structure of the institution constricts the types of behaviour acceptable in pupils and teachers and emphasises comparative worth and competition.

Traditionally, teachers in England have not been subjected to quite the same demands nor have demands been made in quite the same ways: but current changes are leading to the intensification and proletarianization of teaching (Casey and Apple 1989, Noss and Dowling 1990) which will reinforce those contradictions. The major influence for the teachers featuring in the Boston study in becoming aware of their situation (only a first step to changing it) was networking with others, firstly other teachers and secondly with parents and the community. Freedman et al advocate developing teacher support groups for fostering teacher initiated change as the only effective way to combat demoralization and a retreat into conservative practice. As Jean Rudduck has noted, professional learning is 'more likely to be powerful in its engagement with the fundamental issues in education if teachers have constructed their own narrative of the need for change' (Rudduck 1988, p213). Support groups involving teachers from outside the particular institution in which one works may,

then, have a key influence on maintaining intellectual and emotional growth in teaching. Other writers have looked at the support for teachers available from their immediate colleagues and it is to these that I now turn.

The staffroom and colleagues

There are features of the staffroom which are likely to put pressure on beginning teachers to conform to the *status quo* (with respect to equal opportunities), encouraging at least strategic compliance and perhaps internalized adjustment. In many staffrooms, there is a profound unwillingness to engage in significant debate about issues of pedagogy. This may be due to the highly personal nature of teaching where 'the personality of the teacher is easily focused upon ... [so that] disagreements between teachers easily become personal conflicts' (Jordell 1987, p170); or to the fact that colleagues are essential for both company and support and this inhibits the expressing of opinions or the raising of contentious issues (Nias 1989, p171); or to the fact that talk in the staffroom has a *rhetorical* function in preserving teachers' professional identities (Hammersley 1984, p212). Whatever the cause, it has the tendency to reinforce conformism to both the prevailing rhetoric and the prevailing practice in the school.

It is not, however, universal. Jennifer Nias, writing about primary schools, found a small number of teachers who had 'been able to share not just beliefs, practice and ideas, but also constructive disagreement and mutual concern' (Nias 1989, p173) and this had a profound effect on them as people and as teachers. She writes

it is possible for teachers to work in situations in which one or more colleagues enrich each others' daily contact with children, confirm yet challenge each others' basic assumptions about education and its purposes, widen each others' professional horizons and responsibilities, and offer one another interest, attention and esteem as people. (Nias 1989, p177)

Such collegial groups both provided professional growth and were also a source of security. The groups were relatively egalitarian; they were based on a great deal of spontaneous and

open talk where differences of opinion were not only permitted but welcomed; and they served not to enforce conformity on their members but to enrich both their thinking and behaviour (Nias 1989, p178f).

There is another aspect of staffroom life which will specifically militate against change with respect to gender and that is the hostility with which such issues with their 'scent' of feminism are typically met. Marilyn Joyce gives a painful account of what it is to be a feminist teacher within contemporary schooling, emphasising that the isolation that such teachers experience is 'the most universal and debilitating' (Joyce 1987, p80) effect and noting the frequency with which their efforts are devalued and criticised by the individualizing and personalizing of conflicts. This is neither an accident nor a necessary consequence of feminist ideas. Writing in a general context of the world of work, Cynthia Cockburn has said,

Nor was it inevitable that 'feminism' would become a word with connotations of extremism, alienating to many women. The meanings of these words have been actively produced over recent years in a counter-discourse in the media and everyday life, mainly by men who, quite rightly, saw their interests threatened by feminist ideas ... feminism has been anathematized by men, in an attempt to put a stop to its appeal to women. The process has been effective. Many women who in their ideas and practices are demonstrably feminist feel obliged to hedge their views with, 'I'm not a feminist but ...' (Cockburn 1991, p1)

Jean Rudduck found committed feminists who were working for equal opportunities in schools and who deliberately disguised their feminism and its relationship to their equality projects in order to maximise levels of involvement amongst their colleagues and not provide a focus for opposition (Rudduck 1994, p53). Cockburn points out that patriarchal 'common sense' is not automatic but is the result of cultural work actively undertaken, using '[now] the verbal carrot, now the gestural stick, to talk and to 'relate' women into sharing the age-old masculist common sense' (Cockburn 1991, p169). Use is made of gender joking in the staffroom in keeping women teachers subordinated or marginalized (Cunnison 1989) and women teachers working with Inge Bates have given a vivid (although unremarkable) account

of the negative impact on them of gender relations in school (Bates et al undated).

Attempting to use strategic redefinition in the area of equal opportunities is likely to be more fraught with difficulties than in any other.

Implications for the analysis of Phase two

In summary, then, the view of teacher socialization which I developed before undertaking the main part of this study has a number of characteristics. I challenge the notion that teacher socialization is unproblematic, homogeneous, uncontradictory. I do not accept that it is inevitably a process by which teachers become more conservative although, in the nature of things, it is one in which they become more realistic. I do not believe that teachers (now) typically experience trauma and culture shock when they start teaching.

Most less experienced teachers played down the significance of the initial 'reality shock', expressing a confidence in their ability to do the job successfully. (Riseborough and Poppleton 1991, p324)

I believe rather that there is a good deal of continuity between, at least, students in initial teacher education and the beginning teachers they become.

At this stage in the research I expected to be able to make use of the concepts of strategic compliance, internal adjustment and strategic redefinition in my analysis of the Phase two data. I also anticipated that I would be able to use these data to investigate further the notions of idealism and realism, to understand more clearly issues to do with theory and practice and to gain insight into the continuity or otherwise between the students' values, attitudes, beliefs and practices and those they held as beginning teachers. I knew, too, that I had data relating to some of the suggested influences on beginning teachers - pupils, school structures and institutional norms, the experience of the staffroom - although I knew nothing about the impact of biography. I had not undertaken the Phase two work with a view to 'testing' any of these ideas explicitly (indeed, as noted previously, much of the reading on which they are

based had not yet been done when the data was collected): the initial studies were to be 'portrayals' (Macdonald 1977) of the students-becoming-teachers in the contexts in which they were working. Nevertheless, the material discussed in this chapter and my response to it influenced and informed my analysis of the Phase two data and structured what I looked for and what I saw when I used the data to make those constructions. It is to those constructions that this narrative now turns.

Stories of/about three new teachers

The Master gave his teaching in parables and stories which his disciples listened to with pleasure - and occasional frustration, for they longed for something deeper.

The master was unmoved. To all their objections he would say, 'You have yet to understand, my dears, that the shortest distance between a human being and Truth is a story.'

(Antony de Mello, reprinted from Peter Reason and Peter Hawkins, 'Storytelling as Inquiry', p79)

Human meaning making rests in stories ... To be human is 'to be entangled in stories'.

(Eckhartsborg, reprinted in Peter Reason and Peter Hawkins, 'Storytelling as Inquiry', p82)

The best stories are those which stir people's minds, hearts and souls and by doing so give them new insights into themselves, their problems, and their human condition. The challenge is to develop a human science that more fully serves this aim. The question then is not, 'Is storytelling science?' but 'Can science learn to tell good stories?'

(Ian Mitroff, reprinted in Peter Reason and Peter Hawkins, 'Storytelling as Inquiry', p83)

... the examples [I offer] serve as multifarious 'illustrations', in the sense which a Pieter Breugel picture shows the richness and variety of life in a particular situation

(Ole Skovsmore, Towards a Philosophy of Critical Mathematics Education, p59)

In this chapter I present 'portrayals' (Macdonald 1977) of the three students-becoming-teachers who participated in Phase two. These three are individuals with individual histories and working in individual contexts: in constructing these portraits or stories I intend that any meaning for the reader should come from the extent that the accounts resonate or otherwise with the reader's own experience, to the extent, if at all, the reader can 'recognise' (Walkerdine 1990, p196) some aspect of what is described. The 'locus of responsibility for generalizations' (Macdonald 1977, p54) is intended to be with the reader.

Portrayal discussed

I am nervous of describing these portrayals as case studies lest I should be taken to imply that these three teachers were a *case of* something, that they were in some sense *representative cases* of a phenomenon. I intend to make no such claim. Nevertheless, the approach I have adopted - creating a portrait, telling a story - shares many of the characteristics of case study reporting. The research methodology I have chosen encourages me to concentrate my attention on a microcosm, to attempt to study in detail the specific attributes of a particular individual in a particular setting and to hear what she has to say, in order to be able to 'get inside' the meanings that experience has for that individual, to improve the understanding of how the subject positions of that individual are lived. Constructing a portrait allows the *research participants' own constructions*, accounts, perspectives to be reported, as far as the researcher has been able to elicit them and as far as she has been able to hear and record them. What Shulamit Reinharz has written about case study applies to the form of reporting I have chosen.

The case study is a tool of feminist research that is used to document history and generate theory. It defies the social science convention of seeking generalizations by looking instead for specificity, exceptions, and completeness ... The power of the case study to convey vividly the dimensions of a social phenomenon of individual life is power that feminist researchers want to utilise. (Reinharz 1992, p174)

Equally, constructing a portrait or telling a story is an effective device for 'breathing life' into the data, operating by way of our capacity to identify with the character and the setting (Rudduck 1994, p7). Like case studies, such constructions 'permit the reader to build on his or her own tacit knowledge in ways that foster empathy and assess intentionality' (Lincoln and Guba 1985, p358), attempting to call up the everyday holistically and with lifelike qualities that evoke for the reader her own experiencing of the world.

In constructing the portraits or stories, I have also been attempting to make as explicit as possible my own interactions with the research participants and to highlight the interplay between the data and my emerging analysis. Like a case study, a portrait too is '*an effective vehicle for demonstrating the interplay between inquirer and respondents*' (Lincoln and Guba 1985, p359). The use of narrative allows one to vary the distance between oneself and the object of study and this is linked with challenging oppressive, over-rationalized forms of reporting.

Oppressive practice depends on forms of expression organised oppositionally and hierarchically - presence/absence, intellect/emotion, public/private, self/other, objective/subjective, male/female. In each pair of an opposition, the first term is superior. Presence is superior to absence, reason to passion, and male to female. The narrative contests this structure at its root by refusing the domination inherent in such oppositions, by permitting us to hear what they conceal as well as what they express, and by preventing our collapse onto either term.
(Pagano 1990, pxix)

The meaning of the data grew out of my attempt to write the stories of these three students-becoming-teachers: I did not know what they meant before I began. Whilst acknowledging my preconceptions as central and also as not fully knowable, I was attempting at this stage in the research to draw out the theory from the data rather than testing out the data against a theory. By not closing down the data too soon, I also hoped to provide a 'self-corrective technique that will check the credibility of [my] data and minimise the distorting effect of personal bias upon the logic of evidence' (Lather 1986, p65).

We may suggest that storytelling becomes propaganda when the story is treated as It rather than Thou ... and we seek to impose a meaning onto it, rather than allow its meanings for us to become manifest through dialogical relation. (Reason and Hawkins 1988, p98)

Portrayal can also contribute in other ways to issues of validity in naturalistic enquiry. The stories provide 'serious examples' (Skovsmose 1994, p9) of the area of study which are developed in sufficient detail to offer the reader 'an opportunity to probe for internal consistency' (Lincoln and Guba 1985, p359), to test out for herself the trustworthiness or otherwise of the account. In addition, by providing 'thick description' (Ryle quoted in Geertz 1973, p6 and used by Lincoln and Guba 1985, p359) and an elaboration of context, they allow the reader to determine whether and to what extent the emergent findings are generalizable.

If phenomena not only take their meaning from but actually depend for their existence on their context, it is essential that the reader receive an adequate grasp of what that context is like. (Lincoln and Guba 1985, p360)

These considerations, then, formed the background (not, in general, fully articulated) environment and intentions at play for me as I constructed the three stories that follow.

Research context and data sources

I embarked on this stage of the enquiry on the basis of our evaluation of the action research project. We believed that the effect of the action research project on the understandings, outlook and attitudes of the students involved was positive.

Overwhelmingly, the evidence is that the students have accepted the view that their professional responsibilities involve a commitment to providing equal opportunities for girls and boys whether or not this comes 'naturally'; that they feel their attitudes and perspectives have evolved during their time on the course; and that they currently intend to act to mitigate bias when they become practising teachers. (Boulton and Coldron 1990, p32)

The intention was to explore whether or not the attitudes to equal opportunities displayed by the students at the end of their course had proved robust as they had moved into the world of work and also what impact, if any, these attitudes had had on their classrooms.

During their fifth term as teachers in schools, I contacted all of the students in the relevant mathematics cohort. Three of those teaching replied promptly and I was able subsequently to visit all three of them in school. All three are themselves viewed by others as white (at least one has mixed ancestry) and all were working in schools with almost no ethnic minority students. I shall refer to the students as John, Joanna and Wayne. In each case my approach and plan of action was similar. (For details, see Chapter 4.) I obtained permission from the school, the mathematics department and the ex-student involved to spend a day and a half in school, during which time I was able to observe the teacher concerned at work in the classroom, associating with colleagues and generally partaking in the life of the school. I spent most of my time simply accompanying the teacher and observing and recording what occurred, talking to the teacher when the opportunity presented itself and making notes. I attempted to understand the specific school settings in which my ex-students were employed, perhaps, for example, observing departmental meetings or spending some time simply 'listening in' to the general flow of 'chit-chat' or to particular conversations in the staffroom. In addition I interviewed a senior member of the school staff, the head of the mathematics department and also, towards the end of the two days, the teacher concerned. I used an interactive, semi-structured approach (Oakley 1981, Graham 1984, Simons 1977) to interviewing the head or deputy and the head of the mathematics department and an unstructured approach to interviewing the teacher. I also obtained whatever was available by way of written information emanating from the school or the department (prospectuses, school and departmental policy documents, report forms, induction material and so on).

The students-becoming-teachers: John

What, then, were my impressions of John, remembering him on the course and before I visited him again? I wrote

He was a mature student in his early thirties who had been working in the field of community arts before joining the course. He had a modest and diffident manner but was firmly committed to democratic and participatory forms of learning. This ensured that he was always an active member of the class. He was readily identifiable as a gentle, sensitive and responsive individual who cared about other people and worked hard in trying to translate his concern into practice. Previously both in his working life and also in his personal life he had considered equal opportunities issues seriously and had done a great deal of thinking about them. He had grown up in a politically active working class household and had a view on most matters but was in no sense doctrinaire or closed minded. What was new for him on the course was to consider the issues afresh within the educational setting. (personal notes, March 1992)

On the form which was used to record teaching practice assessment by both schools and the student's tutors, there was a section asking for appraisal of equal opportunities aspects of their work (see p89, Figure 8: Extract from teaching practice form). John was awarded one *Average*, two *High* and one borderline *High/Very high*. Before his final teaching practice, when asked to give some specific examples of practice that would merit a *Very high* mark, he wrote

lessons which use resources and ideas which show men and women in non-stereotypical roles, discussion of this

introduction and use of materials from other cultures, discussion of this

teaching time shared equally between boys and girls

tackling sexist, racist comments as they arise in the classroom

careful use of language

He seemed, then, reasonably alert to the connection between providing equal opportunities and at least some aspects of classroom practice. At the end of the course, in a semi-structured interview with a member of the University staff whom John had not previously met, he said about the course

it has definitely made me more aware of certain [equal opportunities] issues and I'm glad that was the way it was.
(tape transcript)

However, when asked if he thought there was something he might be able to do about promoting equal opportunities in his first school, he replied

on my own I very much doubt it. I think for instance a lot of schools nowadays have equal opportunities working parties and I would like to become involved in that kind of area ... I would do my best to ensure ... that at least in the classrooms that I was responsible for, there was some discussion going on about e.o.
(tape transcript)

What sort of school environment did John find himself in and how did he respond? Although the school is mixed and has a balanced intake of boys and girls, *all* the senior management team are men and, in terms of the organisational ethos of the school, there is a very 'male' atmosphere. During my visits, I found, for example, that it was difficult to gain access to the senior management despite prior notice and agreement and that when a meeting was effected it began with remarks the purpose of which seemed to be to indicate my inferior status. The general picture was that decision making was not genuinely consultative nor democratic but was essentially authoritarian. John described the school management as

very autocratic ... things aren't debated ... it's very much "This is how you do it" (from notes made at the time)

and talked about one telling incident. Fairly early in his time at the school, he had objected at a staff meeting to the use of the expression 'manning a stall at the fair'. 'Aren't any women

going to help out, then?' he had asked. Some time later he had applied for internal promotion and was told that his lack of success was in part because of this incident.

Time spent in the staff room indicated that this was an impression wholeheartedly endorsed by at least some of the women teachers: on one of the days I was in the school there was a very great deal of anger, distress and upset about a management incident which led to the following conversation amongst the women.

A: I'd like to put a string round his private parts and pull it tight, very tight, no really [laughter]

B: You'll never eat brussel sprouts again! [laughter]

A: No, have you noticed how they all go around like this [hands over genitals] now in case somebody goes and kicks them one in ... [laughter]

B: They all stick together and have you noticed how X has to run to keep up they're so tall [laughter]

[a little while later when I was overheard asking John about the composition of the management team]

A: They're all men. We wouldn't be in this mess otherwise.
(from notes made by me six hours later)

The school produced a prospectus for parents, a reasonably substantial document of more than twenty-five sides which contained much useful information as well as attempting to give an overall impression of the ethos of the school. Throughout the brochure there was no mention of equal opportunities and as far as I could discover the school had no equal opportunities policies.

Much of this was in significant contrast to the tone, atmosphere and outlook of the mathematics department. Although the departmental meeting which I was invited to attend was conducted on fairly formal lines, was very heavily dominated by the male head of department and was used by some (not including John) as a forum for sexist joking in planning

the end of term meal (see Burgess 1989, Cunnison 1989 for a discussion of the function of such humour), nevertheless the day-to-day life of the department felt very different from this. Both John and a female probationary teacher felt very supported by their head of department for whom they clearly had a great deal of respect. The mathematics policy document included a section on equal opportunities which began, 'The department shall at all times promote a policy of equal opportunities' and continued with specific advice about how to promote the achievement of girls. When I asked the head of department about gender issues in the classroom he said

we haven't done anything special, we have a very open approach, relaxed and flexible but we also push the kids at the same time ... its well documented that girls don't achieve as well and there's lots of research, but in these three years [I've been at the school] the girls here have out performed the boys. (from notes made by me during the interview)

The figures published in the school's prospectus for examination results at sixteen years certainly seemed to bear out this claim.

Interestingly, this contradictory and quite highly charged atmosphere seemed to have had little influence on John and his outlook and values. He said that his attitudes *had* changed but when he expanded on this it became clear that he was talking about his views on the need for good organisation: he said that he gave increased importance to the need for a well-managed classroom, good preparation and so on although he still found these things difficult. 'My fundamental outlook is the same ... it's aspects of my style that have changed' (quotations in this paragraph transcribed from the tape). He had stood out against staffroom pressure to talk about the pupils in a derogatory way and had refused to be involved in 'blaming the kids'. He talked about the difficulties of the probationary year, describing 'the overwhelming sense of "Oh crikey I'm drowning" ' and his feeling of being under a microscope but commented that 'in the end, when you're in your classroom, you can do what you like'.

He said that he had made a conscious decision to keep his head down for a while but as we delved deeper this did not really appear to be the case (see, for example, the incident described above about 'manning'). However, other aspects of his description of himself seemed at least partially borne out.

I know my own limitations, I am a bit lazy, I have good ideas but don't follow them through ... I don't want to stand up and be counted because it's too much hassle. (transcribed from the interview tape)

As he had himself predicted when he was at the University, when the opportunity arose to become involved with an equal opportunities working party he had done so but now it was defunct he claimed to be 'doing nothing'. He said of his experience of the equal opportunities working party

in there I felt I could talk about things that I couldn't elsewhere but at the end of the first meeting I wanted to bang my head against a wall ... I gave up, I haven't got the personal resources to chip away at it. They showed no understanding whatsoever of the issues we discussed, even the most supportive was saying "You've got to be careful". They were patronising me, patting me on the head - "You'll learn, you'll learn". When I was a hippy, when I went to University, when I came here, I expected everyone to agree with me - you'd think I'd learn - but they don't. I backed off again. Either I accept that as one of my shortcomings - at the first brick wall I give up ... What I ought to look for is a school that was sympathetic, where I could feel comfortable working. (transcribed from the interview tape)

However, as the interview progressed, it became clear that he had been much more active than he had remembered himself as being and he became quite excited about what he had done - 'I'd forgotten all this, I'm interested now ... I did display a certain amount of interest in certain areas ... oh it's all coming back to me' (transcribed from the interview tape). He had organised a questionnaire for the whole staff specifically about equal opportunities and resources and had obtained a generally positive response but when he suggested that, on the basis of the replies, a training day be organised he was discouraged from doing so.

[I was told] "You can't do that. We had one and it upset too many people." Men were taken to task by the women about their hugging and their use of words and the men didn't like it so therefore no more talk about equal opportunities

would you do it again?

well, not here ...it's something that I think perhaps I ought to develop more and perhaps might in the future. (transcribed from the interview tape)

Opportunities within his school for in-service development had been limited. John gave a scathing description of one day set aside for school based INSET.

We had this training day, it was supposed to be about managing the pupil in a growing school. I was in a subgroup about improving communication. We spent the entire morning discussing the size of the pigeon holes. I said "We're not supposed to be doing this" but that's all we did. In the afternoon we had time to tidy up the cupboards. This isn't training. On a training day I want training, not to spend the time sorting out management's problems for them. (from notes made at the time)

Under the circumstances in which John began teaching and currently and in the foreseeable future, opportunities for in-service training *beyond* the confines of the school are strictly limited and only likely to occur at the personal cost of an individual teacher's time and money. (For a discussion of some of the negative implications of this, see Pinner and Shuard 1985.)

So what seemed to have happened to John? He was not at this stage in any sense a 'gender leader' (Rudduck 1994) but he had retained as strongly as ever his commitment to equal opportunities: there was at no time during my visit any suggestion of the that's-alright-in-college-but-the-real-world-is-different kind. In the lesson observed he was consciously trying to eradicate the dominance of the boys, albeit not yet with a great deal of success. He retained an awareness of the relevance to teaching of 'personal development, to be open-minded about

things' (transcribed from the interview tape) and voiced the conviction that it was important for the staff group 'to inspect our own attitudes and beliefs and approaches' (transcribed from the interview tape) with respect to racism in order to work for change within the school.

In fact what had happened was just what he had predicted would happen. When other people provided a focus and legitimation for equal opportunities work he was willing and able to make a significant contribution: but when it was absent from other people's agendas he was unable to sustain action either inside the school or, to some extent, inside his own classroom. His experiences in initial teacher education had not yet enabled him to overcome these limitations. Equally, the process of socialisation into teaching had not countered or undone the attitudes and convictions with which he had started but, significantly, the experience had also done nothing to develop his understanding and practice. He had not adjusted internally to the prevailing norms and values of the school; he had attempted modest strategic redefinition but in the face of opposition lacked the skills or the will or both to maintain it; and he had settled for strategic compliance. The potential for and will towards future work was apparent but it felt as though this issue, in common with many others, was in abeyance, perhaps indefinitely.

The students-becoming-teachers: Joanna

What were my memories of Joanna before I saw her again? I wrote

She was a mature student who came to teaching as a second career after working initially in a medical field and then spending some time full-time at home raising a family of two, a girl and a boy. These two were of upper primary age when she joined the course. She was in no sense the sort of woman who would be conjured up by the word 'feminist'; she appeared, not exceptionally, to have an over-riding commitment to her home and family and a willingness and expectation that she would be the main provider of practical work and emotional support within the home. She spoke, for example, of her (supportive) husband's role in terms of his 'helping me with the domestic work'.

Alongside this must be set the notion of her as a strong, independent, capable and experienced woman. Joanna was not an intellectual but had an intelligent and disciplined approach to all her work. She did not find it difficult to make up her mind about things and would be ready and able to offer an opinion when asked; but she endeavoured to keep an open mind and to amend her understandings in the light of experience. *At times there was a divergence between the views she purported to hold and her classroom practice and she was not always aware of the dissonance: typically, she would not be interested in such a contradiction for its own sake but only in so far as it had perceived relevance to her understanding of the events in her classroom and led to practical outcomes.* This was almost always the focus and thrust of her interest in ideas.

She was a warm, likeable and mature person who was willing to both give and get a lot from the course, resilient and reliable as she would need to be to follow a demanding full-time course and run a family home. (personal notes, March 1992, italics added later)

On the form which was used to record the equal opportunities aspect of her teaching practice assessment she was awarded one *Average*, two *High* and one *Very high*. Before her final teaching practice, when asked to give some specific examples of practice that would merit a *Very high* mark, she wrote

use of names/occupations etc from different cultures, classes and both sexes that don't subscribe to the stereotypical image

display posters etc. that show other cultures (eg Islamic art patterns) or women in maths etc.

catering to all needs, being especially aware of bilingual problems and acting accordingly, or having support material for low attainers

encouraging of mixed groups for working with regard to gender, ability, race

positive encouragement equally for same criteria eg not girls for neatness etc

which again seemed to indicate a reasonable beginning level of awareness of some aspects of equal opportunities issues in the classroom. In a semi-structured interview with Joanna at the end of her college course, she said

certainly I'm a lot more aware than I was [about equal opportunities] and consciously trying to ... I think there is an influence [of gender on achievement] but it doesn't necessarily come from within the school, that's what I'm trying to say, the outside pressures and the society that children have grown up in are still so predominantly stereotyped that a school can do its best to negate those but whether or not it will succeed I don't know. (tape transcript)

Her definition of equal opportunities implied no sense of systematic disadvantage, of power relations or oppression

I think equal opportunities means to me ... giving each child the opportunity to develop to his or her full potential ... it's treating every person as an individual human being (tape transcript)

but she did follow this up with quite a wide variety of practical suggestions of ways in which the achievement of girls might be enhanced.

Joanna's school was very different from John's. Here, the first thing that greeted me on entering the school (albeit by a side door!) was a well kept equal opportunities notice board. The school prospectus, early on and prominently, includes a paragraph on equal opportunities and the management style of the school is open and consultative. It is easy to gain access to the senior management team who are generous with their time and attention. Of the senior management team, four are men and three are women. However it may be important to note that the information on the board was entirely related to racial harassment (there was nothing relating to gender and there are very few black children in the school) and the brochure speaks of 'imposing no restrictions' and 'making no assumptions' based on gender rather than finding ways positively to promote the attainment of girls. They also write

It is, however, important that we all recognise that we have much to learn in this area and in this, as in all aspects of schooling, we welcome partnership with parents (school prospectus 1991-1992)

and this perhaps indicates succinctly the current outlook and position of the school.

Here also the atmosphere in the staffroom was very different: although there were inevitable frustrations expressed about various aspects of school life, there was an overwhelming sense of a staff who largely trusted one another and their management team; but perhaps that very sense of consensus allowed or even encouraged *status quo* sexism to continue. One member of the mathematics department sported a mug which read on the side 'There's no problem with sexual harassment here' and on the bottom, inevitably, 'It's one of the benefits'. On the staff noticeboard, there was displayed a thoroughly offensive cartoon: alongside a newspaper cutting bearing the headline *Many Teachers Too Shy On Sex Education* was a picture of a class of leering boys with tongues hanging out; a stick of a woman with an ankle length drooping skirt, lank straight hair, glasses and a dunce's hat; a large woman wearing underwear and fishnet stockings leaning over the boys; and a male headteacher laughing and saying 'As Miss doesn't know about this we have brought in an expert'. It seemed therefore to me that, despite tentative acknowledgement of the relevance of equal opportunities to the promotion of achievement and the generally thoroughly civilised atmosphere prevailing throughout the school, there were aspects of the underlying culture which were hostile to anti-sexism and which might act quite powerfully to resist change.

On the positive side, however, there were a number of strong, respected and effective women in relatively senior positions. Within the mathematics department of ten, five of the staff were women. The attitude and outlook of the female deputy head I interviewed reflected the management style of the school which is open and supportive and this was echoed by the deputy head of the mathematics department. Refreshingly, she was very positive about the

role of initial training - 'They should have all the bright ideas' (from notes made at the time) - and considered the department to be very cohesive but not closed minded.

we don't want people with fixed ideas, we like to think we're forward looking, not standing still, we're looking for initiative.
(from notes made at the time)

When I asked her about the department and equal opportunities she replied

we probably don't do enough, we are aware of the problem, I provide a role model ... we give [the girls] every encouragement, sometimes we do say something, they say "That's sexist" because we do find ourselves using old examples ... it's something you talk about but it's difficult to know what to do ... we can only make sure that their experiences are equal, that we put equal pressure on them ... in the grades obtained, the boys are getting the As and the girls are getting the Bs.
(from notes made at the time)

(The statistics published in the school brochure certainly indicated poorer examination performance in mathematics by girls at sixteen.)

Overall, within both the school and the department, this seemed to me to portray a context in which there was room for manoeuvre and where suggestions for development and change, although opposed by a number, would be listened to by most and welcomed by some.

It is perhaps significant that Joanna's appointment to the school was initially only a temporary one and that she had had to wait until her fifth term before it was made permanent. The news was very recent: she had been informed on the Friday before my Monday visit. At times it looked as though no permanent appointment would be available and that Joanna would have to leave. This background may, quite naturally, have had a profound effect on Joanna's professional development and confidence. The market for teaching jobs in the locality is poor and, because of her domestic circumstances, she had no wish to move house. I gained an

impression of someone for whom 'fitting in' and being acceptable had been of major importance. Very early in my interview with her, in response to a question about what she had discovered was important about teaching since leaving the University, she said,

don't think you know it all, sometimes you can go into a school and they think "She thinks she knows it all" ... as well as bringing new ideas you have a lot to learn and a softly, softly approach and not "This is what the Uni told me, this is how you do it". (transcribed from the interview tape)

She found out what was what in the school, the conduct and values which were espoused, by 'osmosis'. She felt that some of her own values and understandings of teaching and learning had certainly changed since leaving the University and she had some criticisms of the course.

The course should be about, for example, teaching long division not just doing investigations ... I wasn't prepared for thinking about interesting ways of teaching long multiplication ... it came as a bit of a culture shock to realise that what I had to teach was all the nitty gritty, the fundamental ways that it is difficult to get across other than by saying this is what you do, this is how you do it. (from notes made at the time)

Commenting on aspects of classroom organisation and ethos often associated with mathematical achievement in girls, for example providing opportunities for discussion, for working in relatively open-ended situations, for tackling tasks involving posing the problem for oneself (DES 1989b, p20f), she voiced the conviction that

The old didactic methods have to be brought back in ... the Uni would do students a favour [to equip them with these] because it comes as a bit of a culture shock. (transcribed from the interview tape)

This response certainly corresponded with the mathematics lessons I observed Joanna teach. Whether she was introducing algebra to a mixed ability group of eleven year olds or asking them to conduct an 'investigation', her preferred approach was to explain a method that she

wanted the children to use and then to ask them to apply it. Clearly, we had not convinced her about the relevance, accuracy and appropriateness of the view of teaching and learning mathematics espoused by the course tutors (see, for example, Floyd 1981, Burton 1984, Love 1988, Brown 1991. Of the schools working with the University, Joanna's is one of the most committed to initial teacher education both historically and under the new partnership arrangements. The impression gained is of a school genuinely interested in preservice work. One of the two mentors is the head of the mathematics department. Under these circumstances, the 'portrait' makes depressing reading for any espousing such views about the teaching and learning of mathematics.)

When I asked about equal opportunities she said

I don't often think of whether they're girls or boys ... when I organise group work, I don't mix them up, they work in friendship groups, there are more factors at play than you realise. (transcribed from the interview tape)

In the classes I observed, the girls were offered the role of teacher's helper but also sat in a phalanx of seats in the centre front of the classroom, positions usually occupied by the powerful. The boys contributed more in whole class discussions but not markedly so. At age eleven it seemed to me that the disadvantaged in this school (whose intake is skewed towards white, middle class homes) were the black and/or working class students who made little or no contribution to the lesson and whose needs were perhaps not being met. Four girls who occupied the front row of desks were pointed out to me as being the 'brightest'. As we saw above, however, the academic achievement in mathematics of these articulate, highly organised and high attaining eleven year old girls appears to taper off as they go up through the school.

Although Joanna spoke of trying to find a line of two way communication between new and existing teachers and although she felt she had had some influence on 'curriculum delivery'

within the department, she said that 'as far as whole department policy goes, I haven't felt I could say my point'. At the end of the interview, she again referred to 'lying low, observing', connecting this with the fact that the department 'has a high profile and is held in high respect'. Perhaps, significantly, she closed by saying, 'Well, in September, I shall be able to join in' (quotes transcribed from the interview tape).

How, then, to sum up these impressions? I was struck forcibly by a picture of someone highly competent and already very 'professional', regarded by management as 'not a typical probationer' because of her maturity and competence, who nevertheless could only derive personal confidence from an exemplary performance which, most significantly, would be judged *by others* to be so. Predispositions that Joanna had brought with her - her outlook, 'personality' and so on - and the profoundly insecure position in which she found herself worked together to contribute to this: she both acted upon the situation and was acted upon by it.

She had positioned herself within the department in such a way as to present the 'acceptable face' of innovation ('good ideas' for teaching fractions and so on) but she did this from a location within a conservative tradition which would be more likely to offer protection from the critical judgement of others. Although new attitudes and insights would be welcomed by some, they were *demand*ed by no-one and so the position she adopted was the safest. It seemed to me that some of her insights about equal opportunities had been sacrificed to achieve this goal. Joanna had not presented herself at college as being one of those students who see themselves as being passionately committed to a view of education which seeks to grapple with promoting social justice but she had shown a pragmatic awareness of the positioning of girls in mathematics classrooms and a moral commitment to offering them a 'fair deal'. Much that was positive about this outlook seemed to have been lost.

There was continuity with herself at University. For example, both before and after beginning teaching, she drew attention to the aspects of sexism which were outside the school's control

rather than to those about which teachers are in a position to do something, distancing herself from responsibility; and she leant throughout towards a view of equality as seeing people individually and 'treating people equally' rather than viewing some people as systematically disadvantaged. After five terms in school, this had become 'not thinking about whether they're girls or boys' as we saw above. She *had* changed somewhat but unremarkably so. She had made some 'internal adjustment' (Lacey 1977) to the norms at the more traditional end of the spectrum on those prevailing in the school and seemed extremely unlikely to become in the future a motive force for change. Her agenda for teaching was now heavily influenced by a transmission model of learning; involved 'treating everyone the same'; and generally appeared to endorse the taken-for-granted assumptions of contemporary schooling.

The students-becoming-teachers: Wayne

As we shall see, Wayne also experienced a very insecure future after leaving the University. He was a mature student in his early thirties when he joined the course. His first degree was in engineering and he was employed by British Coal prior to the course. He had not obtained his degree by the conventional route but had worked his way up from an engineering apprenticeship; he now saw little future in the industry and was therefore making a career change. His wife was a teacher and she had recently given birth to a little girl.

The notes I made before visiting him in school described him as being

still very much part of the community in which he grew up and spent his early manhood. He was a warm, diffident and caring individual for whom the course was a completely new experience and both a potential threat and a challenge. He was very concerned, for example, when he started the course that his 'very strong Yorkshire accent' would disadvantage him in the classroom. He had not thought explicitly a great deal about equal opportunities before embarking on the course and tended to think in very direct, human terms about the issues rather than from and with a more political perspective. As well as his community, working mates and sports mates, his little girl was also a significant reference point in his understandings and world view. He was passionately 'for' his daughter and used this

as a vehicle for reconsidering his outlook with respect to gender.

During the course his thinking developed on a wide range of issues including those of equal opportunities and not just with respect to education. He said that ideas he had met on the course influenced his outlook on many things and that he could not see things as he did before. (personal notes, March 1992)

Wayne was awarded one *Average*, two *High* and one borderline *High/Very high*. Before his final teaching practice, when asked to give some specific examples of practice that would merit a *Very high* mark, he wrote

shows awareness in lesson preparation that equal opportunities are to be addressed

has equal expectations of all children

material produced shows an awareness of interests of both girls and boys

use of mathematics in other cultures

In the six terms that had elapsed before we met again, in a similar position to Joanna, Wayne had had an unsettled career but he also had been fortunate enough to spend it in one school. He had spent the entire time on temporary or day-by-day 'supply' contracts, not all within the mathematics department, and his immediate future was still not secure although he had one more term's temporary contract ahead of him.

A much less clear picture emerged of this school than of the other two, perhaps due to my being there in more than one capacity (I was supervising a current student on teaching practice at the time I visited Wayne), perhaps due to the fact that the school had been closed and schooling severely disrupted immediately prior to my visit due to a major fire. The senior management had seemed to be elusive and unavailable but when I interviewed the deputy head he was very generous with his time, spoke at length to me and displayed sensitive and caring attitudes. The senior management team consisted of six men and two women but I gained no

strong sense of the school's management style nor how it was experienced by the teachers in general.

Wayne himself was very positive about his placement in the school: he said that it 'couldn't have been better, I like it very much'. He clearly respected the staff

the staff are really hardworking, it's nice to see everyone helping each other, there aren't any, many cliques, you can go and talk to anyone (from notes made at the time)

but it was clear that his major reference group was the department who, he felt, had all been very supportive and had also allowed him to contribute his own expertise. This department too I found hard to characterise. The department were very cohesive and spent a lot of their break and lunch times together in the mathematics suite. They spoke often of 'we' when asked individually what they thought about things and I frequently had a feeling that it was more important for them to voice a consensus and present a united front to me than actually to arrive at an accurate statement of what they thought or felt. It also seemed to me that their rhetoric misrepresented them. The first conversation I was invited to listen to, when I was visiting my teaching practice student rather than Wayne, was not pleasant. I imagine that it was to some extent put on for my benefit as being a representative of 'the other', that is from the training institution, and Martyn Hammersley has noted the ideological function of such talk in preserving commitment to traditional teaching (Hammersley 1984). The head and deputy head of the department, both middle aged, were talking.

deputy head of department: [the students] should be out on teaching practice in schools as much of the time as possible ... I was out for two whole terms on my PGCE [subsequent conversation showed that this was not in fact the case]

head of department: I didn't have any training, learnt on the job, too much theory ...

deputy head of department: but I bet you used a lot of that [raised hand intended to show hitting round the head]

head of department: no I didn't but that was because I used a cricket bat and it wasn't always on the bottom I can tell you
(from notes made six hours later)

This did not square in any way with the quality of the personal relationships I glimpsed in their classrooms. The teachers would often be hidden, perhaps, for example, sitting next to an individual student helping in a quiet and friendly way, and would offer a modest and open persona to the class. They had a traditional view of the nature of teaching and learning and valued quiet and disciplined behaviour ('almost all problems come from bad discipline') but coupled these attitudes with a very high degree of care for their students and commitment to their work. They were highly conscientious and worked very hard.

Another conversation will help to illustrate their contradictory approach.

head of department: all kids are bastards

me: but you like the kids

head of department: you can't abuse the kids and expect them to speak well to you. (from notes made at the time)

The style of management within the mathematics department was described as open, as working as a team and as being genuinely cooperative, with the proviso that the head of department had the final say: everything I saw in terms of the relationships amongst the staff would indicate that this was so.

Equal opportunities with respect to gender had in no sense been taken on board as an issue by the department. When discussing girls and mathematics, I was told

the girls are better than the boys [this was not borne out by the statistics available in the school brochure], coursework helps girls because they are neater and spend more time on it, boys by their nature get it over with as quickly as possible ... we treat

boys and girls alike in our school. (from notes made at the time)

What had Wayne made of this environment? Had he retained the perspectives he developed in the University or had either or both his rhetoric and practice shifted significantly? When I asked Wayne about equal opportunities issues, he spoke eloquently and personally about both himself and his and the school's community. He linked the life of the girls in school to his own and that of his friends and family. There is little employment in the vicinity and there are

a lot of young girls with young families, there's probably a high incidence of teenage pregnancy round here ... [at fifteen and sixteen] the girls tend to give in, accept the inevitable fact that that's what they're going to do ... I would stay at home and look after [my daughter] but my wife wants to do it herself ... some of the lads I socialise with go out every night and leave their wives at home, when I say I'm not going out tonight, I want to stay in with my wife they groan at me. I can't get through to them. (from notes made at the time)

there are a few coloured children round here but I haven't heard one racist comment towards them which I would have expected given my experience of my own schooling ... say like in my basketball team, if they're playing a team with coloured players in it they abuse them ... I've heard more sexist than racist comments ... it's very slowly changing but it will take a few generations yet. (from notes made at the time)

Wayne seemed then to have retained an outlook very similar to his previous one, that is caring, deeply personal and for change to the *status quo*. Much the same could be said of his attitude towards, for example, the learning of mathematics and classroom discipline. Although he said things which echoed the departmental rhetoric like, 'discipline is crucial ... I became stricter', the only one of his lessons which I was able to see was a delightful example of real participation by the students expressed with (very noisy) enthusiasm! He clearly respected his colleagues and valued highly their advice and support but he was able to separate his ideas from theirs. He shared their concern that the students should 'know the basics' but was himself convinced that the lessons needed to be enjoyable and, if possible, exciting if students

were to learn and remember. He was able to retain his independence and also to contribute to the department

the others tend not to try things, I've had some disasters, the others don't risk it as much as I do probably, but some have taken ideas off me and used them. (from notes made at the time)

Wayne, then, in many ways provides a stark contrast with Joanna. He had more reason to feel insecure and vulnerable in his work and yet had managed to retain a substantially independent outlook whilst at the same time positioning himself successfully within the school. Again, I found a strong continuity between Wayne as a student and Wayne as a beginning teacher. He had made no significant internal adjustment to the norms of the school but neither did he seem to have adopted strategic compliance nor strategic redefinition as a preferred mode of operation. Perhaps because his view of and commitment to equal opportunities was fundamentally personal and emotional rather than analytical and related to policy, he had been able to express that commitment in relationships in his own classroom. Perhaps equally and for the same reason, he gave no evidence of analysing his own practice specifically with respect to equal opportunities and had not sought to be proactive in redefining attitudes and values elsewhere.

Observations on the data

My observations about the data fall into four main categories, each of which I pursued further during Phase three. The first two are concerned with issues, raised by the literature, which I wish to question; that is, the supposed discontinuity between the student in training and the new teacher and the inevitability of new teachers being 'minced' by their pupils. The third relates to in-service teacher education. The fourth relates to the teachers' ways of understanding themselves in the world: it is this last which came to be pre-eminent in the results of my research.

First, then, it can be noted that coming into contact again with the students-becoming-teachers held fewer surprises than the literature might have led me to anticipate. Who they were and how they were living their working lives possessed real continuity with whom they had been and what they had seen themselves to be when students. None claimed when talking to me that their training had been irrelevant (although another interviewer, unconnected with their training, might have found a different result); only one of the three had (partially) rejected the ideas she had met in the University and in this case my personal notes written before we met again indicate that those views were a reflection of attitudes and outlook which were clearly present during training. I did not find the 'probationer teacher disaffection with training courses [which had] been well documented' (McNamara 1976, p147) in the past; nor did I find it true, for these new teachers, that 'initial teacher socialization is traumatic, involving deep changes in self and perspectives' (Sikes, Measor and Woods 1985, p12). I saw individuals, albeit constrained by the technical structures and the institutional norms they experienced, nonetheless playing a part in their own socialization. I saw not only new teachers adapting to their new situations through relatively unconditional acceptance of existing values and practices but also 'constructing their identities as teachers in situations marked by tension between what seems given or unalterable and what may be perceived as possibility' (Greene 1991, p10). The current positionings of the students could largely be foreseen; their attitudes and outlook did not appear to be lightly or easily subject to change just because they had moved into the world of work. Perhaps they might be feeling somewhat disempowered but not (yet) disillusioned.

Second, the data raised issues for me about professional development and the nature of institutions. It was noticeable that all of the three new teachers reliably echoed the (uncontroversial) school rhetoric in respect of the question 'What is it most important for a new teacher to work at?' and claimed to have themselves concentrated on this aspect of professional development: but there was no evidence at all, for example, that the one who said that 'presentation was very important' had particularly attractive student work nor that the one who emphasised class control had become a disciplinarian. There was a clear gap, not

unexpected, between what was said and what was done and, because the students were responding verbally in line with what the school was demanding, there seemed little prospect of the dissonance really being explored with staff *within the institution*. None of the new teachers seemed to have any experience at all of that 'potent and heady mix' (Nias 1989, p173) of sharing with their colleagues not only 'beliefs, practices and ideas, but also constructive disagreement and mutual concern' (Nias 1989, p173).

In addition, life within any institution tends to be driven, unsurprisingly, by the day to day business in hand with little or no time and space made available for personal reflection. Such reflection seems an essential element in the process of *professional development for change* and experience suggests that it is unlikely to be a solitary activity. Perhaps I can refer to the interview with John to illustrate this point. As I talked to John the space was created for him to reconstruct part of his life. People's lives become fragmented by the institutions of which they are a part and the process of remembering and retelling enabled John to uncover things of which he had lost an awareness; it allowed him to engage excitedly with his own history as though with a fresh discovery. This was empowering for him in that it reopened for him the possibility of professional change.

These observations endorse what had been expected from the literature and are particularly pertinent for those of us involved in teacher education in the United Kingdom. As the move to make both initial and in-service training more school-based has extended and has become more established, we are faced with the need to address the question of what enables professional development for change. Other skills, knowledge and expertise had certainly been developed within school (for example John's record keeping, Joanna's knowledge of the support services, Wayne's classroom presence) but *not* their ability to engage as professionals in debate about an area of change. Reflection fostered by professional exchange of views seems to be a vital component in the process: the profession urgently needs to create other fora for this to occur in the increasing absence of initial and in-service training which is not school-based.

In the third place, I noted that for none of the students did the school students seem to have acted as 'teacher-mincers' (Riseborough 1985). Perhaps it is too soon to have expected them to have become Riseborough's worn out pessimists but neither did they display the loss of idealism Lacey claimed to uncover (Lacey 1977). John, already fairly realistic about what might be achieved, had become more so and Joanna had certainly adapted her ideas to fit in with the school's expectations for the pupils, but none of them had begun to express disillusionment with their experiences. It has been suggested that 'pupils' expectations concerning what constitutes a good and proper teacher ... make them one of the most potent forces for conservatism in education' (Sikes, Measor and Woods 1985, p119) and my data do not offer a challenge to that: what they do suggest, however, is that thus far the new teachers had not come to feel resentful or cynical about any adaptations that they had made to their practice during their initial work in school. (However, see Chapter 11 for further comment on this issue.)

The fourth (and later central) area, which the data suggested to me might be important in understanding how teachers do or do not become agents for change, concerned the nature of the relationships which people set up between themselves and theoretical descriptions. John, Joanna and Wayne appeared very different in this respect. John was influenced by ideas, understood himself and his practice in relation to those ideas, used theoretical descriptions to see, articulate and try to understand himself and his experiences. Dissonance between those descriptions and his practice and experience troubled him and potentially demoralised him: it also, however, enabled him to resist simply accommodating himself to the *status quo* and to the 'common sense' of his particular environment. He saw himself as having both the authority and the right to evaluate the different perspectives of senior, experienced teachers and to synthesise his own, original perspective as a result.

For Joanna, it almost seemed as though theoretical descriptions were a bit of a nuisance. Her guiding principles and the tools she used to grasp and understand herself and her experience

seemed to be located elsewhere, in a 'metaphoric way of thinking' perhaps (Calderhead 1992a, p20). She wanted to bring her theoretical descriptions and her practice into line but gave the impression that she would never do this by work at a theoretical level, where the relationship between ideas and their implications are analysed. Rather the ideas must give way to a new formula which 'represented' what she currently did. She used external authority both within her teaching itself and in her decisions about how to teach and this fitted in with her response to the question about what she had discovered was important about teaching since leaving the University. The source of authority might be, at different times, the school or the University but rarely, if at all, Joanna.

Wayne offered a different picture again. He appeared not much in the habit of conceptualizing and articulating theoretical descriptions at all. For example, general questions about equal opportunities for girls in school led at once to vivid, localised descriptions of their likely futures. He gave the impression that his passion had been aroused and that he connected his feelings directly with his perceptions and his actions. Contradictions between rhetoric and practice were unlikely to be troublesome: conflict and lack of authenticity in emotions were. I gauged that these were reasonably deeply embedded characteristics, habits of thinking, 'ways of knowing' (Belenky et al 1986) it came to seem, of the three individuals involved and not significantly connected to the material conditions of the schools in which they found themselves.

Overall, then, the impression gained was that the attitudes with which the students left the University had been more stable than otherwise and that beliefs about and commitment to equal opportunities fitted into this general pattern. The initial impact of working as teachers had not been for them to throw over the experience of their training nor for all of them to cope with conflict between their values, beliefs and practices by adjusting internally to the goals and norms of their schools although they certainly, and not unnaturally, appeared fairly well constrained by the technical controls (Zeichner, Tabachnick and Densmore 1987, p54) of their schools.

What is clear, however, is that none of them had yet found a way of *acting* effectively for change. John, the only one with a secure post, had attempted some strategic redefinition but had failed although he may nevertheless have achieved something: Sikes, Measor and Woods observed a teacher strategy

in which the individual outwardly complies with the authority figures (*sic*) definition of the situation but is not in agreement with it, and by their disagreement, reflected in their actions does in effect change the situation. (Sikes, Measor and Woods 1985, p149)

Despite this possibility, the picture is, at best, of teachers able to resist at the level of ideas but not (yet) at the level of action.

Background to Phase three

After Columbus one should not be surprised if one does not solve the problem one has set out to solve.

(Imre Lakatos, *Proofs and Refutations*, p90 quoted in Skovsmose 1994, p111)

There were three strands of development that influenced the design of the research in Phase three. The most significant was my experience of Phase two, the results of which, as I describe below, contributed as well to the change in purpose in the third phase. Another strand of development was a reappraisal of the initial teacher education course followed by the students-becoming-teachers: as I considered additional data I had available from colleagues and from students other than John, Joanna and Wayne (see Appendix 1) and as I reflected on my continuing practice and that of my colleagues, I became convinced that, despite what we had written about processes in our report on the action research, we had not given enough weight nor paid enough attention to aspects of the hidden curriculum. The third strand was provided by the research literature: alongside and subsequent to the initial analysis of the Phase two interviews, I read further about teacher socialisation, about teachers working for change and about ways of knowing and what an emancipatory epistemology might be.

The influence of phase two

Equal opportunities with respect to gender provided the original focus of my personal research and also the context and practice of the action research upon which it built. This is

reflected in the background to the intervention project (see Chapter 3). In the second phase of the research, when I visited the three students-becoming-teachers from the first cohort (John, Joanna and Wayne), this focus continued and informed the structuring and practice of the data collection. It was also the starting point for my initial analysis of that data. However, I sought in the first place to immerse myself in the collected data relating to the three new teachers, attempting to understand and draw independent portraits of these three *as individuals*, aiming to see them whole, striving to capture them in the richness of their surroundings and the complexity of their understandings. I attempted, initially, not to look for similarities or differences between them according to some analytic schema but to tell a story about each one.

These stories were intended to have a dual function. My intention was to communicate the data, offering some of its richness, complexity and 'livingness', in such a way as to allow the reader, assuming my good faith, to make some judgements about the validity of the analysis I would subsequently attempt. The stories were also to be an interim construct between myself and the raw data upon which to base such an analysis, again sharing as much as possible of this interim construct with the reader. The portraits served as a second level of organisation of my experiences, building on the first level of organisation inevitably involved in the process of data collection itself. The data were to 'speak to me' through the mediation of the portraits rather than through some predesigned analytic tool. In other words, I was not at this stage looking for the presence or absence of any particular characteristics.

When I exposed myself to the data in this way, I found anticipated differences between the students-becoming-teachers in the ways in which they had adapted to life in school and the extent to which they had internally adjusted (Lacey 1977) to their schools' prevailing norms. Two things struck me, however, that I had not anticipated. The first concerned 'ways of knowing' (Belenky et al, 1986). I gained a sense of the difference between the participants in the ways in which they appeared to know themselves, to relate to knowledge and authority and to the realm of ideas. These 'ways of knowing' seemed to me to be characteristic of the

teachers, non-accidental, influencing their ways of being as teachers throughout and were a significant key in developing my interpretation of their understandings and their practices. It was my apprehension of this significant difference that led me to read further about the idea of personal epistemologies and how they shape our understanding of ourselves and our being in the world. My reading included both *Women's ways of Knowing: the Development of Self, Voice and Mind* (1986) by Mary Field Belenky, Blythe McVicker Clinchy, Nancy Rule Goldberger and Jill Mattuck Tarule and William Perry's *Forms of Intellectual Development in the College Years* (1970), each of which was significant in developing my thinking. (See Chapter 9.)

The second thing that struck me, which my later analysis implied was not unconnected with the above, was that I could find no evidence that any of the teachers explicitly (nor indeed implicitly as far as I was able to analyse) separated out in their thinking about equal opportunities with respect to gender from their other understandings, analyses, descriptions or practices. The teacher who was 'blind' to gender difference and its implications for her classroom was equally unaware of the grave inequalities in her classroom with respect to class. She also had no sense of how the social structure of her classroom and the way in which she spoke about the pupils were reinforcing inequalities by, for example, damaging the self esteem of low attainers. The teacher who claimed to use ideas to understand his world and his classroom and who voiced a continuing commitment to providing equal opportunities with respect to gender, displayed many of his characteristics and illustrated much of what he wanted to say within the context of 'race'. The teacher whose passions, whose heart was invoked by questions about gender issues understood them within a framework of which class was an irreducible component and responded in a similar personalised way to questions of 'race'. (See Chapter 7 for the relevant data.)

I detected nothing in the data to encourage an analysis which suggested that perceptions, practice or commitment around equal opportunities and gender should be understood separately from some more overarching personal philosophy and perspective, some overall

way of understanding, being and acting in the world. Not only were there connections across different sites of disadvantage. I began to have a sense of a pervasive outlook which would affect all aspects of schooling, including teaching and learning mathematics. My focus therefore began to shift to the idea of the radical teacher. I wanted my research to illuminate how such a teacher thought and felt and how she or he understood mathematics teaching. I wanted to find out how an orientation for change develops, what fosters its development, what sustains it and what inhibits it. I wanted in particular to discover whether characteristic 'ways of knowing', hinted at in the second phase of the research, were significant. I wanted in general much more data than I currently had on what it meant to be a radical teacher of mathematics.

When I say that I began to see equal opportunities with respect to gender as in some sense not a special case but embedded in a world view, I do not wish to deny that there is particular political and cultural work done to maintain this hegemonic aspect of the *status quo* (see Cockburn 1991, especially p169f, for a general discussion and Mac an Ghail 1994, p179f for a discussion related to schooling). I subscribe to the view, described by Gaby Weiner (1994), that gender inequalities in schooling are to be attributed to

patriarchal forces and male-dominated power relationships in which (hetero)sexuality and hierarchy combine to create the dominant male and subordinate female dualism ... education ... can only be transformative if it shifts the curriculum, and school knowledge and educational culture from its male baseline.
(Weiner 1994, p71)

Nor do I mean that an individual may not be more or less alert to particular forms of inequality and disadvantage, more or less committed to certain sites of engagement or willing to prioritise action on some issues above others. Each individual is differently situated and this alone implies that some will be more sensitive than others to a particular form of oppression and to how that oppression is lived. Some will have a deeper understanding of the particular structures that contribute to and preserve different forms of inequality, some ears will be

better tuned to hear and some individuals more able to analyse the discourse through which a particular oppression is mediated. But for the three teachers - white and living and working in or near a northern city - whom I had met in Phase two, their internal structures for understanding their world and the inequality issues within it seemed of a piece.

It had consistently been my intention to extend the number of teachers involved in the investigation during the third phase of the research. I now decided that, where I found a student-becoming-teacher who appeared initially to have some awareness of equal opportunities issues, I would attempt to collect substantial, extended data from them. What data I collected from other teachers would be less in depth and would serve mostly to hint at contrasts rather than to enable me adequately or with confidence to represent their world view. In part, here, I was influenced by a theoretical hesitation. In as much as the methodological outlook and practice that I had embraced involved authentic communication, establishing rapport, perhaps even intimacy, with the research participants, I had some reservations about its appropriateness for eliciting views to which I was not particularly sympathetic and I had significant doubts about my own ability adequately to capture those alternative perspectives (see Reinharz 1992, p263f). I also decided to follow up John and Wayne who shared some sensitivity to equal opportunities issues but who, referring back to my first unanticipated observation, seemed very different from each other in their 'ways of knowing'. Only John eventually participated fully in the extended study, Wayne dropping out fairly early in Phase three.

The hidden curriculum

Practical considerations also had an influence on the design of the third phase of the research. After the Phase two interviews I contacted the second cohort of students (1990-1991) in an exactly similar way to the first. The response was remarkably different. With the first cohort, thirteen students qualified and I attempted to contact them all. Eight replied of which three were not teaching; I did not know whether or not my letters had been received by the other five. In the second cohort fourteen qualified and I again attempted to contact them all. This

time only two replied. Neither was teaching and both were known to me socially. Initially this seemed a major setback in the research. It certainly contributed to my decision to change the design of Phase three but it also sent me back to reconsider data I had collected from this cohort when they were students and also to try to compare their experience of the course with that of the first cohort.

When I considered their time on the course, I noted two differences between the experience of the cohorts. The first was that only with the second cohort had I set up the equal opportunities subgroup. I believe that this had the consequence that students found it harder experimentally to try out changes in their ideas. Because the cohort felt more divided, it was harder for those who were tentative about equal opportunities issues to explore their hesitancy. Equally, some of those who did join the group felt intimidated and out of their depth. Some who did not join felt that they had therefore made a public statement about the importance that they attached to equal opportunities issues, that is, that they were given a low priority, and this then provided a less helpful context for development. It seems likely that the split made it less likely that ideas would be shared and thrashed out fully amongst the peer group and more likely that views would be seen to be cut-and-dried and not open to debate. I conjecture that this in turn made the members of the cohort less willing to invite me to observe their teaching and their thinking two years on, whether they had been part of the equal opportunities group or not.

The other clear difference between the experience of the two cohorts was in the members of the teaching team. (I have used pseudonyms in this section to try to provide anonymity for the participants.) The first cohort had been taught by three tutors, Marian, Keith and me, all of whom were committed to addressing aspects of equal opportunities. Two of the three were women and we were also committed feminists who tried to embed good practice with respect to equal opportunities and feminist principles in all our teaching, not simply those sessions for which equal opportunities was the explicit focus. In addition, we all three shared a theoretical commitment to a non-absolutist epistemology which had consequences for our personal style

and the style of our teaching. Students would be invited to decide for themselves, in the light of background reading and discussion with peers, what they thought about significant educational issues; the views of the tutors would be presented as such and criticism invited; and so on.

The second cohort were also taught by a team of three but, for most of their time at the University, Marian was replaced by Tony. Tony was happy to address equal opportunities issues explicitly in his teaching and indeed was concerned to do so effectively. However, his epistemology, personal style and teaching style were very different from Marian's. His teaching style was charismatic. He argued strongly that we should tell the students what to do, that we should impose our view of what constituted good mathematics teaching upon them and require them to follow such practice in school when on teaching practice. He said, 'Unless we tell them what to do and tell them that that is the right way to do it, they'll just do what the school tells them. And the chances are that won't be any good' (written from memory four years later). He argued that we did not want the students to have open minds; we wanted them to hold our opinions about what constituted good teaching because, after all, we knew best. This necessarily influenced his teaching.

An illustration of this concerned a young woman student of slight build, reasonably quiet manner and determined personality who came to see me at the end of her final teaching practice. She had had some difficulties with classroom management and had been disappointed that no-one at the school had been able to help her develop her own teaching style. They had made suggestions about how she might change her classroom practice that took no note of her personal style or her outlook and opinions. She had sought help from Tony who, generously, had come in, taken one of her classes for her for a lesson and invited her to watch and learn. This (kindly intended) action did not help the student at all because she was not one of the cohort who accepted that there was 'one Right way' of doing things: she believed that she had a right and a need to develop her own practice in the classroom in terms of her own personality and understandings.

This second cohort, then, had had mixed epistemological and pedagogical messages from their tutors with respect to the source of knowledge and the way in which it is validated or revised. (In addition, see Kenway et al 1995 for a useful discussion of the negative effects of authoritarianism in a pedagogy seeking for change.) Perhaps, once they were teaching, some of them therefore felt less inclined to value reflection on practice and less willing to be unsettled by views from outside their current orthodoxy which a visit from me might provide. These reflections reinforced my developing awareness that epistemological considerations were something that I wanted to explore with the participants in Phase three.

Suggestions from the literature

As the focus of my research shifted to trying to understand what makes and sustains a teacher working for change, I noted what other researchers had suggested were significant factors in the development of such teachers. I wanted to find out if these matched up with the experiences of the Phase three teachers and, if so, why they were important and how they were lived. I would attempt to devise a suitable schedule for the extended semi-structured interviewing which would allow me to explore these issues with the Phase three teachers. So, what contribution to this aspect of my thinking did the research literature make?

Richard Butt, David Townsend and Danielle Raymond (1990) write

Teachers' stories suggest there may be three major categories of experiences that influence teacher development. In order, they are the teacher's private life history, professional experiences, and the teacher's own experiences as a student in school. (Butt et al 1990, p261)

I intended to explore aspects of all three.

It is only fairly recently that attention has been turned to the impact of teachers' own biographies, their personal life histories, on their attitudes and actions. It seems reasonable to

suppose (and surely verified by introspection) that what we have experienced in our lives as a whole and the interpretations we have placed upon our lives' events will shape who we are, what we value, how we think and act and so on. I wanted to find out if biography shapes our, little understood, 'metaphoric ways of thinking' (Calderhead 1992a, p20). Sue Middleton had found, for example, that 'teachers who come to adopt a feminist analysis of education have, themselves, experienced discrimination, victimization or marginality within the education process - in their own schooling, teacher training and/or as teachers in school' (Middleton 1989, p53); and Colin Lacey reported that 'it is teachers that score high on liberalism who anticipate feeling blocked' (Lacey 1977, p141). I wondered if these findings would reoccur with the Phase three teachers. (I note in passing that it has been suggested that both constructing one's own autobiography (Aspinwall 1985) and studying the autobiographies of others (Abbs 1974) encourage the reflection which is fundamental to effective development as a teacher and that 'discoveries made in this way leave teachers feeling empowered rather than threatened and more committed to future action' (Aspinwall 1986, p215).)

Sandra Acker suggests that 'there is scope for further research to link the characteristics of past and present lives of both sexes to their beliefs and actions *vis-à-vis* gender' (Acker 1988, p314): I would invite the Phase three teachers to reflect on their autobiographies, both their private life histories and also their experience of their schooldays, and to explore whether or not these provided insight into why they were teachers working for change. For example, Michael Cole (1985) has found that the innovative new teachers he interviewed 'had entered training critical and sceptical about educational institutions and with a conditional commitment to teaching' (Cole 1985, p98) whereas the more conservative tended to have a highly positive identification with schooling based on both their own experience of it and also on significant family ties with the profession. Were the Phase three teachers following in family footsteps? Did the Phase three teachers identify positively with their own schooldays? Or were they entering teaching favouring discontinuity and looking for change towards other conceptions of schooling? Their reflections on their own schooldays might contribute to an understanding of the ways in which

well-worn and commonsensical images of the teacher's work, ...
in unintended ways, select the practices that are available in
educational life. (Britzman 1991, p3)

The third component, their professional experiences, which had been the focus for the second phase enquiry, would continue as a significant element in my interviews during Phase three. I intended that the current school experiences of the Phase three teachers contribute to our understanding of

how our teaching selves are constituted in the context of
learning to teach, and how the selves we produce constrain and
open the possibilities of creative pedagogies. (Britzman 1991,
p2)

In addition, I was interested in the impact of teacher education. Butt et al found that 'conventional teacher pre-service and in-service education seldom are mentioned as being formative when teachers talk and write about their careers' (Butt et al 1990, p261). Naturally, I could not test out in any real way whether or not my case study teachers would *volunteer* initial training as being a significant influence - they would, of course, suppose that my interests would lie here - but I wanted to find out what their perceptions of its importance were by recording *how* they talked about it.

As well as my own reflections, the literature too had suggested that the *hidden curriculum* of initial teacher education might be significant in influencing whether or not students became teachers working for change. George Mardle and Michael Walker (1980), for example, write rather gloomily and deterministically,

teachers do not become re-socialised during their course of
training nor in the 'reality' of the classroom since in essence this
is a reality which they never actually left ... from primary school,
to secondary school to university lecture ... continued exposure
to that [hidden] curriculum, its practices and the commonsense

assumptions by which it is rationalised, constitutes the core of teacher socialisation. (Mardle and Walker 1980, p103)

Diana Leonard (1989) suggests that initial teacher education has failed to work effectively on gender issues and that this is because content only is addressed: the processes remain 'higher education's fundamentally conservative teaching and learning practices - and it is these which are the main source of the generally elitist and male-dominated influence of universities and polytechnics' (Leonard 1989, p26). Kenneth Zeichner, Robert Tabachnick and Kathleen Densmore (1987) discuss the role of the hidden curriculum in teacher education and note that,

[s]tudies of the influence of the formal curriculum of programs suggest that pre-service programs are not very powerful interventions. On the other hand, studies of the influence of the hidden curriculum of programs suggest, without much empirical evidence, that the impact of pre-service training may be far greater than has been thought. (Zeichner, Tabachnick and Densmore 1987, p28)

I began to wonder specifically about the impact, on those students who had followed the two year route, of their first year of study. During this year they followed a curriculum largely concerned with mathematics but taught to them mostly by tutors who wanted to challenge, to a greater or lesser extent, the prevailing hidden curriculum of mathematics classrooms. Several researchers had found significant differences between teachers of different school subjects when considering other teacher characteristics (Lacey 1977, Sikes, Measor and Woods 1985, John 1991). It has been suggested that

The subject sub-culture appears therefore to be a pervasive phenomenon, affecting a student-teacher's behaviour in school and university, as well as their choice of friends and their attitudes towards education. It would seem there is a case for considering the process of becoming a teacher as a multi-stranded process... (Lacey 1977, p63)

Perhaps our two year students were significantly different from our one year students even without the experience of that first year. Some had been highly successful in their school

mathematics but had not pursued these studies at university; thus they defined themselves elsewhere and their sense of identity would not have a major investment in the *status quo* of mathematical knowledge and mathematics education practices.

Finally, my reading also built on and gave initial insight into my observation from Phase two that ways of knowing might be a significant part of becoming a teacher working for change. I wanted to find out where the Phase three teachers were on the map that William Perry (1970) devised to chart intellectual development (Appendix 20). Given the nature of the subject and its placing in contemporary culture, perhaps mathematicians might be the last to relinquish absolutist thinking. Did the Phase three teachers share epistemological perspectives that challenged absolutism? (Belenky et al (1986) had explored women's ways of knowing by using semi-structured interviews and the schedules for those interviews (included as Appendix 21) proved useful in devising my own (see Appendix 10).) What were the connections here in terms of teaching and learning and becoming a teacher working for change? I was already making conjectures about this.

I am now thinking that equal opportunities is part of a whole radical perspective, that that radical perspective may be linked to them as learners: reproductive learners become reproductive teachers in school whereas learners who struggle to engage with the material and to make it their own ... become radical teachers who succeed in overcoming the dead hand of the reproductive environment they meet in schools. (personal notes, August 1993)

These three major influences, then, on my thinking between Phase two and Phase three - analysing Phase two through constructing stories; reflecting on the hidden curriculum of the initial teacher education of the students-becoming-teachers; and reading about teacher socialisation - caused me to shift my research to building case studies of teachers working for change, people whom I called radical teachers.

Ways of knowing

... entering some very slippery epistemological terrain ...

(Jane Kenway, Sue Willis, Jill Blackmore and Leonie Rennie, 1994, p201)

Frances had called into our Resources Centre to look for materials and stopped for a chat. She did not yet know that I thought epistemology was important and volunteered this comment. 'I've been teaching some science this year and doing it *so badly*. It shows that there really is something in teacher training. With science all the knowledge is here [gestures] in *my* head and I haven't got a *clue* how to proceed. With maths, the maths is all out there in the classroom with *them* and I'm very happy with that.'

(Based on personal notes, 1 May 1995)

In this chapter I attempt to elaborate a model of 'ways of knowing' (Belenky et al 1986).

The process of claiming to elaborate a model is not unaccompanied by dread. (See Figure

10: 'This article has to be ...'.) The task of creating a model is also fraught with

contradiction when it is part of a project informed by deconstructivist sympathies.

[E]ven so-called liberatory discourses contain elements of good and bad sense; that is, constraining *and* enabling moments ... Emancipatory strategies must not be blind to

Figure 10



(Cartoon by Marian Lydbrooke, reproduced in Adler et al 1993)

'This article has to be ... '

their own dominating tendencies or to the broader social forces which so frequently re-direct and undermine their agendas. (Kenway et al 1994, p197)

The model is intended to illuminate the thinking of student and beginning teachers of mathematics. These ways of knowing relate to their understandings of the pedagogy of the mathematics classroom but will be seen also to encompass their ways of knowing mathematics. Setting out to do so, I have in mind, then, the need to search for an 'emancipatory epistemic strategy' (Restivo 1983, p129) but I do so with humility. I find, with Sal Restivo, that there are

formidable problems that one encounters in trying to develop a coherent integration of the aims and procedures of inquiry and the aims and procedures of a political agenda orientated to improving the conditions under which human beings live and carry out inquiry. Nonetheless, the effort must be made, just as the actions we undertake in everyday life must be carried out in the face of the ignorance, paradoxes, contradictions, and compromises that obscure, harass, and destroy emancipatory motives, aims, and ways of life. (Restivo 1983, p129)

I shall use the model to try to draw out and offer some explanation for the differences in thinking and in action amongst the students-becoming-teachers who contributed to this study. The model will underwrite the claim that only if certain ways of knowing are characteristic of a teacher will she be able to promote equal opportunities in an unsympathetic climate, that is to be a motive force for change. This will be so not only in the context of working to provide equal opportunities with respect to gender but also with respect to other sites of systematic disadvantage, 'race', class, disability, sexuality and so on. The model also indicates a fundamental and intrinsic link between characteristic ways of knowing and pedagogy, using the terms 'school maths' and 'inquiry maths' as conceptualised by Cobb, Wood, Yackel and McNeal (1992). This will provide the basis

for a discussion of an emancipatory curriculum in general and such a curriculum within mathematics in particular in the chapters which follow.

I am sharply aware, in constructing this model, that all the contributions to its development have been located in, at least, white and Western perspectives. In particular, the main participants and I have been similarly (though of course not identically) positioned by the primary discursive fields of 'race', class, ethnicity, disability and sexuality. As such, unless it is continuously read as being narrowly perspectival, the work becomes guilty of the error of universalism. In this very important sense, the model needs to be read as local. Indeed, even within the teacher education groups of which the participants were members, there was more heterogeneity than has been reflected in this text. As with much other work for change, the model 'does not address the matter of difference in any adequate way at all' (Kenway 1994, p206). (I refer to this issue again in Chapter 12.)

Personal history of the model

The history of the development of the model is thus: the second phase of the study led me to suggest that the characteristic ways of knowing of the three students-becoming-teachers were noticeably different in the ways in which they related their pedagogy to ideas and in the relationships which they set up between themselves and theoretical descriptions. Following on from this, I read William Perry's *Forms of Intellectual and Ethical Development in the College Years* (1970) and *Women's Ways of Knowing: the Development of Self, Voice and Mind* (1986) by Mary Field Belenky, Blythe McVicker Clinchy, Nancy Rule Goldberger and Jill Mattuck Tarule, both of which influenced my thinking and contributed to the development of my own model of the ways of knowing exemplified by beginning teachers of mathematics who are working for change. I subsequently extended my empirical study to include two such teachers (new to the

research) whom I studied in some depth and by revisiting the one teacher from the first cohort of three who had retained a commitment to working for change. This part of the research is described in Chapter 11. Listening to these three talk about their lives, their work and their understanding of mathematics was the grounding for the model of learning I offer here.

Naturally, this linear sequence oversimplifies the process. Of course, I kept in mind my experience of visiting my first three students-becoming-teachers throughout all the later stages. Indeed, I returned to the interview and observation notes I had made many times for a variety of purposes and listened to the tapes again occasionally. Similarly, the experience of the third phase field work, the re-reading of Perry's accounts and of *Women's Ways of Knowing*, the analysis of the new interview data and the creation of my model of epistemological positions all interacted with one another.

The second phase of the study and its results are described above in Chapters 4 and 7. I turn here to a consideration of *Forms of Intellectual and Ethical Development in the College Years* and *Women's Ways of Knowing*. Both books offer rich and complex ideas about intellectual, personal, ethical growth and both convey a deep sense of care, almost of love, for the human beings who are the subjects of their study. Each is written with a passion for the learning process and would make fruitful reading for any teacher. I do not attempt to do justice to this richness in the sections below: rather I draw out from each the points salient to the construction of the model I later elaborate.

William Perry's work on intellectual and ethical growth

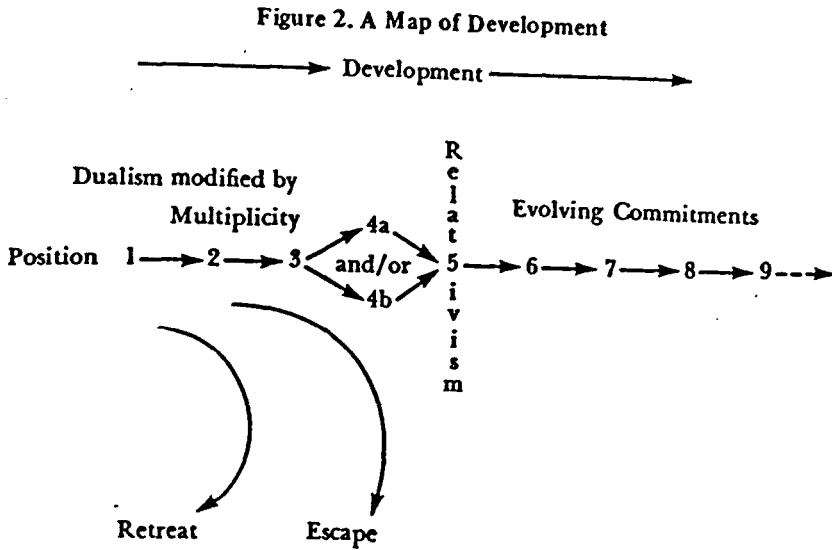
The study on which Perry reported was based on 140 student volunteers from Harvard and Radcliffe enrolling during the years 1954 to 1963. Students were interviewed towards the end of each of their four years of study; the results included 84 complete four-year

sequences. The illustrations and validations in the study drew very largely on the reports from the men. Perhaps in recognition of this and certainly in the unexamined practice of the time, the student is referred to throughout as male. I have maintained this usage in this section as part of the attempt to convey to the reader the meaning of the original which, naturally, cannot be separated from the discourse of which it was/is a part. The interviews were all conducted around the question of whatever 'stood out' for the student about the year, leaving 'the student as free as possible to speak from his own ways of perceiving himself and his world... [allowing] a candid exploration of what was important to them in their own experience' (Perry 1970, p18).

On the basis of an analysis of this interview data, the research team constructed a scheme of intellectual development detailing nine stages or positions from *Basic duality* through various forms of *Multiplicity* to *Relativism* and *Commitment in relativism*. The initial schematic representation and the full chart of this development are included in Appendix 20. A later, modified map is shown in Figure 11: A map of intellectual development (1) (Perry 1981, p79) and illustrated in Figure 12: A map of intellectual development (2) (Perry 1981, p80). Here we can see the essential elements of the overall structure: increasingly complex dualism is followed by a clear break into relativism which is then elaborated, involving increasing awareness and with increasing commitment.

All the initial positions (1 to 4) involve a dualistic way of knowing: Right/Wrong, good/bad, us/them and so on. Throughout these stages, 'meaning exists "out there", along with rightness, power, and sound advice' (Perry 1981, p90). Intellectual development moves the student from a position where there are right answers for everything which are known to the authorities whose job it is to teach them; through an understanding that it might be legitimate for learning to involve working out which is the right opinion rather than being told; through an awareness that there are some things that are not known *yet*,

Figure 11



Dualism. Division of meaning into two realms—Good versus Bad, Right versus Wrong, We versus They, All that is not Success is Failure, and the like. Right Answers exist *somewhere* for every problem, and authorities know them. Right Answers are to be memorized by hard work. Knowledge is quantitative. Agency is experienced as “out there” in Authority, test scores, the Right job.

Multiplicity. Diversity of opinion and values is recognized as legitimate in areas where right answers are not yet known. Opinions remain atomistic without pattern or system. No judgments can be made among them so “everyone has a right to his own opinion; none can be called wrong.”

Relativism. Diversity of opinion, values, and judgment derived from coherent sources, evidence, logics, systems, and patterns allowing for analysis and comparison. Some opinions may be found worthless, while there will remain matters about which reasonable people will reasonably disagree. Knowledge is qualitative, dependent on contexts.

Commitment (uppercase C). An affirmation, choice, or decision (career, values, politics, personal relationship) made in the awareness of Relativism (distinct from lower-case *c* of commitments never questioned). Agency is experienced as within the individual.

Temporizing. Postponement of movement for a year or more.

Escape. Alienation, abandonment of responsibility. Exploitation of Multiplicity and Relativism for avoidance of Commitment.

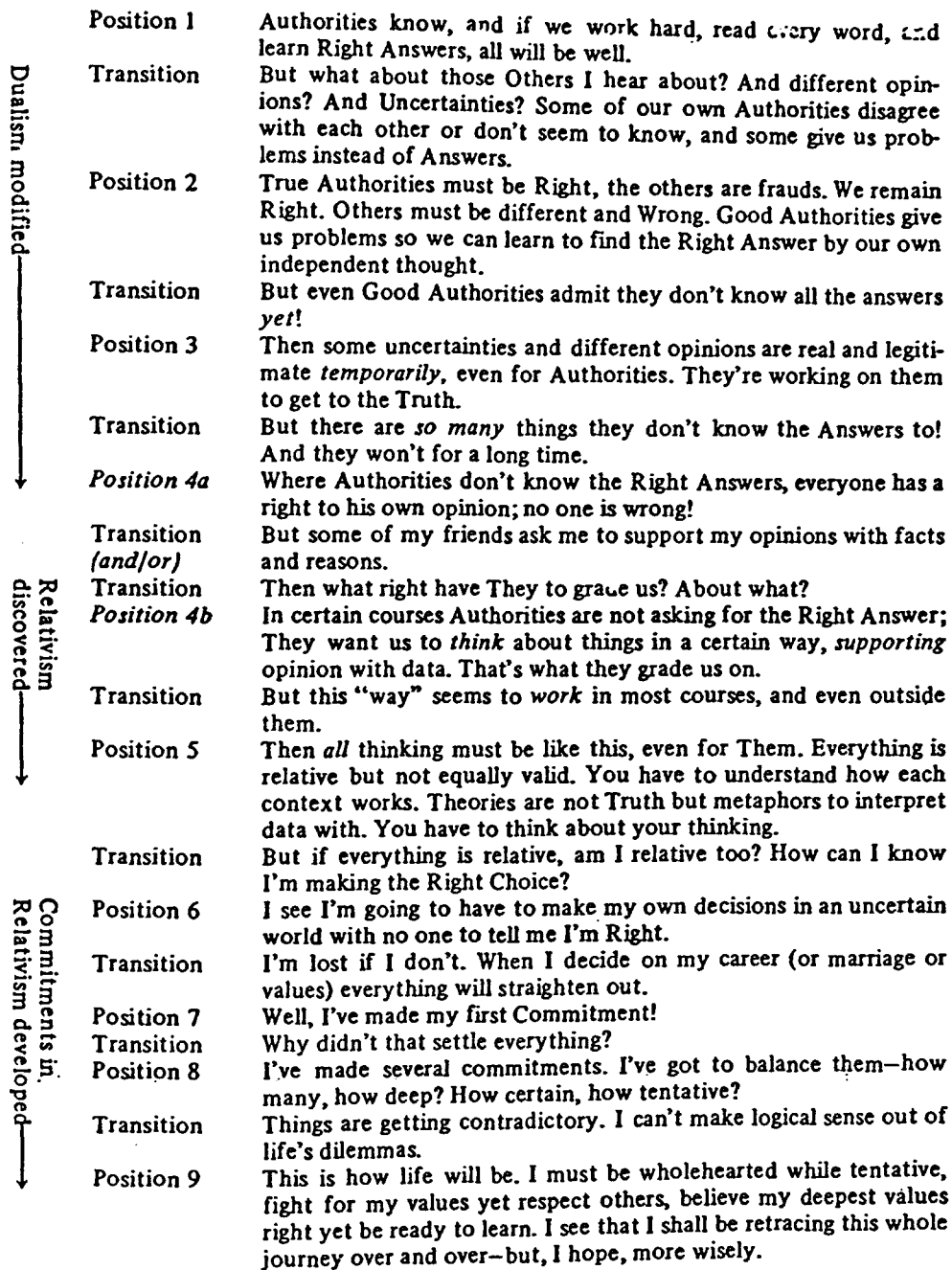
Retreat. Avoidance of complexity and ambivalence by regression to Dualism colored by hatred of otherness.

(From Perry 1981, p791)

A map of intellectual development (1)

Figure 12

Figure 1. Scheme of Cognitive and Ethical Development



(From Perry 1981, p79)

A map of intellectual development (2)

about which authorities may, for the time being, legitimately disagree; and on to a position where 'everyone has a right to his own opinion; no one is wrong' (Perry 1981 p79) and/or to the adoption of a relativist *style*, but only because that is 'the way They want you to think' (Perry 1970, p100). This last position is 'the structural foundation for Relativism' (Perry 1970, p101) but diversity of opinion is seen as leading to personal 'Rightness' rather than calling forth 'Relativism's analysis, rules of evidence, disciplines of inference, and concern for the integrity of interpretations and systems of thought' (Perry 1981, p85). The students are now at a critical point in their career: they may move into 'cynicism, anxiety, or a new sense of freedom' (Perry 1981, p88).

If they continue to develop through Perry's positions to the beginnings of a relativist perspective, the students become aware that theories are not 'Truth' but models or metaphors which we can use to try to make sense of experience and as such they explain the data more or less well, are more or less coherent, and so on. Relativism is defined as

[d]iversity of opinion, values and judgement derived from coherent sources, evidence, logics, systems, and patterns allowing for analysis and comparison. Some opinions may be found to be worthless, while there will remain matters about which reasonable people will reasonably disagree. Knowledge is qualitative, dependent on contexts. (Perry 1981, p80)

Development continues with the realisation that 'I'm going to have to make my own decisions in an uncertain world with no one to tell me I'm Right' (quoted in Perry 1981, p79). First commitments, decisions, affirmations, choices are made; an awareness grows of the tensions between uncertainty and commitment; finally the tensions between wholeheartedness and tentativeness are embraced.

[This last stage]... maintains its vision of meaning, coherence, and value while being conscious of the fact that it is partial, limited, and contradicted by the visions and claims of others. It holds its vision with a kind of provisional ultimacy ... (Fowler 1978, p22, quoted in Perry 1981, p96)

The students now experience the origins of meanings as coming from within themselves, making the shift from an external to an internal locus of control and opening up the possibility of committed action.

"I'd never believed I could do things, that I had any power, I mean power over myself, and over effecting any change that I thought was right." (quoted in Perry 1981, p94)

Throughout, the model is developmental: 'a "Pilgrim's Progress" of ways of knowing... [a] map of sequential interpretations of meaning' (Perry 1981, p77f). Two justifications are offered for this. Firstly, the empirical: 'we considered the order of the appearance of these structures throughout the students' four year reports and found this order to be remarkably regular' (Perry 1970, p47). Secondly, it is argued that there is an essential logic of progression inherent in the positions because 'students thinking in the forms of advanced Positions can understand earlier meanings and procedures... students thinking in earlier forms cannot understand the assumptions of advanced Positions' (Perry 1981, p105). A student whose way of knowing is based on relativist assumptions can make sense, for example, of information presented by a teacher who is working within a dualist perspective: '[the student] would have little difficulty in interpreting the experience accurately without revising his basic assumptions about the nature of knowledge. His assumptions logically extend to the possibility that a given lecturer might "have the point of view that" there was but one correct answer' (Perry 1970, p2). This is not so if the perspectives are reversed. A student with a dualist perspective cannot make sense of a

lecture offered from a relativist perspective (nor, although Perry does not note it, can a dualist lecturer make sense of a relativist student!): '[the student] must either revise his basic assumptions or interpret the experience in some such way as, "The lecturer is talking all over the place" ' (Perry 1970, p2). (This is further illustrated by student responses to each others' comments about courses (Perry 1981, p104f).)

Although there is a small acknowledgement in the original study that individual students may express themselves in a range of positions, it is claimed that in each case they found a strong central tendency which justified placing the student at a particular stage (Perry 1970, p49f). This position is developed a little in the later writing when it is acknowledged that 'individuals mature their cognitive structures at different rates in different areas of their lives' (Perry 1981, p89), that 'growth and discoveries are recursive' (Perry 1981, p97) and that development can be helical. Nevertheless, the sense conveyed of an individual as located in a certain position remains strong.

Women's Ways of Knowing

Women's Ways of Knowing is based on a study of 135 women, including 'a number of [the] disadvantaged and forgotten' (Belenky et al 1986, p11). The authors began from the observation that women are under-represented both as creators and subjects of psychological theories of human development and in the belief that, if heard, women's voice would offer a different understanding of knowing from the male paradigm. Further, ways of knowing are of central significance in our lives because 'our basic assumptions about the nature of truth and reality and the origins of knowledge shape the way we see the world and ourselves as participants in it' (Belenky et al 1986, p3).

The interviews, each of between two to five hours, all began with a similar starting point to that adopted by Perry and proceeded 'gradually at the woman's own pace to questions

concerning self-image, relationships of importance, education and learning, real-life decision-making and moral dilemmas, accounts of personal growth, and visions of the future' (Belenky et al 1986, p11). This agenda sprang from a conviction that many women valued lessons learned other than in formal educational settings. On the basis of the interviews, the researchers developed five major epistemological categories for women's perspectives on knowing. These were

silence, a position in which women experience themselves as mindless and voiceless and subject to the whims of external authority; *received knowledge*, a perspective from which women conceive of themselves as capable of receiving, even reproducing knowledge from the all-knowing external authorities but not capable of creating knowledge on their own; *subjective knowledge*, a perspective from which truth and knowledge are conceived of as personal, private, and subjectively known or intuited; *procedural knowledge*, a position in which women are invested in learning and applying objective procedures for obtaining and communicating knowledge; and *constructed knowledge*, a position in which women view all knowledge as contextual, experience themselves as creators of knowledge, and value both subjective and objective strategies for knowing. (Belenky et al 1986, p15)

The authors note that Perry's dualist position can be likened to *received knowledge* but draw attention to the fact that for many of the women in their sample

this world of "Authority-right-we" was quite alien... [They] seemed to say "Authority-right-they". They were as awed by but identified less with authorities than did Perry's men. (Belenky et al 1986, p44)

They point out that since the *received knower* believes that all knowledge originates outside the self, she must look to others even for self-knowledge (Belenky et al 1986, p48): it is the liberation from this that comes through most strongly in their *subjective*

knowers. Unlike Perry's multiplicitists, who experience their position as giving them 'the right to their own opinion' and with whom they share their epistemological grounding, these subjective knowers feel, modestly, 'It's *just my opinion*' which is 'what works best for me' (Belenky et al 1986, p66 and p70). They distrust logic, analysis and abstraction, even rationalism itself, because they are emblematic of an authority which has failed them. They have learned to listen to an inward voice which they had previously denied.

With the shift to *procedural knowledge* comes

conscious, deliberate, systematic analysis ... The inner voice turns critical; it tells them their ideas may be stupid. Women at this position think before they speak; and because their ideas must measure up to certain objective standards, they speak in measured tones. Often they do not speak at all. But this is not a passive silence; on the other side of this silence, reason is stirring. (Belenky et al 1986, p93ff)

Procedural knowing can be either connected or separate. Separate procedural knowers are like those of Perry's students who are able to utilise the voice of reason but do so only because they accept the practices and standards demanded by the authorities. They perceive objectivity as requiring the complete suppression of the self. 'Feelings and personal beliefs are rigorously excluded' (Belenky et al 1986, p109). Connected procedural knowers, on the other hand, know that 'each of us looks through the world through a different lens, that each of us construes the world differently' (Belenky et al 1986, p97). They learn through empathy; their premise of connection seems violated by the making of independent judgements and, consequently, '[w]ithin their own frameworks, these women said that they could make moral judgements, but they did not wish to impose their judgements on others' (Belenky et al 1986, p117). They do not speak with the voice

of personal authority because they 'seek to understand other people's ideas in the other people's terms rather than in their own terms' (Belenky et al 1986, p123f).

Fully reclaiming the self, absent from both sorts of procedural knowing, provides the impetus for developing the fifth epistemological position: *constructed knowing*. Objective and subjective knowing, rational and emotive thought, personal knowledge and what they have learnt from others are reintegrated by constructed knowers. They ' "jump outside" the frames and systems authorities provide and create their own frame' (Belenky et al 1986, p134). They acknowledge that all knowledge is constructed, that truth is a matter of context and that the knower is an intimate part of what is known. There are implications for how they learn.

Once knowers assume the general relativity of knowledge, that their frame of reference matters and that they can construct and reconstruct frames of reference, they feel responsible for examining, questioning, and developing the systems that they will use for constructing knowledge. Question posing and problem posing become prominent methods of inquiry ... (Belenky et al 1986, p138f)

They appreciate expertise, but the contribution of 'experts' is evaluated and not automatically accorded attention and respect. They are, presumably, no longer amongst those girls and women 'who have more difficulty than boys and men in asserting their authority or considering themselves as authorities' (Belenky et al 1986, p4f). Finally, they are seriously preoccupied with moral commitments and strive to translate them into action (although the complexity they experience is likely to be different from that of Perry's young men and to entail performing a ' "juggling act" with the pieces of their life' (Belenky et al 1986, p151)). They have developed a personal, unique, authentic voice.

The authors note the clear sequential ordering of epistemological positions to be found in Perry's work. They conjecture that this is a result of the fact that the students were relatively homogeneous in terms of social background and educational profile and were subjected to similar educational and life experiences during their four years of study. They contrast this with their own study.

When the context is allowed to vary, as it did in our study, because we included women of widely different ages, life circumstances, and backgrounds, universal developmental pathways are far less obvious. (Belenky et al 1986, p15)

They do not, then, claim a developmental hierarchy for their epistemological perspectives. Limits need to be set to this disclaimer, however. Their perspective of *silence*, for example, is seen as 'the simplest way [of knowing] we could discern' (Belenky et al 1986, p23), being a position experienced as mindless and voiceless and expressly excluding the silence that can come when confidence in received or procedural knowledge breaks down. Equally, the *constructed knower* both has ways of understanding all the other positions (cf Perry 1970, p2) and also occupies the position esteemed, sought after, validated and desired by the authors. There is also a strong sense in their writing, not, I believe, denied, that individual women at particular times are located in a specific perspective.

Outline of an *authority* model of ways of knowing

In this section I outline a model of ways of knowing which is intended to illuminate the thinking of student and beginning teachers of mathematics. The underlying organisational principle behind the construction of the model has been the sifting out of those aspects of teachers' epistemologies which make a difference to what, as teachers, they think, believe and do. I have sought to isolate and separate out those features which help us to understand these differences, maintaining distinctions where to do so is helpful in pursuit

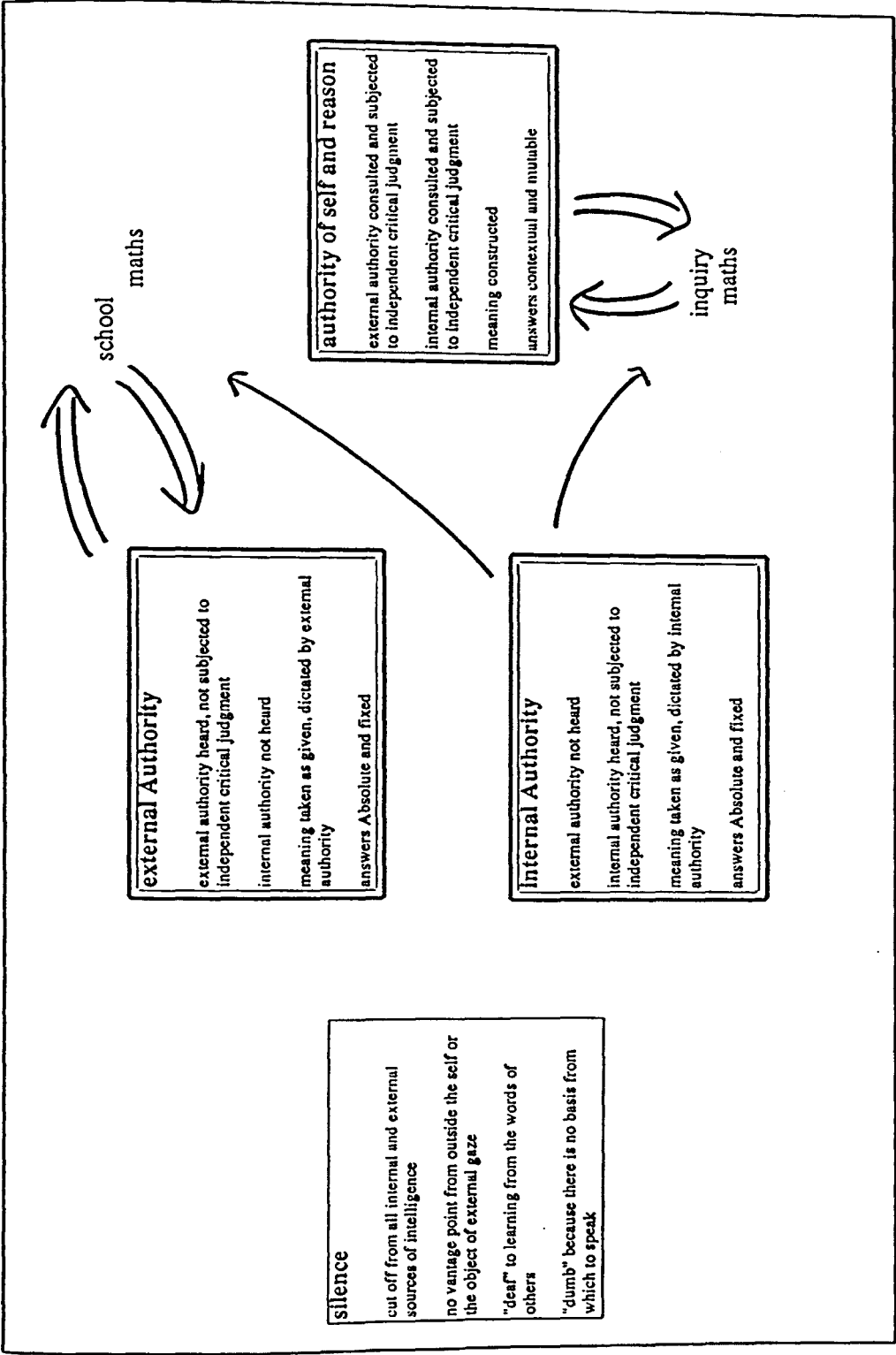
of the stated goal, conflating distinctions where it is not. Consequently, the model is simpler than those offered by Perry and Belenky et al, both of which can be mapped on to it. The essential explanatory concept at the heart of the epistemological model that I construct in what follows is that of *authority*. The model is sketched out in the remainder of the chapter.

The model is presented in diagrammatic form in Figure 13: An 'authority' model of teacher epistemologies. Some distinguishing characteristics of each perspective are outlined in Figure 14: Features of the 'authority' model of teacher epistemologies and are discussed below.

Silence

The perspective of *silence* owes a great deal to the position of the same name outlined in *Women's Ways of Knowing*. It was hardly heard from Perry's elite, male undergraduates (although see Perry 1988, p149 and p151 for an illustration of the muteness and the terror) and is much more likely to be experienced by those who are not part of the hegemonic group. It cuts off the knower from all internal and external sources of intelligence; the knower cannot see herself as developing, acting, learning, planning or choosing. She may have no vantage point from outside the self with which to view herself or she may see herself only as the object of such a gaze. She will feel 'deaf' because she cannot learn from the words of others and 'dumb' because she has no voice. Where this position departs significantly from that described in Belenky et al (1986) is that it is not irrevocably left behind when other ways of knowing are available. By its very nature it is seldom *heard* in the context of teacher education, but it still can be experienced at moments of self doubt or as an underlying subtext in any of the other positions. This perspective is significant in the context of working for change when, as with most equal opportunities work, such change involves challenging dominant others: even though

Figure 13



An 'authority' model of teacher epistemologies

Figure 14

silence	external Authority	internal Authority	authority of self and reason
not represented amongst Perry's elite, male undergraduates	Perry's positions 1, 2, 3 and 4b	Perry's position 4a	Perry's positions 5 to 9; internal voice listened to but not necessarily consciously acknowledged
perspective of 'silence' from Belenky et al	'received knowledge' and 'procedural knowledge' from Belenky et al	'subjective knowledge' from Belenky et al	'constructed knowledge' from Belenky et al
reason not known, unacknowledged	reason may be valued because <i>They</i> say so	distrust of reason	innocence of reason questioned
by its nature, seldom <i>heard</i> in teacher education, can still be experienced at moments of self doubt or as underlying subtext in any of the other positions	strong epistemological link with 'school maths', the ways of knowing experienced by the teacher and expected of the pupil support one another does not preclude attempting to teach 'inquiry maths' though not supported epistemologically	weak epistemological link with both 'school maths' and 'inquiry maths', the way of knowing experienced by the teacher does not encourage contemplation of that of the pupil	weak epistemological link with 'school maths', the ways of knowing experienced by the teacher and expected of the pupil do not support one another strong epistemological link with 'inquiry maths', the ways of knowing experienced by the teacher and expected of the pupil support one another
provides no defence against the critiques of others nor against unpleasant classroom events, both of which may provoke this perspective	provides no defence against the critiques of important others, but can give feeling of protection against unpleasant classroom events	provides little defence against unpleasant classroom events, can involve the rejection of the feelings and worth of others, likely retreat into <i>status quo</i> 'school maths' for protection of the self	allows a critical distance from the critiques of others and from unpleasant classroom events

Features of the 'authority' model of teacher epistemologies

usually transitory, the perspective of *silence* is likely to be evoked when one is under threat. In addition, also significantly, it is immobilising.

Because this voice is difficult to hear and, unsurprisingly, was not recorded in my interviews, I illustrate it from another context. Sometime after finishing the first draft of this section, a colleague who is a university tutor reported the following experience. He was chairing his first staff-student meeting during which he was asked a difficult question by a student committee member. He claimed that he lost all sense of what he himself believed and his response was driven by only two concerns: to echo to the student what the student wanted to hear and to do this in a way that would keep himself also 'looking good' in the eyes of his staff colleagues. His mind was blank and his own voice was silenced.

It is everywhere acknowledged that beginning teaching is a deeply challenging experience. The new teacher is struggling to maintain and develop a sense of herself or himself as a legitimate member of the profession, very often in the face of (at least apparently) hostile pupils and with a felt need to become established in the eyes and under the judgement of significant others. The beginning teacher is likely sometimes to feel thoroughly threatened by such experiences. Both the critiques of others and also unpleasant classroom events are likely to provoke a perspective of *silence*, which perspective, of course, provides no defence against either.

It seems at least plausible that beginning teachers of *mathematics* are particularly likely to be prone to experiencing the perspective of *silence*. Knowledge of mathematics itself is commonly perceived as being based upon the authority of others, such a perception extending from those of our pupils who ask 'Is it an add, miss?' (Brown and Kuckemann 1976) to University professors of mathematics.

A common cause for concern is that there is far too much emphasis on self-discovery rather than the presentation of material as a body of knowledge. Such knowledge is the culmination of the work of very smart people over a very long period of time. It is laughable that pupils can achieve mastery (*sic*) of such work through self-discovery.'

Professor Crighton, Head of the department of applied mathematics and theoretical physics at Cambridge University (Times Higher Education Supplement 1995, p6)

It also seems reasonable to suppose, therefore, that those who are drawn to the subject may typically be more comfortable with an epistemology based on external 'guarantees' and that such an epistemology will form part of the pervasive subject sub-culture found amongst student teachers (Lacey 1977, p58f and 63f). This would be congruent, for example, with the finding that mathematics PGCE students had an external orientation to their own professional learning, 'choosing to model their planning upon the work of others' (John 1991, p316), in contrast to some other subject specialists who tended to have an internal orientation and 'to view planning as a process of self guided discovery' (John 1991, p316). (See Burton 1992d for a discussion of subject culture within the secondary curriculum.) If these conjectures are correct, it would suggest that those entering mathematics teaching are also particularly prone to *silencing*, since a key feature in situations evoking this perspective is the presence of someone perceived as a significant authority figure who will make judgements about right and wrong.

(A useful comparison can be made with the 'panic' so eloquently described by the participants in a study of adults' experience of mathematics (Buxton 1981, especially p1-9) as a '[p]ushing the button that cuts out logic ... "mind in chaos" ... nothing is stable, information "topples out of the mind" ' (Buxton 1981, p4f).)

External Authority

The perspective of *external Authority* includes Perry's (1970) pre-relativist positions and corresponds to *received knowledge* and *procedural knowledge* from Belenky et al (1986). Within this perspective, authority is external to the self and lies with 'experts'. The voice of external Authority is heard and is not subjected to independent critical judgement. Meaning is taken as given and knowledge is assumed to be fixed and absolute rather than contextual and changeable. There is no sense of an inner voice to which heed might be paid. This epistemological position offers no defence against the conceptions, critiques, ideas and practices of significant others: indeed beginning teachers experiencing this perspective can be expected to seek out just such manifestations in order to know what to think and how to behave. Such an epistemological perspective offers strong support to the *status quo* whatever that happens to be, whether the voice of the tutor or of the mentor during training or, subsequently, the established view prevailing in the employing school. This means that, by definition, it is antithetical to working for change.

If we consider the mathematics classroom, the accepted practice is currently more likely to be 'school maths' than 'inquiry maths'

Learning as forced activity is found in 'standard' teaching, leaving no space or freedom open to the students ... A mathematical textbook is usually a carefully elaborated sequence of orders and commands, reflecting the commands put forward in the curriculum and made audible by the teacher. The classroom becomes a drill ground. The textbook may contain an attempt to motivate by giving fascinating examples and exercises, but the students are not invited to take any decisions concerning the direction of the learning process. The students' intentions are not taken in to account. (Skovsmose 1994, p185)

Therefore the *external Authority* perspective will tend to lead to the adoption of 'school maths' rather than 'inquiry maths'. In addition, there is a strong internal epistemological link between this perspective and 'school maths' since the way of knowing experienced by the teacher is the same as the epistemological position demanded from the pupil. An epistemology based on *external Authority* does not preclude the possibility of, for example, 'doing investigations' where this is an accepted part of pedagogic practice; but it invites understanding such work as a new area of content to be 'mastered' (*sic*), a new set of rules to be learnt, a new set of (given) strategies to be acquired. (See Love 1988 for a critique.) The relationship between an *external Authority* perspective and a particular view of mathematics teaching is elaborated further in Chapter 10.

(It seems that this epistemological perspective may be widespread amongst teachers of mathematics. The second cohort represented in this study also contributed to a review of personal skills and qualities possessed and/or desired by them as relevant to the job of teaching. The only aspects of their ability to work with others that these post-graduates felt satisfied with when they began the course were 'co-operation with a boss, taking orders' and 'tact, diplomacy, politeness' (Payne 1991). Their education thus far had equipped them to submit to authority in ways of behaving: it seems not unreasonable to suppose that for many this would extend to ways of knowing.)

Internal Authority

The perspective of *internal Authority* is that held by Perry's (1970) young men who maintained, 'Everyone has a right to his own opinion' and it corresponds to the *subjective knowledge* of Belenky et al (1986). Here external authority is not accepted but the voice of Authority is still heard. This way of knowing is still bounded by Authority which provides Absolute right answers but now the Authority is the self. This internal authority is listened to but it is not subjected to independent critical judgement and the knower is

unwilling to submit to the analytical judgement of others. This perspective can make the knower impatient of dialogue. If *internal Authority* vouches for the truth and the truth is known directly by the knower, what purpose is served by discussion, debate, analysis and the exchange of ideas?

The strength of this perspective lies in its affirmation of the self but it provides little protection against unpleasant classroom events. This is because it does not support 'seeing things from the other person's point of view'. There is no theoretical perspective from which to understand the apparently hostile behaviour of others which is therefore likely to be both personalised and misunderstood. Hurt and bafflement are likely to precipitate a retreat into the *status quo*, in this case 'school maths'. The perspective of *internal Authority* does not have a strong epistemological link with either 'school maths' or 'inquiry maths' because it does not encourage the consideration of the epistemological claims of others. However, in its reluctance to engage in critical debate with others, it is unlikely to foster a critical stance in pupils, an essential goal for an 'inquiry maths' approach and, as I shall contend below, fundamental to an emancipatory curriculum.

Authority of self and reason

The perspective of *authority of self and reason* is that of Perry's (1970) *relativist knowers* and of the *constructed knower* of Belenky et al (1986). External sources of authority are listened to and evaluated as is the internal voice. Both external and internal authority are subjected to independent critical judgement. Knowledge is understood to be constructed and meaning to be negotiated; they are contingent and contextual and personal in the sense that they reflect the positionings of the knower. In this sense, reason itself is not innocent. This epistemological perspective permits an understanding of how power relations shape what it is possible to think and to say. It is therefore able to comprehend a critique of contemporary gender relations in particular and unequal relations in general that the other

epistemological perspectives cannot. It is able to stand outside received frameworks and to acknowledge the existence of hegemonic discourse and justificatory myths (Powell and Solity 1990). It allows the recognition that,

Some of the representations of dominant groups are likely to be labelled as self-evident, and put to use to enforce conformity, put a subject beyond dispute, and deal with ambiguous and anomalous events. These representations will be prime targets for those who want to criticise, change or demolish the reigning social order. (Restivo 1992, p125)

It is in this sense an emancipatory epistemology.

In addition, there is a strong epistemological link between this perspective and that of 'inquiry maths' because the way of knowing demanded in that context from the pupil is congruent with the way of knowing of the teacher. It does not preclude the teacher choosing to teach 'school maths'. It is not uncommon, for example, for teachers working within this perspective to see part of their task as being to ensure the best possible external certification for their pupils. There is no epistemological reason why they should not consider a 'school maths' approach most likely to yield results: the decision in this case would be a pragmatic one and it would make sense to share the decision and the grounds for taking it with the pupils. However, an 'inquiry maths' approach would be the natural outcome if the teacher was interested in developing the pupils' mathematical thinking. In this sense, such a perspective would currently imply working for change to prevailing practice.

Lastly, this is the only one of the perspectives that provides a teacher with both an experiential and a logical impulse to respect the school students with whom they work. The students carry authority of a kind within them: the teacher and the student meet as

epistemological equals and therefore need to work together to comprehend the world and to forge more adequate representations of it.

In all these ways, then, the knower whose epistemology is based on the *authority of self and reason* is encouraged to look for change to prevalent practices in contemporary schooling and to the taken-for-granted norms of many mathematics classrooms, to de-nature the present and to re-vision and re-envision the future (Kenway et al 1994, p202). Working for change is never easy (see, for example, Rudduck 1994, Weiner 1994) and will be particularly difficult for a beginning teacher: nevertheless, this epistemological perspective allows a critical distance to be maintained between the critiques of others and the painful experience of unpleasant classroom events. It therefore opens up the possibility of retaining an independent view of the nature and purposes of schooling in general and mathematics education in particular.

Further characteristics of the model

The model is not developmental for reasons outlined below but it is hierarchical. There are two reasons for this. First, the way of knowing that I have called the position of *authority of self and reason* allows the possibility that the knower can comprehend the other positions whereas this is not so in reverse (cf Perry's model). Second, there is a *moral* hierarchy involved. *Silence* does not allow the knower to be an actor in the sense of consciously choosing what to do and of investing her actions with meaning, essential to a moral act. Knowing based on *external* or *internal Authority* allows the possibility of action and moral choice but the moral framework within which such choices are made is perceived as given rather than constructed. The position of *authority of self and reason* allows independent critical judgement and grants and demands responsibility for the moral framework as well as the individual choices and actions themselves.

The model is not intended to be developmental although there will be links, transitions, interconnections between the epistemologies, and later chapters will explore the pedagogical implications of a commitment to inculcating the perspective of *authority of self and reason*. I embrace the view that an individual may have different ways of knowing about different aspects of their lives or have different ways of knowing about the same aspect of their lives at different times; that some movement back and forth between the perspectives is characteristic of human knowing; and that, because our lives become fragmented by both the social institutions and the discourses with and within which we interact, we can and do hold different perspectives on the same things at the same time until an opportunity comes to reintegrate (temporarily) our knowing as we reconstruct ourselves. (I invite the reader to verify this through introspection but see also, for example, Weiler 1988, Norquay 1990, Walkerdine 1990, Foucault 1991 especially chapter 3.3.) The more fragile our hold on the *authority of self and reason*, the more likely is the retreat to Authority or silence. Advancement through the hierarchy is not once-and-for-all, but it will be argued that different pedagogical practices promote or retard such movement.

Finally it should be noted that the model is not intended only to present ways of knowing as abstract, cognitive structures. Attention has been drawn above to the moral dimension of each of the perspectives: here I want to underline that there are *affective* aspects to each perspective. *Silence* is accompanied by fear, loss of a sense of agency and feelings of powerlessness. Although *external Authority* allows the knower at a surface level to be the author of acts, it is a perspective which militates against feelings of autonomy and authorship. The knower is deeply dependent on others, especially authoritative others. It too can be a fearful position because the knower, not having an internal authoritative framework to underwrite and give meaning to her acts, has nothing to protect herself from the hostile criticism of 'experts' whose word she must accept. The perspective fosters the

desire for safety and caution and engenders feelings of constraint. The knower is not free. The perspective of *internal Authority* allows the knower authorship and control and a sense of authority and personal validation. Because the knower is not concerned with the states of mind of others, however, it implies feelings of separation and isolation. Because she cannot readily understand the acts of others from their perspective, acts of hostility are particularly painful and the actions of others lead to feelings of confusion and vulnerability. The perspective of *authority of self and reason* offers the possibility of combining authorship with empathy. Although such a knower may be lonely, she will not be isolated and may have the opportunity to experience 'the joy attendant upon intimacy with an idea' (Belenky et al 1986, p102). Such joy, when experienced, provides the teacher with the affective motivation to pursue engagement in emancipatory education.

The model explored

In this chapter I shall explore further the theoretical links between an epistemology based on the authority of self and reason and an emancipatory curriculum. I consider the educational implications of the model of ways of knowing constructed in the previous chapter, noting that the ways of knowing available to pupils (in school) are constrained by the epistemological stance of their teachers and by the kinds of knowing that those teachers construct as feasible and possible.

An emancipatory curriculum

An emancipatory curriculum is one in which the teacher seeks to empower the learners with whom she works, both *qua* learners and also as critical citizens within a democracy, where empowerment is taken to mean developing democratic social forms that enlarge and enhance those individual capacities which lend themselves to individual autonomy and collective responsibility and freedom (Giroux and Freire, 1988, pxiv). It is a curriculum of which a fundamental purpose is the promoting of learners who are 'informed and critical readers of their life worlds and ... informed and visionary agents and advocates for a better world' (Kenway et al 1994, p201). A commitment to social justice in education is more than a question of equality of distribution (for example, universal secondary education or economic support for access to higher education); it involves a participatory and counter-hegemonic curriculum and an awareness of the historical production of (in)equality

(Connell 1992). In order to teach the acceptance of inequality, 'schools must be the sites of differentiation, of fragmentation, or of dominance' (Davies 1992, p128); in order to teach its rejection, they must become sites of collaboration, dignity and respect.

The notion of a teacher seeking to pursue an emancipatory curriculum, a radical teacher, embraces but extends beyond that of progressive educator, following here Paul Ernest's use of the term (Ernest 1991, p181ff). Within a progressive ideology, the learner has responsibility for her own learning; the learning is involving and participatory; the teacher becomes a facilitator; the teaching is designed not only to enhance knowledge but also to change the learner; and affective as well as cognitive aspects of learning are respected (Brandes and Ginnis, 1986). The first cluster of attributes, then, that a radical teacher seeks to develop in her students are autonomy, independence, personal authority, choice, responsibility. For the progressive mathematics teacher, the aim of mathematical education is the development of the learners' creativity and their realization of self through autonomous enquiry within mathematics. Consequently, the emphasis is on the *processes* involved in the work that students do. Within the educational ideology of progressive mathematics educators,

[t]he processes of mathematical problem solving and investigating, such as generalizing, conjecturing, abstracting, symbolizing, structuring and justifying, figure more prominently than the specification of mathematical content. (Ernest 1991, p191)

The radical teacher endeavours to create a context in which the learners feel a sense of authorship of and control over their mathematics; the mathematics is personal in the sense of being personally directed and chosen; and both thinking and feeling are recognised as contributing to (or hindering) learning.

But the idea of the radical teacher includes more than this. It involves recognising and challenging the unequal power relationships behind

the "banking" concept of education, in which the scope of action allowed to the students extends only as far as receiving, filing and storing deposits ... [where] knowledge is a gift bestowed by those who consider themselves knowledgeable upon those whom they consider know nothing. (Freire 1972, p46)

Because we live in an unequal world, unequal in terms of power, opportunities, access to resources and so on, a curriculum based on transmitting received knowledge is oppressive: it gives no opportunity for challenging the (unequal) *status quo*.

The transmission model of teaching, in a traditional formal classroom ... is the opposite of what we need to produce learners who can think critically, synthesise and transform, experiment and create. We need a flexible curriculum, active co-operative forms of learning, opportunities for pupils to talk through the knowledge which they are incorporating. (Gipps 1993, p40)

An emancipatory curriculum involves helping students become aware that who is considered knowledgeable and who is not reflect the social positions and power of the knower, that '[t]here are numerous hidden and uncritically accepted assumptions ... about human nature and the natural world ... [that] legitimate ways of experiencing and comprehending reality' (Restivo 1983, p130). This suggests a pedagogy which emphasises questioning, decision making, negotiation, discussion, recognition of difference and respect for multiple ways of knowing. All of these imply that the teacher is attempting to foster in herself and in her pupils an epistemology based on the authority of self and reason: *self* because the student is at the centre of the decision making process and *reason* because the decisions are made in a culture of questioning, discussing, analysing,

negotiating. Of course, neither of these terms can any longer be regarded as unproblematic.

All human ideas are situated. Thus there is no neutral, universal reason available as an arbiter of truth or knowledge. Similarly, there is no empirical, knowable object called the 'self' waiting to be discovered or observed. (Griffiths 1995, p227)

The *reason* of this epistemological position is not that of 'western rationality' (Walkerdine 1994, p74) with its accompanying fantasy ' "Reason's dream", a dream of an ordered universe where things once proved stay proved forever' (Walkerdine 1994, p74). It is a reason which permits, for example, metaphoric thinking, that acknowledges that knowledge is contextual and not universal (see Walkerdine 1988, especially p183-201, for a discussion of these attributes and 'western rationality'); a reason that is interwoven with emotive thought (Belenky et al 1986, p134) rather than distanced from it; and, crucially, a reason that attempts to integrate personal knowledge with the knowledge of others. It recognises and embraces the need for negotiating shared meaning and for constructing 'argument' in a multiplicity of ways, attempting to interrupt the objectification, the formality and the combativity of 'Reason' and helping one remain 'paradoxically aware of one's complicity in that which one critiques' (Lather 1991, p10).

The *self* is understood as constructed and reconstructed, not essentialised. It is 'best understood as a subjectivity produced within the discourses in which it is positioned *and positions itself*' (Griffiths 1995, p227, my emphasis). Emancipatory thinking requires the retention of agency and the possibility of the individual as an active participant in the (social) construction of meaning. Thus the need for

[t]he active nature of students' participation in the learning process ... This means that the transmission modes of pedagogy must be replaced by classroom social relationships in which students are able to challenge, engage, and question the form and substance of the learning process. Hence, classroom relations must be structured to give students the opportunity to both produce as well as criticise classroom meanings ... knowing must be seen as more than a matter of learning a given body of knowledge; it must be seen as a critical engagement (Giroux 1983, p203)

It requires the teacher to develop an epistemology that permits an understanding of how power relations shape what it is possible to say and think, since 'our basic assumptions about the nature of truth and reality and the origins of knowledge shape the way we see the world and *ourselves as participants in it*' (Belenky et al 1986, p3, my emphasis).

The authority of this epistemological perspective cannot be that of *internal Authority* where knowledge is *only* personal and not also social, where there is no need/reason to negotiate meaning with others nor to respect their knowledge and their way of knowing. In an emancipatory curriculum, the acquisition of knowledge is

not limited pedagogically to students exercising self-reflection but opened up as a race, gender and class specific construct to include the diverse ways in which students' experiences and identities have been constituted in different historical and social formations [... offering] students the opportunity to read the world differently, resist the abuse of power and privilege, and construct alternative democratic communities. (Giroux, 1992, p75)

Teachers and students begin to understand *themselves* as located in and by a variety of positions, experiencing a pedagogy which develops the critical capacity to challenge, to find one's own voice, to take risks, which allows for the possibility of hope. Each of these

encourages the capacity to see beyond the world as it is (an essential component in devising a plan for what the world might be) and to understand that knowledge is social as well as personal, that 'all knowledge claims are socially constructed and rooted in social interests' (Restivo 1983, p147). Such a pedagogy will also encourage the students to respect the affective side of the learning process: they will be involved in the production of and have an investment in passion, will feel and come to respect joy, frustration and pain.

(Although I write here about the irredeemably social nature of knowledge and accept that concepts 'are not *merely* social products, they are *constitutively* social' (Restivo 1994, p2), I am not asking the reader to accept that 'it is social worlds or communities that think, not individuals ... individuals are *vehicles* for expressing the thoughts of communities or "thought collectives" ... *minds are social structures*' (Restivo 1994, p2f). This is not because (thus far) I reject such a notion but rather because I do not (yet) comprehend it adequately; nor do I understand what the implications of such a view would be for human agency and thus for emancipatory action in the mathematics classroom.)

An emancipatory pedagogy is also not compatible with *external Authority*, where there is a Right way of thinking and just one right way of thinking, an answer and just one right answer to every question. If they are to see beyond the taken-for-granted, to see the possibility of themselves being transformative individuals, the learners need to understand the socially constructed and therefore unguaranteed nature of their knowledge. From this perspective, knowledge is held tentatively albeit with commitment. It is necessary to be able to sustain the paradox of understanding the constructed and contingent nature of knowledge on the one hand with the capacity to be committed on the other (Perry, 1970). Belenky et al (1986) in their study of women found a pattern of such development being dependent upon and flourishing as a result of sustained discussion over time with sympathetic peers. It seems likely that much of the same pattern of development will be

true of other learners who are not part of the hegemonic group and who have to struggle to find an authentic voice. Such a voice is not developed on the basis of external authority. An emancipatory curriculum, then, depends upon 'an epistemic strategy that recognises consciousness as a complex, multi-layered, multi-dimensional phenomenon ... [a strategy] not based on any claims about ultimate truths ... not clothed in guarantees of any kind' (Restivo 1983, p140f).

Implications for the mathematics classroom

The way of knowing that I have described as based on the *authority of self and reason* asserts that knowledge is constructed by the knower. Such a view of knowledge is widespread within the writings of the mathematics education community, albeit not much exemplified in the learning of mathematics from nursery to university. There is considerable philosophical debate within the mathematics education literature about what a full statement of such a constructivist perspective might mean and I do not intend to review this discussion here. (For an argument for radical constructivism, see von Glasersfeld 1990; for a comparison between radical constructivism and 'moderate' constructivism, see Goldin 1990; for an elaboration of social constructivism, see Ernest 1991. See Jaworski 1994, p14-35 for a useful review and p206-213 for a discussion of contemporary issues. See Lerman 1994 for a recent critique.) Neither is my concern here to argue that mathematics classrooms where practice is based on such a perspective are more effective in promoting mathematical learning (although I do believe this and most of the authors quoted in this chapter believe so too). My concern is with the links between constructivism and an emancipatory epistemology.

In this chapter I shall describe what I have called 'inquiry mathematics', (following Cobb, Wood, Yackel and McNeal 1992), indicating how such practice is embedded in a constructivist epistemology. It is to be contrasted with 'school mathematics' which has an

entrenched position in mainstream contemporary Western culture. 'School mathematics' rests on a taken-for-granted understanding of the nature of mathematical knowledge which accords it the status of absolute truth. The truths of mathematics are certain and unchallengeable, are 'objective', given and unchangeable. Mathematics is free of moral and human values and its social and historical placings are irrelevant to its claim to truth. (For a fuller description and a philosophical critique of this position, see Ernest 1991, chapters 1.1 and 1.2.) In a classroom where the agenda is 'school maths', the teacher will 'constitute mathematics as the activity of following procedural instructions' (Cobb et al 1992, p573). These procedures are regarded as 'ahistorical, unalterable norms that [do] not have a specifiable source ... [they are] both fixed and self-evident' (Cobb et al 1992, p588f).

'Inquiry maths', by contrast, is based on a view of mathematics as being 'co-constructed' (Cobb et al 1992, p573) by teachers and students, a product of the human mind and, consequently, historically located, influenced by the knower and mutable. I shall attempt to draw out those characteristics of a mathematics classroom where learning is predicated upon a constructivist perspective which link such a classroom to an emancipatory culture.

Learners make the mathematics

A teacher accepting a constructivist perspective will start from the premise that 'the learner is not *given* knowledge, but actively constructs it herself' (Jaworski 1988, p292). What is to be learned is not already pre-located in the teacher's head waiting (simply!) to be transferred to the learner's. Borrowing Seymour Papert's image, the task is not, as in a fantasy poetry lesson, to undertake an investigation to uncover that 'Mary had a little lamb' but to be involved in a personal and creative act (Papert 1972, p236). Learning is the continuous process of making sense of experience rather than the absorption of pre-determined mathematical knowledge and therefore 'teaching is seen as the provision of

opportunity to make sense and encounter constraints rather than to convey knowledge' (Jaworski 1988, p296). The notion of critique is fundamental to emancipatory mathematics education; to critique is to perform an act and the capacity to do so cannot be developed in school unless the learner takes some responsibility for the learning process.

This is in contrast to the transmission model of learning which envisages items of content (or correct strategies reified as content), pre-defined and non-negotiable, being 'delivered' to the head of the learner, reinforcing 'teachers' allegiance to limited bodies of content... enshrined as ritual' (Noss and Dowling 1990, p2). In this 'banking' (Freire 1972, p46) mathematics, knowledge is seen as hierarchical, the teacher's mental models are superior to the learner's and education becomes the process of implanting those models in the mind of the learner. As Leone Burton has pointed out, such a view of mathematics is not emancipatory. Rather it makes the subject attractive to the hegemonic group.

Ultimately, hierarchy is about the use and abuse of power so it is not surprising that the discipline of mathematics is more attractive to European, middle-class males, the dominant and powerful group in society. (Burton 1993a, p5)

Because learner enquiry and the construction of meaning are valued rather than knowledge of theorems or the representation of formal proofs, teaching based on a constructivist perspective 'shifts the focus from teacher delivery of "knowns" to learner investigation of "unknowns" '(Burton 1992a, p2). The agenda for learning is changed, opening up the possibility of an emancipatory mathematics curriculum. I write 'opens up the possibility' rather than 'requires'. Although the epistemology that I have described as based on *authority of self and reason* is strongly linked theoretically to an emancipatory curriculum, it does not by any means guarantee it: an individual must still take responsibility for their own moral agency and accept or deny a commitment to working for

change. Similarly, some writers about constructivism in mathematics seem ambivalent about where the authority is located upon which knowledge is based:

The traditional approach assumed that learning facts and algorithms would lead more or less naturally to successful application in appropriate situations. We are now quite sure that this is untrue. Constructivism says that we must help students develop more powerful ways of thinking. *We must give students "tools to think with"* - and these are not merely formulas and algorithms. They include concepts and powerful metaphors and heuristic procedures and understanding, including even a deeper understanding of oneself and one's own modes of learning and thinking. (Davis, Maher and Noddings 1990b, p188, my italics)

It is unclear whether or not for these writers the authority remains external to the learner, albeit that the teacher 'gives' mental constructs to the student rather than algorithms.

Meaning is negotiated

In classrooms organised from a perspective that mathematical knowledge is constructed by the knower, the negotiation of meaning is a central aspect of the learning process.

Mathematical meaning varies from one individual to another and communication depends upon the ability to share each other's meanings ... Discussion and negotiation in the classroom are vital, not only in terms of the mathematics which is superficially being considered, but in terms of the deep-rooted expectations and conventions which influence the mathematical stories being considered. (Jaworski 1988, p291f)

The process of constructing meaning for oneself is enabled and enhanced by trying to convey that meaning to others. 'When I was talking about the problem it explained itself to my head' (quoted in Splash 1992, p23). The mathematical language used in the

classroom is not 'pre-digested and non-negotiable' (Burton 1992b, p3) but, like mathematical knowledge, is conjectural. Although we construct our own meanings, '[w]e are not just solipsistic robots... We are constantly seeking resonance with ourselves and with others by expressing our stories and seeing what others make of them' (Mason 1988, p156). Teachers and learners together act as a 'community of validators' (Cobb et al 1992, p594). This talking is always potentially emancipatory.

Constructivists make a distinction between "really talking" and what they consider to be didactic talk in which the speaker's intention is to hold forth rather than to share ideas. In didactic talk, each participant may report experience, but there is no attempt among participants to join together to arrive at some new understanding. "Really talking" requires careful listening; it implies a mutually shared agreement that together you are creating the optimum setting so that half-baked or emergent ideas can grow. "Real talk" reaches deep into the experience of each participant; it also draws on the analytical abilities of each. (Belenky et al 1986, p144)

Respect for such talk is incompatible with a view of knowledge assured by external authority, the basis of 'school maths'. (It also questions validation lying *only* with the internal authority of self and not subjected to critical analysis, but such an epistemology of mathematics is rare.) Paul Cobb, Terry Wood, Erna Yackel and Betsy McNeal point out that, typically, 'teachers do not initiate and guide the explicit negotiation of routines of interpretation' (Cobb et al 1992, p590) whereas they found, in a classroom characterized as one of 'inquiry maths', that 'the classroom tradition was one in which the teacher and the children constituted mathematical truths in the course of their social interactions and that the acts of explaining and justifying were central to this process' (Cobb et al 1992, p592).

Because the emphasis is on the learners making meaning, it is counterproductive to break the subject down into 'easily digestible' bits or to break down general ideas into apparently unrelated stages. Techniques are learned in the context of solving problems and practised if they are found to be useful. Mathematical activities are sought which are rich in providing opportunities to speculate, to make and test hypotheses, to explain, reflect and interpret, to make decisions and to extend. (See Ahmed (1987), Trikett and Sulke (1988) for a discussion.) An atmosphere is generated within which problem posing is encouraged and problems can be re-posed, the linguistic assumptions hidden in their original formulation being questioned (Brown 1986). Such a problem posing pedagogy

represents a powerful emancipatory teaching approach, and when successfully implemented, empowers learners epistemologically ... it encourages active knowing and the creation of knowledge by the learners, and it legitimates that knowledge as mathematics. (Ernest 1991, p291)

Because meaning is actively constructed by the learner and because such meaning making is fostered by dialogue, emphasis is placed on collaboration and working in groups (with their emancipatory potential) rather than on individual performance and competition.

Difference and the individual are respected

If each of us constructs our own meaning in mathematics, then each person's meaning has a right to be heard, shared, considered. In the 'school maths' classroom analysed by Cobb et al, '[e]very challenge identified was made by the teacher, and, in this sense, she acted as the sole validator of what could count as legitimate mathematical activity' (Cobb et al 1992, p587). They note that 'teaching as it is typically conceptualized does not acknowledge the plurality of possible interpretations that students might make' (Cobb et al 1992, p590). 'Inquiry mathematics' implies recognition of difference and respect for multiple ways of experiencing mathematics and its interactions with the world of each

learner; the implications of social context for the knower are recognised. (For a challenging interpretation of what this means, see Fasheh 1991.)

Where difference is respected, where the authors of knowledge are recognised as such, where each person's knowledge is valued, a climate exists within which the growth of confidence and self-esteem is encouraged. Where each person's learning is validated, this growth is also away from dependence and towards autonomy and self respect. 'School maths', with its content-driven, hierarchically organised agenda and frequently test-dominated assessment (Burton 1993a, p10), is antithetical to the development of self-esteem in any but those whose thinking conforms to the hegemonic discourse and who are successful in closed and predictable outcomes. Where genuineness and respect inform classroom relationships, pupils sense of their self worth is enhanced (Charlton and Hunt 1993); such a sense of self worth is fundamental to providing equal opportunities and in working towards the development of transformative individuals.

This also raises for me the (unresearched) question of discipline and control. It seems a reasonable conjecture, and I had hints from my research that it was so, that the need/desire for a tightly controlled classroom militates against 'inquiry mathematics'. A teacher for whom orderliness, quiet and the outward signs of industry are of paramount importance is unlikely to allow effectively for either independence or difference. It may be that at times for some teachers the personal need for control and the personal threat from disorder and indiscipline are great enough to obliterate equal opportunities from their agenda. (See Breen (1990) for a discussion.) One of the most committed to and effective on gender issues of the teachers I have known told the class she was teaching that she was not going to deal with the bad behaviour of the boys; this would release time for constructive mathematical work with the girls. I do not know if this is a sensible strategy: what I do know is that most of us would not have the courage to try it.

'Inquiry mathematics', then, is embedded in an epistemological perspective based on the authority of self and reason, one which can 'keep us alive to the possibility of something new under the sun' (Restivo 1992, p100). Such an epistemology is a *logical* prerequisite for emancipatory education although I wish neither to argue that it is a *sine qua non* for emancipatory commitment and practice nor that it guarantees, either logically or in actuality, such commitment and practice. As well as rational thought and intentions, myths and metaphors affect how we think and what we do, what we believe and how we act. However, an epistemology based on the authority of self and reason opens up the possibility of challenging the 'personal fatalism ... servility ...[and] negative self-esteem' (Skovsmore 1994, p189) engendered by 'school maths'. Both 'inquiry maths', then, and an epistemology based on the authority of self and reason are linked to an emancipatory mathematics curriculum; and this in turn is necessary if we are to provide equal opportunities with respect to gender in mathematics classrooms.

I conclude with an illustration of this interconnectedness, referring to the literature on equal opportunities, gender and mathematics which is the issue with which this study began. Zelda Isaacson has given an account of working with women returning to mathematics. She lists the (successful) strategies that she used to promote their learning and draws some conclusions about the sorts of places mathematics classrooms need to be if the mathematical learning of girls is to be enhanced.

[T]he key strategies... were: to encourage group work and discussion; to provide structured investigative activities; to legitimate the women's "common sense" knowledge and give them confidence in their ability to learn new mathematics ... Mathematics classrooms need to become places where originality, independent and creative thinking and imagination are valued. Individual's contributions and ideas must be welcomed, not rejected. Common-sense

knowledge should be validated and built upon ... [They] need to be places where talk is encouraged and where collaborative, co-operative work is the norm. (Isaacson 1990, p21 and 26)

In such a mathematics classroom, critical education is a possibility.

The model exemplified: teachers working for change

I have outlined a model for understanding different ways of knowing which I claim are found amongst teacher education students and (new) teachers and I have argued that there are theoretical links connecting epistemology and emancipatory education which offer an explanatory rationale for the perpetuation of inequality in and by mathematics classrooms. I offer here data from Phase three which exemplify the model.

In their development the data and the model influenced one another reciprocally, the model emerging from my experiencing and thinking about the data, both as they were collected and as they were re-read or listened to again and transcribed. After the model was constructed, I analysed the data in detail with the model in mind, looking for material which would illustrate it or challenge it. The data in this chapter are offered in this spirit. Because of the decision which I took to base Phase three data collection on teachers whom I anticipated would be attempting to offer equal opportunities in their classrooms (see Chapter 8), their perspectives figure largely in this chapter. It is their epistemologies, interpersonal frameworks, pedagogies and histories which form the narrative of the chapter. Glimpses of other teachers and other epistemological perspectives occurred and I have attempted to record these, either contemporaneously or retrospectively. However that process has been haphazard and unsystematic. I have therefore employed the device of introducing this subsidiary information as an aside when it contrasts with or in some other way offers a commentary on the main narrative: the main narrative can be read independently of these insertions. I have used a

typographical device in order to keep the reader alert to the fact that these other data are insubstantial and sometimes accidental: these interventions are presented in italic script. In using this material, I have included not only those data which appear to be in tune with the model but also any evidence I found that might challenge it. In the latter case, I conjecture a resolution. These other students-becoming-teachers and the sources of the data are identified in Appendix 1.

Phase three data collection

Phase three of the research involved collecting data from three teachers whom I perceived as working for change. My intention was to seek to understand what makes and sustains such a teacher, a radical teacher, and to try to show something of how such a working life is lived. I began the process by seeking out teachers who I believed might fit into this category. I contacted John and Wayne from Phase two. I also contacted two other teachers who were working locally who had seemed when in training to espouse the sort of views I was interested in exploring and who, I had heard informally, were still committed to change. I visited each of the four in school (only seeing the two who were new to the study in their classrooms) and interviewed them there. I also tried to set up interviews which were extended, taking place in each case over a number of weeks and, where possible, at the teacher's home rather than in the school (see Cole 1985). At this stage, Wayne dropped out (although he agreed that the Phase two portrait was fair before doing so) and so does not feature as one of the case studies in this chapter. (I did, however, return to this curtailed data later after I had begun to elaborate a model of teachers' ways of knowing. It provided a (tentative) illustration of an epistemology that has only fragile connections with emancipatory practice.) The details of my contact varied between the remaining three and it is to these details that I now turn.

John

The first of my radical teachers was John whom I had visited during Phase two. It was now nearly two years later and John had fulfilled his intention of moving schools to one which had an overall philosophy closer to his own. I wrote to him there and asked if he would be willing

firstly to consider the portrait I had drawn of him and to offer me some feedback on it and secondly to participate in some further, extended interviewing. He replied promptly and said that he would be happy to do so.

I sent him the material that related to him from my initial analysis of Phase two, what I described as 'the "picture" that I made of you and your situation' (see Chapter 7), so that he would have a chance to read it before we met again. I told him that I wanted to know about the things that I had got just plain wrong but that I also wanted his response to the interpretation that I had put on things. There was only one small thing that needed clarifying (was I suggesting that he had joined in the sexist joking at the departmental meeting?). Apart from that, he had found the portrait fair and was only concerned that I understand that *he* might be mistaken about things.

[what I have to say], it depends on what sort of a day I've had, on how I'm feeling at the time so it's very difficult to be completely and utterly honest about things ... different people may give a completely different picture, just talking to one person you just get one person's opinion ... it does ring true, there's nothing there I wouldn't agree with or that I think's a surprise. (transcribed from the tape)

I met John on six occasions, once very briefly in his new school and then five times at his home during the early evening. I used a semi-structured approach to the interviewing. The schedules I used are attached in Appendix 10. In each case before we met I sent John a copy of the questions that I expected to guide us in our next discussion. We often did not cover all this material and I then included what remained in the next list. All our sessions were tape recorded. After I had finished all the data collection for Phase three, I listened to the tapes and then produced edited transcripts, including all material in the transcript that I thought might have any bearing on what had made John the teacher he was and on what sustained him (see Appendix 11).

Frances

Frances was at the end of the second term in her first year of teaching when I contacted her. She was a two year PGCE student and I had worked with her during both her mathematics year and her professional year. I had seen her in the middle of the autumn term when she had called into the Mathematics Centre for a chat and had found me there so I knew that, at that stage, she was as committed as ever to change in mathematics classrooms. I wrote to her explaining that I was interested in finding out what beginning teaching had been like for her, both generally and with respect to equal opportunities issues; that I would like to spend a day with her in school seeing her teach and talking to her head of department and the senior member of staff responsible for new teachers; that I would like to interview her about this; and that I would like to do two or three follow-up interviews exploring her personal history and her ideas about knowing and about learning (Appendix 9).

She, too, readily agreed, despite the fact that 'on a recent INSET day for NQTs ... we all unanimously agreed that the worst thing that could happen would be for a tutor to come into our classroom and see how badly we were doing'. She wrote, 'It will be really nice to ... talk about this strange and horribly difficult job' (personal correspondence). The visit to school went as planned and I saw her subsequently on three occasions, each time for an extended interview in her home during the middle evening. I followed the same procedures as I had with John. The schedules used are attached in Appendix 10 and the edited transcripts in Appendix 11.

Matthew

Matthew was at the end of his second year of teaching when I contacted him with a similar proposal to the one I had made to Frances. He too agreed and I visited his school and saw him teach. I interviewed the senior member of staff with responsibility for students but the head of department was absent. I was also able to interview Matthew during the school day. He made himself available at two different times, both sessions lasting over an hour. The first time I made notes of the interview and checked them and wrote them up that day. The second

time I was able to tape record what was said. I interviewed Matthew on one subsequent occasion, also in school, and again this was tape recorded. There were some practical difficulties and constraints in organising the interviews and he did not have the schedule of questions (Appendix 10) to read each time before we met. As with John and Frances, I made edited transcripts of the tapes after all the data collection for Phase three was complete and these edited transcripts are included as Appendix 11.

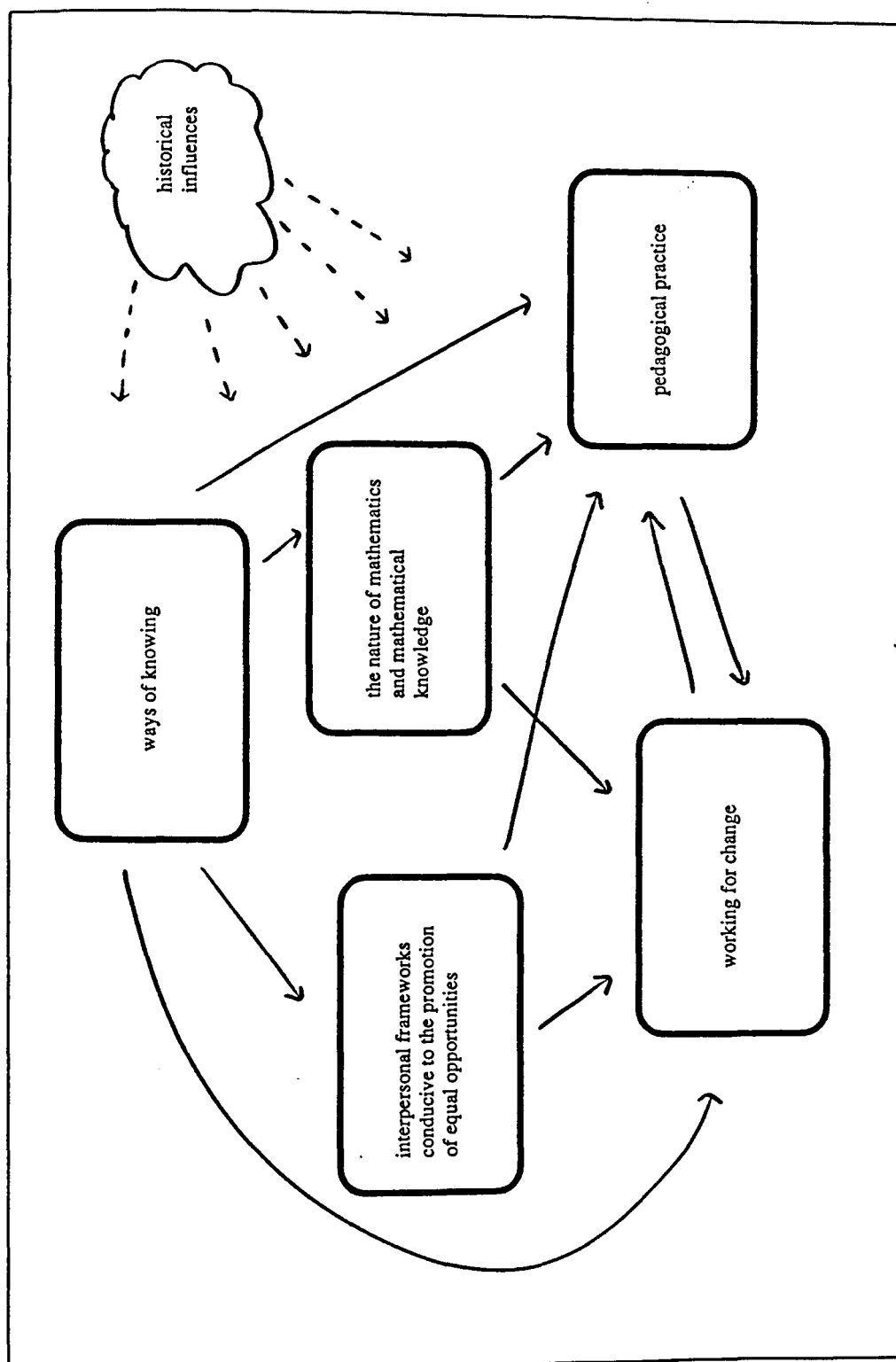
These, then, were the three students-becoming-teachers with whom I had contact that I characterise as teachers working for change. Figure 15: Data analysis structure for Phase three sets out the way in which I have grouped the data relating to these three new teachers and shows how these aspects of the data are interconnected. This sets the agenda for the rest of this chapter in which the data is used to flesh out the theoretical structure, to illustrate through the voices of the research participants how it is experienced. Unless otherwise stated, the quotations from John, Frances and Matthew are from the edited transcripts. Sources of data for the other contributors are given in Appendix 1.

Ways of knowing

Before I begin to consider the epistemological perspectives of John, Frances and Matthew, I place an important *caveat* on what follows. As I have explained elsewhere (Chapter 9), I do not claim that any of us is fixed into only one outlook, one world view, one epistemological perspective. I believe that it is characteristically human for us to be contradictory in our approach to and interpretation of the world. Experience and our reading of it are fragmentary. Nevertheless, certain activities (of which I believe long interviewing can be one) allow us temporarily to reintegrate those fragments and to offer our predominant view.

I have the feeling that this exercise has helped me more than
you (Frances, postcard received after the interviews)

Figure 15



Data analysis structure for Phase three

(And see John in Phase two, Chapter 7). The generalizations that follow are intended to relate to that predominance offered under such reintegration rather than in some unproblematic sense taken to be *always true* of any of the individuals involved in the research or other teachers anywhere.

With each of the three teachers working for change, the voice of the *authority of self and reason* could be heard. Each of them was able to speak confidently about making decisions for themselves: consulting others, seeking advice, reasoning things through but happy to accept themselves as the final arbiter. They were not afraid to make their own decisions and to take the consequences.

If it's something that's got a specific answer to, I just go and ask someone who I know's got the information that I want. For instance, am I supposed to be telling these kids that bar charts should have gaps or not? and then find out what other people are doing and then carry on doing what I was doing in the first place anyway [laughs] because it seems to me that that's much more sensible anyway (Matthew)

I was responsible for Y7, I knew what I wanted to do but I didn't feel very confident about discussing it with the head of department because I thought he probably wouldn't agree with it, so I just said I'm in charge of Y7 and did it anyway, just keeping him informed (John)

A lot of it's [laughs] making mistakes and thinking hell I'm going to have learn to do this better ... I've got to find some better methods of recording what is happening in my lessons because there are instances when you get a really clear view that somebody's sorted something out ... I've got to find a way (Frances)

This authoritative voice was not experienced by other new teachers.

Amy [wrote the exam that my year 9 had to take]. There were points I didn't agree on but I sort of backed down because I'm not very good at asserting myself [laughs] (Beth)

The teachers working for change would seek information from others to help in the decision making process.

I always ask someone [if it's about school]. I suppose I'd ask them and they'd give me their answer and I might discuss it a bit, and then I'd go away and think about it and then I might get back to them because I'd have to sort of yeah sort of assimilate it and compare it with all sorts of other ideas and things
(Frances)

on points of information, what I call a technical question really, [I] look it up in a book or whatever, [and then use] somebody else, [like] how far on the national curriculum are they, the mark for a piece of coursework ... In terms of wider questions which aren't technical ... I wouldn't go and ask somebody ... I would have to think very carefully about what I thought about it in the first place, the issues, so with something like that I would be starting from not having a particularly fixed position, and I'd want to hear what other people have to say (Matthew)

With the other teachers there was less sense of them recognising that consulted sources might differ or that they themselves would necessarily be involved in judgement whether or not this happened.

*Ask a colleague or several colleagues. Refer to the literature
(Simon)*

Look it up in a book, or ask one of my colleagues. I would try the former first as pride stops me from showing weakness ... If sources disagree then I would weigh the evidence and try to make an informed decision as an intelligent person (Kevin)

The teachers working for change valued the process of discussion and debate as one in which they were able to shape their own perspective. They were not fearful or ashamed actively to search out others to consult, seeming to see themselves as being part of a meaning making community.

Me and Chloe talk a hell of a lot, we're not discussing some decision we have to make but we are discussing something we're doing, something we're in the middle of (John)

I imagine I'd have lots of discussions with everybody in the department but particularly with people who I felt were closer to me in terms of the way that I'd be looking at it ... I would go and talk to people I knew politically who are nothing to do with teaching about what they think as well, and try and step outside it (Matthew)

The LEA days were brilliant because I spent all the time talking to [people who had been on the course with me] ... There's no doubt that in the end that's where your support comes from (Frances)

John illustrated the instability of authority of self and reason and the tendency to seek *external*

Authority as a guarantee, either the external authority of other individuals:

Well I sometimes find myself being fooled [laughs] by that kind of thing, where I would ask one person, I would be discussing something with one person and they'd put forward their view point and I think that sounds reasonable, and then I'd go and speak to somebody else and they'd say hmm I wouldn't do it like that and then I have difficulty in thinking, well, which one is right. I agreed with that person and now I'm agreeing with this person, what do I believe? I sometimes have difficulty with that as well, actually knowing which of those two people's advice I should follow ... (John)

or the authority of a doctrine:

... sometimes I feel to myself thinking which one should I agree with, I mean which one's the socialist and which one's ... (John)

but he was able to return to his own authority and concluded:

... but that's not always a good way to decide. Probably I'd think about it myself and come up with a third alternative, and it

may be the alternative that I thought of in the first place if you know what I mean. It might be that speaking to two people about it would, I'd probably end up adapting it a bit and getting a mixture of what I first thought and what the other two people said (John)

Beth, on the other hand, seemed to require that external Authority define her task for her: she did not seem pleased with a freedom that the teachers working for change might have enjoyed and she seemed to wish to believe that the constraint she sought (but did not find) was a given of schooling.

the year 9 and year 10 top set work is purely in Amy and Dick's heads, it's not written down anywhere so I didn't have any overview of the year before the year started. Like before my first term I sat down with Dick and he said here are some good topics you can start with, but I was working in terms of a month by month you know and so I never actually knew what had to fit in in what time, and it seemed pretty haphazard. I mean they've now put it all together in a year 9 scheme of work but it's all very general ... And I think I was thrown in in the deep end. I suppose this year the reason I haven't done many of the things that I think are innovative or creative is because I've had to prepare every single lesson for my year 9 and year 10 top and that's like 8 lessons a week and that's like all Sunday gone ... I think some time on the course could be spent on things like ... how you can use [a set text], there was no guidance on following schemes of work that were already written and to be honest that's what you get when you get into school really (Beth)

Each of the teachers working for change was able to see developments in their own thinking over time and was not troubled by the fact that their opinions could change, that they lived in an intellectual world without absolutes.

In contrast, when urged by her university tutor to keep an open mind about educational issues at the same time as being committed to a provisional framework for action, Sara said

How can I keep an open mind? I'll just be convinced by who ever spoke to me last (Sara, reported to me shortly afterwards and noted down retrospectively)

Indeed, they seemed to take pleasure in such changes in their own thinking and viewed them positively. When Matthew was asked what had stayed with him from the course, his immediate response was 'the stuff about reflecting on the learning experience'. Such development was well regarded by them and they felt confident that being wrong and changing one's mind were a fundamental part of the process.

I might change my mind afterwards and change things but I don't worry about them, once I've made a decision I don't feel I have to stick to it, if it's wrong it's wrong (John)

but then I've changed my mind about so many things to do with maths that maybe I'm going to change my mind about that one as well (Frances)

I used to say very flippant things like teachers are agents of the state ... I had to think it through, it's not as simple as that (Matthew)

going to university ... it probably made me a bit more open minded as well, it meant a lot to me, the discussions and the ideas from the Marxist lecturers. I really began to understand things, discussing ideas with other people and so on, and then being more open minded ... (John)

What I think today, and I might not think it tomorrow, is ... (Matthew)

but I do change my ideas on things a lot (Frances)

The multi-cultural elective and going to the non-attenders unit showed me different ways of looking at things (John)

All three of the new teachers thought it was important to try to see things from another's point of view and expected their own ideas to develop in consequence.

interestingly though I'm starting to come to an alternative point, not an alternative point of view ... which is interesting because that's not what I expected in terms of equal opportunities and gender the issues to be (Matthew)

Not to hold exactly the same point of view but to be able to have a good discussion about it ... (John)

[The INSET day] was really interesting for insight into the classroom. We were reasonably polite when [the tutor] was giving her spiel but then we just ignored the exercise and talked about what we wanted to talk about. And in Y10 there's a group of girls who for the last month have been completely obsessed with one of their birthday parties and they have lists out and this is their agenda and they couldn't care what I say and it was interesting to behave in exactly the same way myself (Frances)

Frances spoke of experimenting with alternative perspectives to see what they felt like, as it were, from the inside.

Sometimes I'm listening to somebody else and they have a completely different view to me and I argue dramatically against them and think what they are saying is rubbish, and then I get myself into another situation where somebody holds my view and I argue the person's point of view that I originally had the argument with and see how it feels arguing it from their view and then I tend to sort of come to some kind of middle, not always a middle ground because sometimes it's not something you can have a middle ground on but I then sort of come to some kind of conclusion but I feel as though I have to hold, I have to try holding the different views before I can decide. But to be able to do that you need a group of friends who can cope with having different views, who can cope with a range of opinions and views ... to say something totally outrageous and see what it felt like, and that's what I kept wanting to do ... I wanted to kind of say things that were not the kinds of ideas we were supposed to have and see what it was in them that might be appealing or at the very least to reject them properly. I mean that would be the nice thing about working in a school for quite

a long time, you might actually build up relationships with other members of staff that would enable you to do that (Frances)

They were deeply aware of the contingency of their knowledge and understandings and that one's world view is in part dependent upon the vantage point from which one is doing the viewing.

I can't imagine how I would have taught without the course. I can't imagine how I would have thought about things like, I don't know, mixed ability, or girls and boys, or anything really if I hadn't had the time to sit and think about it, particularly in the first year with that group of people ... who had a whole range of ideas and backgrounds which made it even better, our reactions to learning maths were very different so we were able to sort of talk about ... and I suppose ... well it did change my view of maths quite a lot (Frances)

It's very strange being in school with 250 people watching you in a week because you suddenly start to think well I wonder what they think of me and it's very different to thinking what your peer group thinks of you because you have some idea what your peer group is likely to think of you because it's what you think of them (Frances)

I think about people I know who have been brought up in a home where there's racism and sexism and they've kind of worked things out for themselves or at least from their later experiences that that's not right and I often wonder, would I have had the strength and the understanding and the knowledge to go against that. That's something I'll never know ... (John)

Wayne had begun his teaching career committed to providing equal opportunities. However, as I have noted in Chapter 7, his view of and commitment to equal opportunities was fundamentally personal and emotional rather than analytical and related to policy. After visiting Wayne in Phase two, I wrote

He appears not much in the habit of conceptualising and articulating theoretical descriptions at all. For example, general questions about equal opportunities for girls in school lead at once to vivid, localised descriptions of their likely

futures. He gives the impression that his passion has been aroused and that he connects his feelings directly with his perceptions and his actions.

Relating this now to the epistemological model developed in Chapter 9 I would characterise Wayne as relying for his knowing upon internal Authority. When I approached him for a second time to ask him to participate in Phase three, he said that he was thinking of leaving teaching because the students in his present school were 'awful' and that he was fed up with the way they treated him. Because he relied upon personal feeling rather than reason to vouch for knowledge, he had no protection against unpleasant classroom events and was rejecting the worth of others.

I also heard from other teachers this reliance on the personal without seeking to subject that personal knowledge to validation by reason. It occurred when they volunteered thoughts about teaching style: the implication was that all teaching styles are equally valid and the choice rightly depends only upon the personal feelings of the teacher. I asked them what the purpose of initial teacher education is. External authority was rejected: I was left with the feeling that teaching style was considered to be only a matter of personal taste and not the subject of critique.

to examine a range of teaching styles and approaches to see what suits you (Simon)

not to mould you to a particular style or way (Janet)

(Concluding this section on ways of knowing, as an indication of how perspectives can change and because the voice of *silence*, by its very nature, is seldom heard, I include an extract from Frances's interviews in which she remembers this other perspective. She spoke of the terror and voicelessness she had experienced in the past. Unsurprisingly from a feminist perspective, this had been evoked in a context of contemporary, Western arrangements for domestic childcare.

It was very very very scary living in West Camford because all the women around with me had five bedrooms and a nanny and were very very confident and assertive about what they did and it was a very undermining society to move in. The ones that were at home with their children had such strong ideas about what you should and shouldn't do with children ... I'd taken Grace round to play and endless awful things had happened. Grace had just done all the things that children shouldn't do including throwing a chair down the stairs on top of this woman's child [laughs]. I can remember very distinctly just how terrified I felt that afternoon and how unconfident and awful, I couldn't say anything, my sentences all came out wrong, it was pathetic (Frances)

The epistemological perspectives of John, Frances and Matthew naturally had implications for the way they viewed mathematics and mathematical knowledge and it is to the data relating to this that I now turn.

The nature of mathematics and mathematical knowledge

Listening to Frances talk about what she believes mathematics to be, there is a very strong sense of someone intrigued by epistemological questions, enjoying the puzzle of how we know and what claims we can make for our knowledge. She escapes the contradictory position of being doctrinairely relativist!

Do triangles exist? [laughs] I started to think about the difference between maths and science ... You always hear it quoted that maths is a tool, maths is a tool ... and starting the course ... neatly disposed of that idea and the maths became something in itself but it wasn't science and it wasn't like science so what was it? was it something that was objectively out there and you had to discover it which I suppose is more like science so do triangles exist in the universe and human beings have got to find them or is it just totally made up by people right from the start. And I think I'd been holding onto the idea that its totally made up by people right from the start for a very long time until I came across, back to π , and then I found myself saying this is the only bit of maths that I think is like science because π is just there and people found it and I don't think I think that people made it up at all, it just seems to be there but that makes it stand

out from the rest of maths. So maybe it isn't maths, maybe we should get rid of π out of the maths curriculum, it's not allowed to count, so I still think about that because there are other things like π really, geometric things and number patterns. But then I don't know about number patterns because you wouldn't have the number patterns if you hadn't decided on the numbers in the first place which is quite, if you could get people to sit down and think about it, is quite an exciting thing really because if you start off by saying that we're going to count because counting is useful and serves a lot of purposes so we devise a system of counting or tallying in some sense but you then discover that all these strange amazing things happen with these numbers that you've devised and where do the strange amazing things come from? (Frances)

The philosophical problem of the relationship between mathematical structures and the real world is also unresolved for Matthew. He too rejects an absolutist perspective and recognises the existence of historical and cultural imprints on mathematics.

What I think today, and I might not think it tomorrow, is: it's a game. You play your game with symbols and ideas by moving symbols and ideas around, so I suppose that's seeing it as something that's independent of us but dependent on us as well. So it's obviously got some independence, it's an objective description of something and helps to describe the world around us, a language that helps to describe the world around us and that's objective but at the same time that description has a particular bias and so on (Matthew)

Matthew saw mathematics as being actively co-constructed within a community involving both teachers and learners (cf Cobb et al 1992), not simply as an isolated, personal production.

It's not like we have mathematics in there waiting for us to discover it, that isn't the way it works ... my ideal about learning is ... about kids or individuals building a mathematical structure around them which isn't one that's discovered and it isn't one that's either discovered in themselves or discovered out there but it's a structure which is developed. And within that conversation and talk are really important (Matthew)

John also said that he believed mathematics to be 'socially constructed' whilst laughingly acknowledging that his practice didn't always match this perspective. He added that he did not believe mathematics to be

a 'set of truths and rules' because I don't think you can apply the word truth to mathematics, particularly as a lot of the axioms are being questioned so I don't think you can apply the word truth to any body of knowledge really (John)

All of them, then, saw mathematics as something best described as a human product, either choosing to emphasise its personal construction or its social dimension. (See also Appendix 12 which gives their individual responses to Figure 16: Views of mathematics and mathematics education.)

Figure 16

Social group	Industrial trainer	Technological pragmatist	Old humanist	Progressive educator	Public educator
View of mathematics	Set of truths and rules	Body of useful knowledge	Body of structured knowledge	Process view, personalised maths	Socially constructed
Mathematical aims	Basics, numeracy	Useful maths to appropriate level and certification	Transmit body of mathematical knowledge	Creativity, self-realization, through mathematics	Critical awareness and democratic citizenship via mathematics
Theory of Learning	Hard work, effort, practice	Skill acquisition, practical experience	Understanding and application	Activity, play, exploration	Questioning, decision making, negotiation
Theory of Teaching Mathematics	Transmission	Skill instruction, motivate through work relevance	Explain, motivate, pass on structure	Facilitate personal exploration, prevent failure	Discussion, conflict, questioning of content and pedagogy

(Based on Ernest 1991, p138)

Views of mathematics and mathematics education

Students-becoming-teachers whom I have not characterised as working for change thought differently. When asked about the views of mathematics listed in Figure 16: Views of mathematics and mathematics education, the only response Janet made was emphatically to deny that mathematics is socially constructed. Simon too rejected 'socially constructed': he considered mathematics to be a body of structured knowledge. He added

*I would once have argued more for the social construction of mathematics. I no longer believe this, it seems too wishy-washy
(Simon)*

For Kevin too mathematics was a body of useful knowledge, a body of structural knowledge and meant 'numbers and their manipulation, both in concrete and abstract terms'.

Interpersonal frameworks conducive to the promotion of equal opportunities

The epistemological perspective of the *authority of self and reason* also offers an intellectual apprehension of other human beings, an interpersonal framework, which is conducive to the promotion of equal opportunities. There are a number of elements in this equation: the sense of personal authority of the teacher which allows her to believe that she is an actor in the arena of schooling; an awareness of the contingency of things which allows her to challenge the taken-for-granted and to see that things might be otherwise; and a respect for all human beings since they are the originators and final arbiters of knowledge. These elements interconnect across various themes that emerged from the teacher interviews: the themes I identified are not 'blaming the kids'; understanding things from the students' points of view; being confident about oneself as a moral agent; and not imposing labels on the students.

These teachers who are working for change do not blame their students for failure (cf Lacey 1977). They do not attach fixed labels to their students which suggest that the problems of schooling are outside the teachers' ability to influence such as the intellectual shortcomings of their students, their moral turpitude and so on.

In this respect, perhaps more than any other, they seem profoundly unlike their colleagues who are not working for change.

[Children fail because] they give up. Attendance [is] a major problem. Teachers can't teach if children don't attend. [There is] lack of parental support and role models (Janet)

[Children fail] for any number of reasons: bad teaching, lack of motivation, social problems, expectations of parents (both too high and too low), lack of relevancy of courses. More importantly lack of ability - some children will never succeed in academic life no matter how much support and help they receive (Kevin)

Beth felt critical towards many of her students.

Some of the kids here are really horrible and they get away with it (Beth)

Her response to disagreeable classroom events,

You get a lot of abuse being a teacher (Beth)

was to blame the students and to attribute to them moral deficiency.

I think the kids are quite lazy, quite laid back, don't do homework. I think they're a bit arrogant and lazy and I don't think the system deals with them well. Like ... everything's by like appealing to their better nature. But kids just, like, just haven't got a better nature you know (Beth)

John specifically linked a vision of a school having 'strong equal opportunities policies' with 'there wouldn't be any talking about the kids'. All three teachers working for change understood that there are structural reasons for failure:

we make it so hard for them to succeed. There's about 55 million ways they can fail, and it's an eye of the needle to succeed, it really is (Frances)

We live in a crap society basically. They come into an institution which has as its primary goal reproducing the attitudes which are suitable for good workers, doing what you don't want to do, doing what you're told to do, working to bells. As teachers you're in a hierarchical institution with kids at the bottom of the heap so again they fail because it ain't set up for them to succeed, that isn't the objective of school. I mean it is in one sense, it isn't in the sense of really wanting them to achieve because if it was then it would have to be a very different sort of place (Matthew)

and they considered it to be their responsibility to help their students overcome the effects of those structures. For example, Frances said

One of the issues I've got more and more certain about is that thing of children not being able to learn if they feel very very insecure for one reason or another, that you've got to bend over backwards for them not to feel worried or frightened or undermined (Frances)

Some thought there were structural reasons for failure but distanced themselves from them, refusing to implicate themselves or to see themselves as agents who might achieve change.

Some children are labelled as failures early on and never recover from this. Some children react to all offers of assistance with hostility and cut themselves off from success. Poverty reduces chances of success as do the educational weaknesses of parents and poor or abusive parenting (Simon)

The three teachers working for change have a vision that things might be different which precisely connects with their ability to work for change. They are able to see things from their students' points of view.

This week I had two classrooms that were so alive with anger and fury because I was told to set a test with my Y10 sets and it

was GCSE questions on topics that they hadn't necessarily covered, maybe not even this year let alone recently, and it was real, photocopied GCSE papers which is quite threatening and it was the same test for [all the] sets and the same amount of time and they did appalling badly ... and each time when I gave the papers back it was just awful and it was even more awful because I was on their side and I understood entirely why they felt the way they did, I totally sympathise and yet from their point of view they just got at me with fury for the whole lesson. And I just felt very sad and thought why on earth are we doing this ... I wonder that any of them get anywhere (Frances)

there are some extremely bright lads who are very poorly motivated for year 7 kids ... there's all sorts of cultural issues ... they don't correspond to how teachers want children to behave (Matthew)

we ask so much from them that's unfamiliar ... there's very few good reasons provided for doing what they have to do if any reasons at all ... what are you going to offer them that's going to make them think it's worth while being in school (Frances)

I understand a bit about how they feel when someone says do this. I try to avoid making the kids feel like that there's no justification for them being there (John)

there's 30 people who are feeling unconfident about their learning and, you know, fairly vulnerable about you sort of getting at them and them being shown up or whatever (Frances)

I don't very often let anything go by, like a sexist comment, certainly not in the classroom. I try not to give the kids too hard of a time about holding these views that come from their parents (John)

As well as being confident of their own abilities to construct knowledge and make decisions about areas of knowledge as seen above, these teachers were confident about setting their own (moral) standards:

John Major wants to push back to a traditional approach so I want to resist this and so I think: that must be wrong, so what's right? (Matthew)

[Am I making progress?] it would be nice to have some time to think about that properly, to actually take some time out ... the trouble is that as soon as one problem is solved, you know, my sights just go higher and I become more aware of what I want to do, there's never a sense in which I think oh yes I've got that cracked, I'm immediately then looking at the next thing I want to do. It just carries on and on and on and I don't know when that process stops really ... Around you you can see a lot of people [laughs] where the process stopped when the classes would shut up. It must be tempting to just relax at that point ... but I don't think that'll happen, I think I'm going to be hell to live with forever as long as I'm teaching [laughs] (Frances)

[How do I decide?] it's what promotes certain sorts of values (Matthew)

In contrast, Beth, well into her second year of teaching, seemed all at sea in terms of setting her own goals, making decisions about her teaching and following such decisions through.

There's no critical eye on my lessons, I need someone to say I'm not that bad. I keep making the same mistakes. I've started an appraisal book but I only kept it for two days ... The trouble is because there's no probationary year, I'm not assessed. I'll set targets for next year but I've no-one to talk to about them because there's no time (Beth)

The course sets you up for failure ... It sets standards very high. I set myself high standards but it sets such a high marker to keep up with (Beth)

Specifically on the issues of how students are grouped and organised within a school the three teachers voiced a commitment to not imposing groupings on students according to their attainment, this on the grounds of human dignity, linked to the idea that such groupings reflect feudal (Tahta 1994, p25) notions of inherent ability. Nothing in the interview schedule referred to the issue of mixed ability teaching and I asked no questions about their views. All, however, volunteered reflections which challenged, at times, the notion of inherent ability and, consistently, their schools' practice of setting the students in mathematics.

One of my occasional fierce lectures, when I get fed up with my years 10 and 11 [lower sets], is telling them there'll be nothing worse than finding themselves in a job where they're far cleverer than the person who's in charge of them, and they'll be very frustrated (Frances)

I want to teach in a school which in mathematics is much nearer to a mixed ability school (Matthew)

... all this sets rubbish (John)

Certain principles I keep coming back to and that I think are worth defending, principles of fairness and equality, that every person's worthy of respect, those sort of ideas, then they really inform my motivation to carry on saying I don't want to see streaming and I don't want to see setting (Matthew)

Explicit links between epistemology and pedagogy

All of the three talked at some length about teaching and learning mathematics. In their talk they illustrated both the connections with 'inquiry maths' (Cobb et al 1992) indicated in the epistemological model outlined in Chapter 9 and also aspects of educational practice that contribute towards an emancipatory pedagogy. They themselves saw their understanding of the nature of mathematics as inextricably linked to their aims, motivations and practice. I asked them to consider 'one person's way of characterising different outlooks on maths and maths education' based on Paul Ernest's classification (Ernest 1991, p138f) and reproduced in Figure 16: Views of mathematics and mathematics education.

If you take this as being one extreme [points to column 1], you've got a set of truths and rules which you then transmit to a student which involves some kind of one-sided activity where the teacher's doing all the talking or writing and the kids are just doing the examples, so though I'm sure we all use that technique from time to time. But this idea of socially constructed, it's, I would say there would be more discussion going on in my classroom than there would be in a classroom like that [gesturing towards column 1] and there would be more freedom

for the kids to pursue something they were interested in than there would be in a classroom like that (John)

I don't think mathematics is a body of knowledge so I can't transmit it (Frances)

Matthew volunteered some reflections about the nature of mathematical knowledge when reflecting on a lesson of his that I had observed.

For me, teaching traditionally is I'd started like that [like I ended the lesson today] and I'd said, Right what we're going to do now is a whole series of questions where you have to add a percentage to something and then you've got to take that percentage off, something like that ... they'd have ended up getting a method or a process, a series of steps to go through ... [but the exposition from the board today] was generated by their own activity ... which is the way my ideal about learning is moving which is much more about kids or individuals building a mathematical structure around them (Matthew)

Matthew recognised that his view of mathematics as both socially constructed and also as 'a language that helps to describe the world around us' affected what he did in the classroom.

It must do and it does at all sorts of levels. It affects it in terms of trying, where possible, giving problem solving tasks, goal orientated so you've got some problem to solve and you get the maths along the way in the process of solving the goal so in that sense the kids are constructing the mathematics. But at the same time it's to do with describing or trying to solve a problem in the world, the outside world. That's on a very deep level. On a more basic level, I try and get them to puzzle, to think, answering questions with questions and so on (Matthew)

He was also aware that alternative perspectives amongst his colleagues were in turn related to their classroom practice and that changes in the former were necessary if one wanted to achieve change in the latter.

... actually in terms of changing people's deep perceptions about, about mathematics, and so on, and about what we should be doing ... (Matthew)

Pedagogical practice

Features which were found in Chapter 10 to be characteristic of a classroom where the work is predicated on 'inquiry maths', as in one where the teacher is striving to create an emancipatory curriculum, were consistently endorsed during the interviews with John, Frances and Matthew.

They all spoke of the need for their students to work in a way which permitted the construction of meaning (cf Jaworski 1994), of not having the curriculum broken down into predigested bits.

an approach where you start the kids off with some ideas and let them run with it for two weeks and see where they get to, obviously more structured than that but that's generally the way I think we should be working with them (John)

I've tried to hold on to not to spoonfeed, not give things piecemeal in tiny pieces (Matthew)

I gave them a problem to do with fractions ... and I gave them two weeks to do and they kept coming and talking to me about it and that was a massive change, you know that was really nice, really nice ... One of the things I want to encourage is for them to do longer term pieces of work, I've started doing that with my top set for homework saying they have two weeks to work on it and I want them to keep coming and talking to me about it as and when. A lot of what they do is disjointed and quick and doesn't come together (Frances)

There are certain things I can't do because the classes are not structured in such a way, the course is not structured in such a way. So I can't for instance start with the topic of say, suppose we're doing some work on circles and I start with the topic of that and have some doing some work on, you know, just drawing circles, circle patterns, others finding out something about π , others finding out something about the area of a circle,

and have that full range and start with a topic and just go with it. Because it's split up into small chunks in each year and there's certain things you can do but there are limits whereas if you say had half a term you could really do something with it (Matthew)

John also described a classroom where different students could be doing different things and related this to letting the students develop ideas, of allowing the students to have some control over the agenda (cf Skovsmose 1994).

sometimes I have about 6 or 7 activities going at the same time because somebody's finished something and I'm chatting to them and as the result of talking to them they set off onto something else and there's another group who're working together and I'll really enjoy that when they're all working away ... those are the best lessons. They try some of their own, they sometimes say can we try some of our own. I try to encourage that, for them to set their own problems (John)

sometimes something will happen that will change the whole purpose of the lesson (John)

Kevin too spoke positively of a willingness to abandon the plan for the lesson but I wonder if here the intent is different. He does not give a sense of responding to the possible agendas of the students.

I am always quite willing to stop what I had planned and go off to explore a tangent that catches my, or the classes, attention. I think it gives classroom discussion more room for manoeuvre as I am not always looking to lead it. I am quite happy to let it wonder around a subject as I think this increases understanding (Kevin)

Flexibility and responsiveness to the students are valued and there is an openness to negotiation.

I think in terms of what I do in the classroom at best there's discussion with them to try and motivate, discussion of targets and goals (Matthew)

This was linked with the rejection by these teachers of a transmission model of teaching and learning (cf Burton 1992a, Skovsmose 1994).

there would be more freedom for the kids to pursue something they were interested in [in my classroom] than there would be in a classroom [based on transmission] ... do you have a computer at the back for the kids to work on if they want to or not? I would have a computer at the back for them to work on, and I mean do you allow them to explore something that they've found that might not even have anything to do with the lesson, that other model of teaching wouldn't fit in with that (John)

I've had confirmed that standing up at the front of the classroom really doesn't do anybody any good whatsoever, [laughs] that it's a fairly useless teaching method to be honest and that I'm not sure that anybody really gets taught anything (Frances)

Yesterday we were going over the exam paper so it was necessarily didactic. Though, no, that's not true, there are a lot of different ways I could have done it. Anyway, it contrasts with today which is a much more fluid lesson so the lesson this morning was much more like I'd like to be (Matthew)

After the election I decided to do a lesson on it, on majorities and so on, and the other teacher who teaches them humanities said why don't we team teach so about half way through the lesson we were talking about percentages because someone had 7% of the vote and one lad at the back said so how do we do that then. And I was just about to launch into well let's have a think about this, how could we do it when Norah says oh what you do is divide this number by this one and times it by a hundred. Afterwards I said that's not how I would have done that, I don't think they learnt that ... I said next time we team teach we'd better discuss it a bit beforehand [laughs] because I try to get them to think about it a bit and not just tell them how to do it (John)

Janet too claimed to reject a transmission theory of teaching but chose in its stead 'explain, motivate, pass on structure'. Kevin also felt happiest with this theory of teaching.

Interestingly, he coupled this with a statement about 'discovery learning', showing clearly how this concept can be linked to an external Authority epistemology.

I feel that, where possible, children should discover mathematics for themselves. Having discovered it for themselves, I then explain that actually someone else discovered this before and here is the appropriate way to write it down (Kevin)

There is no sense here of a personal and creative act (see Papert 1972, p236), nor of developing the capacity to criticise and produce classroom meanings. He claimed that 'investigational methods' were 'one of his preferred ways of working' but added 'I also like "chalk and talk" a lot'. His overall view might be encapsulated in the following remark.

I enjoy starting with a blank class and making it understand (Kevin)

Although Simon also spoke of discovery rather than construction, his view of himself was somewhat different. (See the concluding words of this chapter.)

I would describe myself as a facilitator rather than a teacher. I aim to guide and shape the students' discovery rather than acting as a fount of all wisdom (Simon)

Central to Beth's pedagogy, however, was the notion of explaining.

[My top year 9] have ... covered a lot of topics but never really had any problems explained because they've been taught by supply teachers (Beth)

There could be something on the course about [set texts] ... like I don't know how to teach out of a book, I don't know what to go over on the board, I don't know how to bring it together you know ... I feel like I've got no control ... 'Cos, I don't know, you

don't have as much teacher input ... You don't know the best way to explain things (Beth)

All of the teachers working for change placed emphasis on and valued student discussion and sought to develop it within their classrooms.

within that, conversation and talk are really important
(Matthew)

I would say there would be more discussion going on in my classroom ... (John)

In terms of teaching and how you actually teach in the classroom you might have what is a textbook exercise and you can turn that into a discussion exercise ... quite simply
(Matthew)

Student talk was not valued by all the students-becoming-teachers:

[Group building?] I don't build any of my groups ... like I don't do much group work at all, the kids talk too much (Beth)

and discussion and questioning were marked by Simon as being definitely not representative of his outlook.

The quest for a curriculum which encourages critical thinking is linked by Matthew to a problem based approach to mathematics (cf Giroux 1983):

[I try], where possible, giving problem solving tasks, goal orientated so you've got some problem to solve and you get the maths along the way in the process of solving the goal ... I try and get them to puzzle, to think, answering questions with questions and so on (Matthew)

the sort of task-orientated, what-do-you-need-to-know-in-order-to-get-to-a-particular-goal which is the way my ideal about learning is moving (Matthew)

and also by Frances who places emphasis on the work being such as to challenge the students and is aware that this is often lacking.

It seems to me that for a lot of them what happens, what their experience of maths is in secondary schools is that they get given things they can already do essentially because they get the satisfaction of doing it right and your classroom control is far far easier, and that for a lot of them they get a diet all the way through of things they can already do, to the extent that the worksheets in year 11 are the worksheets in a sense of year 7 really (Frances)

They want to foster in their students the same confidence and personal authority that they themselves feel where one grapples with difficulties, comes to conclusions which later have to be revised, where getting things wrong and changing one's mind are fundamental to the process.

Some of the things I want to get across to them will be unsettling to them, that writing neatly isn't what it's all about, that I want to see their working, that I don't want it to be hidden, or just the idea that when they actually get things wrong that that process of getting things wrong and then sorting it out is actually when they're learning [laughs] that they're learning by getting things wrong and it's not something that they should tear the page out of their book and try to pretend it never happened (Frances)

[One thing I got from the course] that has personal implications about infallibility ... [was] a very strong message "It's OK to be wrong" [in mathematics] (Matthew)

I often say in the classroom when I'm presented with beautifully neat books usually the girls' with beautifully neat answers written and there's a pile of stuff in the bin, that the stuff in the bin is their maths and I don't want to see the beautifully neat answers so then they get cross with me. Because all the scribbles and the crossings out and the getting it wrong and doing it again is their maths, it's the process of thinking it

through and starting on a track and giving it up and going down a different track (Frances)

Not all teachers thought so positively about wrong answers even when seeing the need for a secure environment where error would not have to be a source of embarrassment.

I try to create a working environment ... a pleasant environment where, you know, kids can put their hands up to questions even if they know they're going to be wrong. I think my year 9 second set are my best and I try really hard with them 'cos you know they're not very bright but I think they're really enthusiastic about maths ... but like they're bursting out of their seats some of the time and they're the kids that can't do it, and I hate it (Beth)

Because they wished to foster autonomy and personal authority in their students, their attitude to classroom management was not disciplinarian.

I think I ... as far as possible I try to get the kids to be working in an atmosphere where they actually are wanting to do the work and try to get a nice atmosphere in the classroom. When they come in they should expect to put something in as well, I tend not to be strict in the sense of having their heads down, I'll have a little chat (John)

I'm thinking that as this pressure [of larger classes] increases, you can retreat but it isn't a solution, a more discursive style is needed more or else you just get into a battle trying to get the kids to do things they don't want to do, you end up rowing and shouting (Matthew)

I value the pastoral side of things and the way students are looked after and considered and the support from management in terms of discipline. I value that quite highly. There are other things I appreciate but, the overall way that the majority of staff behave towards the kids. There's a lot of kids at the school with a lot of problems and the school has a way of dealing with that that shows a caring attitude (John)

I've learnt to avoid confrontation whenever possible, if there's a way to sort things out without confrontation (Frances)

This perspective was not shared by others.

there's the problem of being a new, green teacher who cannot yet anticipate all the fiendish ways students will find to undermine you ... It has made me into a much more suspicious and cynical person than I used to be and I now understand why 'real' teachers on t.p. used to demonise children (Simon)

I am more of a disciplinarian than perhaps I thought I might be (Kevin)

I think I am quite an authoritarian person to be honest. I mean I keep saying please and thank you [to the kids] and it really bugs me. I think, I mean [I want to say] 'just do it' you know. Like I'm really nice, I used to be really cold in the classroom on TP, I was told don't tell the kids off so harshly. Like in a school like this, you need positive discipline, but what's positive discipline or is it just weak discipline? (Beth)

I didn't expect to become quite the authoritarian I am now. It became obvious to me though after a few months of teaching that I needed to feel in control (Simon)

There's no school rules, the staff and the pupils agree, you know, agreement that they've come up with, that they shouldn't chew in class, and they shouldn't hit people in class and they shouldn't be offensive to other pupils or staff. But you know there's no real school rules and in terms of sanctions there's no sanctions apart from your own sanctions that you impose. [It's not enough.] ... I don't think the system deals with [the kids] well. Like no-one here will have a confrontation here, there's real avoidance of confrontation in the school, like everything tries to be smoothed over (Beth)

Generally, then, the pedagogy which these three teachers working for change espoused had the characteristics associated with 'inquiry maths' and had the hallmarks of an emancipatory curriculum. Interestingly, however, they were divided in their response to aspects of the 'public educator' (Ernest 1991, p138f) philosophy and practice (Figure 16: Views of mathematics and mathematics education). Matthew strongly endorsed critical awareness and

democratic citizenship via mathematics as a goal (see Appendix 12) but John and Frances found the notion problematic. Both felt the need for further thought.

And this one, 'critical awareness and democratic citizenship via mathematics', although it sounds quite a ... a ... a positive statement to make I would agree with the first bit critical awareness, I'm not sure about democratic citizenship through teaching maths. I mean it may come as part of something else but it's not, it may come about through something else, in the method of teaching it but I don't think you can, I don't know, I'll have to think a bit more about that actually (John)

We had an interesting debate over the weekend about this because I thought you would have an axe to grind but Alex didn't agree ... 'Critical awareness and democratic citizenship via mathematics', I must say I find very difficult to think about. Because I know the idea of fostering critical awareness hasn't really dawned on me in terms of my maths teaching and I can't decide whether it should have done or not [laughs] because it's something that I associated so strongly with other areas of the curriculum that I find ... but then I've changed my mind about so many things to do with maths that maybe I'm going to change my mind about that one as well (Frances)

Frances's misgivings, however, precisely grow out of her commitment to inculcating in her students that epistemological *authority of self and reason* which I have claimed is at the heart of an emancipatory pedagogy.

but 'democratic citizenship' annoyed me, I don't know why ... in fact in this [column 5] you're not any different from [column 1] except that what you're trying to squeeze the worms towards is something that in theory, that sounds rather nice and good but I'm not convinced, I think it's fishy, fishy (Frances)

Working for change

All three teachers saw themselves as working for change and as not sharing the taken-for-granted outlook on schools. John referred to 'all this trauma of people like me going into

school' holding different views from the prevailing ones and both Matthew and Frances were committed to not following the common-sense of schooling.

The chances are you will work in an institution which is hierarchical to a greater or lesser extent and that raises questions, how do you cope with that hierarchy, how do you get change and create change (Matthew)

I want to do it the way I want to do it [laughs] (Frances)

They felt that they had achieved some changes in their schools, had achieved some successful 'strategic redefinition' (Lacey 1977).

I'm quite argumentative and I argue my corner but there's definitely been a process where I feel I've had some sort of effect, I've mentioned the banding [where I had some success] (Matthew)

I think I've been surprised how much influence you can actually have when you keep at it, and you are consistent and determined with people that you do get through sometimes or even that quite often you do get through (Frances)

They saw themselves as untypical of the profession.

Yes I did [anticipate being blocked] I don't think I thought it would be the case in most jobs but that was a bit silly really because given the departments I've seen it would make more sense to assume that yes most places it would be difficult (Frances)

It seems to be if you try to talk about something, people just haven't got that breadth of vision ... I thought GNVQ, it was an opportunity to rethink everything to do with the school but other people couldn't cope with the concept because it's too far away from what they're used to (John)

Where are all the people that think like us? All the people who write all those articles in magazines? [laughs] (Frances)

In particular they all had things to say about working for change on gender issues. I did not particularly emphasise matters overtly related to gender in the interviews as can be seen from the schedules (see Appendix 10) but all of them spoke about it at some length.

John, for example, mentioned his use of language and the time he spent with boys and girls. He was hesitant about defining girls' and boys' behaviour but summarised his views as 'the major thrust of EO work is trying to deal with the problem and the problem is boys'. He was aware of the need for both the department and the school to take up and work on the issue, was involved in policy making on equal opportunities issues and was focusing on his own classroom as well. As well as talking to me during the interviews, Frances also wrote to me subsequently about two issues, one of which was gender. She was struggling to make sense of her theoretical understanding of the issues based on reading research findings, her lived day-to-day experience in school and her wider understandings of society. She was committed to enhancing achievement of both boys and girls and knew that understanding the gender dynamic was central to this, both the ways in which girls lose out in schooling and the hopelessness of the current social positioning of working class boys. Matthew too was concerned about the absence of motivation amongst the boys both for its own sake and because of the way it contributes to holding back the attainment of girls. In his own classroom he was concerned to encourage the contribution of girls, to promote positive images and to challenge the sexism of the boys. He was involved in school wide policy making about equal opportunities issues.

The other teachers represented a variety of positions. In response to a very broad and encompassing question about gender issues, mathematics and schooling, Janet commented

Department 3 females, 1 male, next year 4 females. Less of a problem in this school than other issues (Janet)

Simon and Kevin both responded more fully. Simon mentioned avoiding 'the slightly creepy flirting that some straight male teachers engage in' and checking materials for sexist images but said

[I] confess to not having thought a great deal about the subject while teaching, though maybe that's not entirely true. It's a cliché to say "I treat boys and girls the same" but I do attempt to ... My views have not really permeated beyond my classroom (Simon)

Kevin was concerned about the boys but whereas Frances and Matthew's concerns about their underachievement seemed intermeshed with and supportive of a concern for girls, Kevin's tone was different.

I feel that too much positive discrimination has gone on towards girls and that it is time to redress the balance. Everyone seems to have spent so much time on the girls ... My views are slowly starting to be thought about in the department although it is hard not to upset the 'feminists' (Kevin)

Biographical influences

The final aspect of the data analysed in this chapter is that of the historical influences on these three teachers. They spoke of their personal histories, the influence of their teacher education course and their initial socialization into teaching. I attempt here briefly to draw out aspects of each of these, not with any claim that there are here to be found *causes* of their being teachers working for change. Rather I simply refer to patterns which can be detected or not to test out ideas offered in the literature. (See Chapter 6, the last section of Chapter 7 and Chapter 8 for the relevant discussions.)

None of the teachers had a strong vocational commitment when they began their training (cf Cole 1985). John's comment that he was thinking about trying to obtain some further

qualification when the leaflet about the course came through the door, that he did not have 'a vocation or anything' and that it was fairly arbitrary was typical.

I had in the back of my mind that I might do a PGCE and I was really tempted by the first year of the course which wasn't going to have much to do with teaching and I suppose I thought that during that year I would decide if I definitely wanted to carry on in teaching, so in many ways it was just lots of things falling together (Frances)

In a similar fashion most of the others also drifted into teaching.

I'm not sure why I decided to become a teacher ... perhaps I have taken the easy, safe and familiar option of staying in school rather than growing up and going out into the real world (Kevin)

None of the teachers working for change had strong family links with school teaching although Matthew's mother worked in adult education (cf Cole 1985).

Beth, who was often unsympathetic to equal opportunities issues and was not involved in working for change, had substantial family connections with teaching.

Oh, everyone [in the family] is a teacher [laughs]. That's why I didn't come into teaching [laughs]. This is going to sound awfully conceited but I knew I'd be quite good at it, like I knew I could do the job, I knew I mean like just from hereditary input [laughs]. Both my parents are teachers, my sister's a teacher you know I kind of knew that I could do it, it was something that I would succeed at if I did it (Beth)

Although Janet and Simon had no family connections with school teaching, Kevin too came from a family that included teachers.

I was happy most of the time at school. I went to a Grammar school in Sevenoaks. It had traditional values and generally good teachers and certainly tended to put us out with good

qualifications ... both my parents are former primary school teachers. My father is currently heavily involved in GNVQs (Kevin)

Janet also described herself as having been 'very happy' at school but Simon was not, although for very particular reasons. (See the concluding words of this chapter.)

I was not happy at school. The main reasons were the difficulty of being gay and having to act straight and the terror of the consequences of being found out (Simon)

The experience of their own schooling recorded by the teachers working for change also varied. John had been unsuccessful at his local boys' grammar school: he did not apply himself to the work, mostly 'dropped out' and eventually left at the end of the fifth year with one pass at 'O' level in the General Certificate of Education. Matthew, on the other hand, had had a successful career at the local comprehensive although he had taken an oppositional stance to much that occurred there.

I always attained well at school. Secondary school I went to a boys' comprehensive school which had a girls' school next door, which, yes, it was not bad. It was a setted school, 1 to 7, and invariably I was in set 1 but my friends were drawn much wider than that. I mean I say I was happy at school and I enjoyed school but I truanted quite a bit, more than the odd day ... It was a school that had very strong uniform. There were times when teachers and senior teachers tried to actively discourage me from keeping the friends I did ... I made very political statements about not accepting the regimentation, not accepting those sorts of strict structures but at the same time it wasn't conflicts with teachers personally (Matthew)

Frances, in contrast again, was not only a highly successful student but also conformed to the school's expectations and norms (contra Mardle and Walker 1980 and cf Sikes, Measor and Woods 1985, Calderhead 1992a).

I went straight through the grammar school ... school was quite a nice place to be with lots of opportunities to succeed and we

did lots of nice interesting things ... and the work wasn't a problem ... for 13 weeks before the Oxbridge exam I hardly left my room and just slogged and slogged (Frances)

However, by accident, she fell foul of everyone's expectations immediately after her university finals by becoming pregnant and thus was forced to stand back from those taken-for-granted norms, to reassess and to form an independent perspective.

being single, pregnant and unemployed in Deptford delivering leaflets and cleaning posh people's houses is more than an eye opener (Frances)

It also put her in a position where she understood herself to be oppressed (cf Middleton 1989).

I read Germaine Greer and she made the point that we have made it as awful as we possibly can for women to bring up children, we've isolated women, we've put them down, we've made it seem as though it's the most pathetic and belittling thing you can do to go off and have babies and that there's no value at all in being at home with children (Frances)

This made her unlike John and Matthew who did not tell of any experiences in which they had themselves been the objects of discrimination.

On the other hand, Beth had experienced sexism and Simon had been subjected to homophobia. (See the concluding words of this chapter.)

[The apprentices] were very prejudiced but they changed their ideas about women by the end of the week [when I was doing outdoor education with them]. It was very good for me (Beth)

I dislike the widespread homophobia of the students and the lack of seriousness with which it is tackled. I take it very personally, it is sometimes directed at me and I won't be sad to leave because of this (Simon)

All of the teachers working for change still seemed to find their initial course of teacher education both relevant and moulding of their views (contra McNamara 1976).

This included Simon but whereas the teachers working for change seemed to expect to continue indefinitely developing their views, Simon did not give this impression. (See the concluding words of this chapter.)

I think I decided on a great number of my core values at the [Uni]. After questioning them and adapting them to the realities of classroom life they are still with me and I'm eternally grateful for having had the opportunity to sort them out early on ... The [Uni] experience allowed me to create an 'ideal teacher/teaching model' - I don't live up to it but at least I know what I'm aiming for (Simon)

Unsurprisingly, not all the students-becoming-teachers felt that the course was relevant or important in shaping them as teachers.

A real school has made me into a good teacher ... The [Uni] gave you the mental means to be a good teacher in an ideal well-resourced school. The crunch was how you adapt this approach to a real-life school ... it opened my eyes to investigational work, but it is still not the perfect answer to maths in the classroom which is how it appeared at the [Uni] ... [Initial teacher education] should give you the basics (Janet)

Naturally, it is difficult to assess this in comparison with other research findings since I was the interviewer. Matthew felt that the course had equipped him to resist some of the pressures attendant upon work in school.

the path of least resistance is to revert to tried and tested, how you were taught, all that sort of stuff. I suppose in terms of the course, the course has given me a lot of options in terms of going back and saying hold on a minute this isn't necessarily the

best idea in the long run or even in the shorter for that matter
(Matthew)

Messages from the hidden curriculum were acknowledged as being central.

if you see people and listen to them who are doing something very well and give it a lot of credibility then for me anyway I instantly think that there's something worth doing and I'd like to try and do it so I suppose really that a collection of staff in the Maths Ed Department that really convinced me that [teaching mathematics] was something worth doing and that there was a lot more to it than I'd anticipated so... It would be difficult in interesting ways and that really tempted me I suppose (Frances)

[The message from the course was] mathematics is something enjoyable, that it should be displayed ... You get a sense of there being some democracy in terms of the way things are decided within the [Maths Education] Centre. I think within that, in terms of relationships, with students there was efforts made to give a sense of equality, equal status. [As a teacher] it was motivating and still is in the sense, in the sense that it's important to know that there are, that it's possible to work in that way ... and that general message of valuing mathematics
(Matthew)

They talked about the course as though what they most felt they had gained from it was that it had opened doors into a new vision for them, particularly a new vision of mathematics. I asked them to look back at the course and review it in the light of their experience now as practising teachers. These three teachers all immediately spoke about ways it had made them see things differently. John's first response to the question of how the course had connected with his teaching was

The multicultural elective and going to the non-attenders unit showed me different ways of looking at things (John)

Frances and Matthew both spoke about the nature of mathematics.

[The course made me see things differently] certainly in terms of mathematics. A very different way of learning maths. For example the tiling activity we did right at the beginning ... lots of other occasions. You can't rely on that intellectual approach, a more intuitive approach has value. That has personal implications about infallibility and about valuing intuitions and so on. A very strong message "It's OK to be wrong". This did come from the course (Matthew)

I suppose there are times when with particular issues you remember a conversation or whatever ... [but] it's more an opportunity to learn maths and to talk about learning maths with the group of people that I was with who were, in a way, who had a whole range of ideas and backgrounds which made it even better, our reactions to learning maths were very different so we were able to sort of talk about ... and I suppose ... well it did change my view of maths quite a lot and I'm sure that must and definitely does influence what I'm like in the classroom (Frances)

Beth however said

[the course is] great for motivation but when you start teaching you can't be exciting and innovative all the time ... I think we were very well prepared and came out with a tremendous lot of resources. In this way, it's a lot better than other courses. Students come in here and expect you to provide them with ideas (Beth)

All of them adopted a fairly robust and realistic attitude to the impact of their initial socialization into teaching (cf Lacey 1977, Sikes, Measor and Woods 1985, Zeichner and Tabachnick 1985).

the first term here, it was just like being dropped and I didn't know Mark [a supportive colleague] that well to start with and I found it quite hard to get to know him and I just thought aaargh [laughs] and you know here I am you know just to survive really with no support. [I wasn't obsessed with survival.] No, it's the opposite. I am a perfectionist, I don't want just to survive, I want to do it the way I want to do it [laughs] which is probably why the first term was so awful. I mean a lot of the more experienced staff say just survive, just survive, all the first term is survival, if you can get through without having three

weeks off being ill you'll have done well. But to me that's like you've done crap, that's nothing like good enough (Frances)

your issues for the first couple of years, in the first year it's surviving and it's classroom management and you learn to take everything off the department you can in terms of learning how to, classroom management. This year I've been seeing how the actual mathematics and the way activities are structured mathematically are essential to classroom management and that has been the strong learning point. And now I suppose I'm starting to look at the wider structure and it's becoming more important now (Matthew)

I don't think, I really don't think that I've had any large changes in direction really. I think it's just evolved really that I started off with a certain view that I wasn't always able to put into practice in the early part of my teaching and it's become easier and easier to put it into practice, it's developed and changed and probably my thinking's changed a bit but it's not been sort of chopping and changing it's just been a gradual evolution (John)

Most of the other teachers were also sanguine about their experience of their first year.

Survival for the first year then you can develop and grow
(Janet)

I always enjoyed teaching, right from the start ... I don't think I was obsessed with surviving, perhaps more mildly anxious about it (Kevin)

Although deeply committed to teaching, the pressure to be a 'proper teacher', suggested as an important aspect of teacher socialization, seemed to be one which it was possible for the teachers working for change to resist (cf Sikes, Measor and Woods 1985).

I think my gut reaction would be just to be myself. I find it a bit odd sometimes, assuming a role. I think I want to be able to be myself in the classroom and I don't think it's right right now and I don't know whether that's because I'm not confident enough about teaching or I don't rate myself as experienced enough or whether I'm still conscious that there are too many situations in which I don't know quite what to do and perhaps I have some

sort of default mode which is to be, to act a teacher in those situations or how I think a teacher should act ... since [we talked about Heather being herself in the classroom] I've seen another person in the classroom, and she was even more herself, she was totally, she was so relaxed, she had exactly the same style of humour as she has in the staffroom (Frances)

Beth on the other hand was ambivalent about the need to be a 'proper teacher'. She felt that this was an important part of what the job was about although she found it uncongenial. She was critical of her school because relationships between staff and students were informal and relaxed even though in some ways this suited her better personally.

I find the role hard. I don't think I fit easily into the role, you know, I think I can get on really well with teenagers but to get them to work you have to be different, you have to be strict and be hard and, you don't so much in this school, well I think you do, I think people aren't and I think kids don't work in this school ... I think this school is very slack in ways like that and I think the kids take advantage. It's a like non-uniform school, the kids wear what they want, the staff wear what they want, like you can come to school in jeans and nobody blinks an eye and I really like that [laughs] so I can be me in this school. In this school, I don't have to put on a performance (Beth)

Concluding word

The evidence offered in this chapter has been used to illustrate the theoretical model linking an epistemology of the *authority of self and reason* with emancipatory education. It is not intended to *prove* such a theory but to offer some accounts of how the epistemology and the pedagogy are 'lived' by the research participants. The model is not intended to be deterministic but to offer an interpretation of experience which can help to guide our practice with students in initial teacher education. Patterns of response have been offered linking their ways of knowing with their understanding and practice of the teaching and learning of mathematics; and a narrative has been constructed connecting these together and to their view

of mathematics, their interpersonal frameworks, their willingness and capacity to work for change and their personal histories.

Most of the tentative and conjectural evidence from other teachers has flowed alongside the main narrative and has fallen into place beside it. However, there is something more to be said about Simon. During his time at the University, Simon expressed and sought to put into practice a commitment to equal opportunities. He is the one research participant whose perspectives and practice as a teacher (the latter by hearsay and by his own account) mark a discontinuity between being a student and becoming a teacher. He is also the one participant whose evidence is noticeably not in conformity with the model I have offered. He was no longer working for change but some of his perspectives were in tune with those of the teachers who were continuing to do so. For example, his time at the University enabled him to see things differently from how he had seen them before and he wanted to explore these ideas in theory and practice through the equal opportunities group and he did not see himself as 'a fount of all wisdom' in the classroom. At other times his perspective conforms to that of the other teachers. For example, he has abandoned an understanding of mathematical knowledge as constructed by the knower and has become cynical about pupils.

Why does he stand outside the pattern? I make a conjecture that the homophobia which he has experienced and which he reports as being deeply and painfully felt has, understandably, reduced his capacity to be open minded and to respect others as each being the source of knowledge. I write tentatively, striving not to assume familiarity (cf hooks 1991) and aware that this work is produced in a context of heterosexist supremacy. I assume, since he offered it, that he wished this contrary voice to be heard. He has now left school teaching and this country. I write of him with respect and I hope that new experiences will reawaken those capacities in him.

Conclusion

People making history but not in circumstances of their own choosing ...

(From Matthew's discussion of the thesis)

after Marx

... dreams and anguish bring us together.

(Quoted in Rudduck 1988, p213)

Ionesco

Overheard in a northern University

I *told* them that they *had* to use my lesson plan proforma for their assignment - I have failed all the ones who didn't.

Unless we tell them what to do and tell them that that is the right way to do it, they'll just do what the school tells them.

Perhaps we just haven't got time on the BEd to let them learn in the way that we'd like.

It's a luxury which only the more able can afford. The rest we have to tell them.

I'm happy to report results as pass/fail to the exam board but I still want to give them a mark - and we're not going to tell the students it's just pass/fail, are we?

(Remarks overheard from staff working with students in initial teacher education, 1992-1995)

Because we are unable to make predictions ... taking any action means running a risk. That is the condition for ethical commitment and for every form of critique ... Utopia is lost, but now even minor changes make sense.

(Ole Skovsmose, *Towards a Philosophy of Critical Mathematics Education*, p191f)

In this last chapter, I review the claims of this thesis and attempt to look forward from them to action.

I set out to investigate the implementation of a gender component within the PGCE course at a northern university and the consequences of that intervention upon the working practices of a sample of the students-becoming-teachers involved. The implementation of the component was the subject of Phase one of the study. In Phase two, I began the follow-up work by visiting three of the new teachers in school, observing them at work and interviewing them. I had intended that these interviews and visits would be the first of a number but, as I reflected on these early results, the focus of my enquiry changed. I had not detected, at this first stage in their careers, significant differences in the *practices* of the three new teachers with respect to acting successfully to combat gender inequalities in their schools and classrooms. In addition, I could detect no way in which the differences between the three teachers with respect to equal opportunities were in turn differentiated with respect to sites of disadvantage. However, I did perceive differences in their level of commitment to and in the nature of their understanding of equal opportunities: some perceptions and intentions, voiced at the end of training, about implementing equality in their classrooms had proved more robust than others. I also gained a sense that the ways in which these three teachers related to theoretical descriptions of the world were very different, both in what they held knowledge to be and how they saw themselves as knowers. These results of my analysis of the Phase two data led, then, to a re-focusing of the research in Phase three. I decided to try to characterize teachers working for change and to understand what makes and sustains them. Through the dialectical interplay of reading, writing, data collection and data analysis, I became convinced that *teacher epistemologies matter* in understanding how it is possible to become and to remain a teacher working for change. This is the central theme of the thesis and is elaborated through a model of the epistemological perspectives of (beginning and new) mathematics teachers. The model describes and explores the consequences of four such perspectives.

My conclusion is not that each of us can be reliably located as having *one* epistemological framework nor that the four perspectives described offer a complete characterization of all possible ways of knowing. Rather my claim is that filtering experience through the lens of this model helps us understand more about becoming/remaining a critical teacher within the given locality. Indeed, the research derives whatever catalytic validity (Lather 1986) it has from the extent to which each of us who is similarly positioned and who teaches is able to use the model to help to resist dominant discourses, to retain a capacity to act and to sustain a vision of ourselves as agents of change.

I use the rest of this chapter to explore some implications of the research for initial teacher education, to give a brief summary of the areas I have noted as needing further research and to discuss the possibility of change.

Implications for initial teacher education

It would be the task of a different work to attempt to lay out in detail what an initial teacher education programme might look like that took seriously the conclusion of this thesis: that teachers' ways of knowing matter and that they are significant in enabling or working against teachers' capacity to promote an emancipatory mathematics curriculum in their schools. Any such programme would need to take note that, like us all, the students will be

located within a complex web of discourses ... offered many ways of seeing and being themselves; many positions to occupy ... They will draw consciously, or, more likely, unconsciously, on the discursive repertoire which resides within them and in different degrees and ways either take up or reject the positions offered. (Kenway et al 1994, p192)

They will be active readers of, and always re-writing, the offered pedagogies of teacher education. Critical teacher education, like gender work in schools, in as much as it involves trying to make available resistant discourses and to destabilise hegemonic ones, will therefore

be 'predicated upon an expectation of tension, ambiguity, instability, contestation and resistance' (Kenway et al 1994, p197). I wish in this chapter to try to elaborate what some of the guiding principles might be in devising a critical teacher education programme. In particular, I consider the challenge to an apprenticeship model of teacher education, both the technicism of the approach and its commitment to being wholly school-based; I note the requirement for self-reflexivity and dialogue; and I discuss the role of subject studies.

Critique of the apprenticeship model of initial teacher education

The model of ways of knowing constructed in Chapter 9 identified an epistemology based on the authority of self and reason as having strong links with 'inquiry maths' and, through this and also independently, with an emancipatory curriculum. The *local* validity of both links was claimed: whether or not those links survive translation into other localities, for students and beginning teachers positioned otherwise, is an open question that this research does not address. Fostering such an epistemology therefore becomes central to any similarly positioned teacher education curriculum which is to be critical and liberatory.

The key features of the epistemology based on the authority of self and reason are

- external authority is consulted and subjected to independent critical judgement
- internal authority is also consulted and subjected to independent critical judgement
- meaning is acknowledged as constructed by the knower
- knowledge is understood as contextual and mutable.

A teacher education curriculum based on these assumptions cannot therefore be one in which the neophyte is apprenticed to the expert upon whose knowledge and judgement she or he uncritically relies (Rudduck and Wellington 1989). This is a challenge to much of the rhetoric (and probably much of the practice) of school-based initial teacher education. Deborah Britzman underlines the connection between the apprenticeship model and the maintenance of the *status quo*, drawing out the link with an epistemological perspective based on external authority.

The myth that experience makes the teacher, and hence that experience is telling in and of itself, valorizes student teaching as the authentic moment in teacher education and the real ground of knowledge production ... In this discourse, everything is already organized and complete; all that is left to do is to follow preordained paths. The problem is that when experience is perceived as map, it is taken to order perceptions and guarantee essential truths ... what is expressed in actuality is a discourse of common sense. (Britzman 1991, p7)

Within this view, becoming an effective classroom practitioner who is working for change cannot be separated from one's development as a 'critical reflective transformative [intellectual]' (Hill 1991, p121), someone who is able to look behind the taken-for-granted. This is not to deny that practical craft knowledge is important (see Brown and McIntyre 1993 for a useful contextualising of 'craft') but is rather to understand that all educational practices are suffused with theory; and therefore need to be a subject of critique. Each practice is part of a discourse, perhaps resistant, perhaps hegemonic, which needs to be deconstructed. It thus becomes impossible to detach the educational practices of the classroom from a theoretical analysis of their meanings.

People use theory all the time; and it is their personal theories which determine how they interpret the world and their encounters with people and situations within it. (Eraut 1989, p184)

It is the job of a critical teacher education curriculum to enable practitioners, student or otherwise, to make explicit their own theories and those of others and to subject them to independent analysis and judgement. Leaving theory and practice and theory-in-practice unexamined cannot but, in general, support the hegemonic discourse of education. As Martin Powell and Jonathan Solity point out, the influences on teachers are not generally 'open, understandable and non-manipulative' (Powell and Solity 1990, p6). It is only as personal and public theories are elucidated and *praxis* is developed in the light of experience, evidence and the viewpoints of others that we stand a chance of offering some resistance to 'the

"normalizing" and "regulative" aspects of dominant discourses [which] operate to subvert attempts at fundamental change' (Weiner 1994, p98).

Developing a theoretical understanding about, and informed by, one's own practice will therefore be central to teacher education for change: and, pragmatically, it is not a logical or psychological necessity 'that to *improve* practice we must initially and immediately *focus* on practice' (Goodson 1991, p38). On this basis, the understanding of teaching as an *intellectual* activity needs to be reasserted. Those engaged in initial teacher education who wish to foster

the development of a teaching force which reflects in a critical manner on taken-for-granted assumptions, which can articulate reasons for contesting some of the conventional wisdoms about pupils, their interests and abilities ... [should] be encouraging students to be 'intellectual about being practical'. (Troyna and Sikes 1989, p25)

Also on this basis, it is no longer possible to subscribe to a model of student teacher development which deals *first* with practical skills and *later* with reflection on the nature, use, embedded ethics and so on of those skills. Since all practice is imbued with moral meaning and is the explicit exemplification of (someone's) implicit intentions, such a separation must of necessity be incoherent or, if intended, not honest. Teaching is not simply the aggregation of effective techniques: it is a moral activity which integrates practical, cognitive, interpersonal, affective and intellectual aspects of the teacher and requires recognising those aspects of the learner too.

It is not a consequence of chance that the apprenticeship model of initial teacher education has gained in prominence during a period of governance under the New Conservatism (see Wilkin 1990). If theory is characterised as separate from practice then practice becomes either the acquisition of skills by following the experts (practice validated by external authority) or 'what feels right to you' (practice validated by internal authority). Practice becomes atheoretical and therefore not subject to independent critical judgement by the student or the practitioner

(practice interrogated by the authority of self and reason). Margaret Wilkin has directed attention to the rhetorical results of the philosophy of the current government.

That skills are stressed and theory is either marginalised or discredited echoes the belief that theory is empty argument and that common sense and getting on with the job are what matters. (Wilkin 1990, p20)

In other words, the elimination of intellectual engagement with practice works to leave unchallenged and thus to preserve the *status quo*. In this discourse, 'common sense' and rhetoric replace rational argument from evidence (see, for example, Gipps 1993 and Swanwick 1990 for a discussion). Members of the Centre for Policy Studies advocate that training should be reduced to 'learning "the tricks of the trade" - the tips that make for successful teaching' (Lawlor 1990, p12) and are deeply critical of PGCE courses which, typically, 'expressly state that there is, and should be, a link between theory and practice' (Lawlor 1990, p18), which 'theory' includes methods of teaching, the planning of learning experiences, classroom management, the use of educational aids, evaluation and assessment! (See Lawlor 1990, p16.) Discussion of the notion of 'competency' echoes these concerns.

Essentially it is critical reflexivity which is at issue. The competency approach legitimates itself by asserting its self-evidence rather than by claiming superior reason. Its concern with 'transparency' ... *presents its own models as simple reflections of the real rather than constructs*. (Jones and Moore 1993, p395, my emphasis)

At an epistemological level, then, the technicist, apprenticeship approach to teacher education stands opposed to the authority of self and reason and, thus, opposed to a potentially liberatory and critical curriculum.

A key element in the production of the desire for change is the experience of dissonance between what we want to do and what we are doing, between the values that we hold and

those which are embedded in our current ways of working, between our epistemology and the way of knowing that is the taken-for-granted basis for our classroom practice.

... in order to commit themselves to change teachers must reflect on their own experience of schooling, higher education and teaching, and on the view of knowledge that these experiences have yielded. The teachers who can claim to 'own the problem of change' are those who recognise a potentially creative dissonance that they are prepared to confront and deal with. (Rudduck 1988, p205)

This is as relevant to student teachers as it is to established practitioners. Gill Crozier and Ian Menter (1993) found that it was very unlikely that such dissonance would be a focal point of attention in the school-based element of initial teacher education. Looking at issues of racism and sexism, they found rather that, within the school context, both mentors in school *and* university tutors colluded in ignoring and attempting to render invisible matters of potential controversy. Critical reflection is less likely to occur when teacher education (initial or in-service) is wholly based in school. *All* the students-becoming-teachers whom I visited in school, whether teachers working for change or not, welcomed my visits because of the opportunity the visits provided to stand back from day-to-day practice of schooling and to reflect consciously on their practice. When investigating 'gender leaders', Jean Rudduck noticed

[o]ne distinctive feature ... was that they had read about and debated these issues - but not, generally, with their own colleagues in their own schools ... Given the pressures on teachers during the school day it is not surprising that the school is not a site for reflective discourse about fundamental educational issues. (Rudduck 1994, p123)

It seems equally likely that the school alone will not easily be a site for critical reflection for student teachers. (However, see Jaworski and Watson (1994) for a sensitive contribution on how to promote student teacher reflection through the mentoring role.)

Offering a model of self-reflexivity

Teacher education for change seeks to preserve the sense of agency and of ourselves as actors. It includes in its definition of the interaction between theory and practice the notion of *situational understanding* (Elliott 1991, p6).

Situational understanding and the decisions derived from it are grounded in an awareness of the self as an active agent in the situations to be understood, and therefore as one who is capable of influencing the lives of others. (Elliott 1991, p18)

Equally with any other teacher, teacher educators are such active agents. Inasmuch as those of us who are involved in teacher education are able to draw attention to the dissonance and conflicts between our own rhetoric and practice and to offer a model of a way of knowing that we bring to bear on our own dilemmas, so far do we contribute towards the possibility of an emancipatory curriculum.

[C]ritical teaching in dominant institutions means that teachers are constantly living a contradiction. But possibilities for critical work exist within that very contradiction. It is vital that teachers recognise not only the structural constraints under which they work, but also the potential inherent in teaching for transformative and political work. (Weiler 1988, p52)

I have no reason to suppose that making explicit our own situational understandings, analysis of constraints, intentions, decisions, actions and so on - deconstructing the discourse in which we are participating and coming to 'understand the assumptions in which we are drenched' (Rich 1980, p35) - is easy. On the contrary, my experience is that far from successfully disclosing what and how and why I am doing what I do in the classroom, such messages mostly remain part of the hidden curriculum despite my intentions to the contrary. However, I conjecture that achieving such explicit self-reflexivity, albeit in minor and incomplete ways, will contribute to students' capacity, in turn, to critique their own teaching selves, to have

some knowledge of how such selves are constructed in the context of learning to teach and 'how the selves we produce constrain and open the possibilities of creative pedagogies' (Britzman 1991, p2). Magda Lewis notes that

The challenge of feminist teaching lies for me in the specifics of how I approach the classroom. By reflecting on my own teaching, I fuse content and practice, politicising them both through feminist theory and living them both concretely rather than treating them abstractly. (Lewis 1990, p485)

She offers some examples of strategies she has adopted in the (women's studies) classroom, the explicit articulation of which would be part of a self-reflexive critique. Writing in a different context, Jane Kenway, Sue Willis, Jill Blackmore and Leonie Rennie have suggested that 'a performance metaphor' (Kenway et al 1994, p205) may be useful in de-naturing the results of genealogy, in assisting the process of deconstruction. Perhaps it might be possible for teacher educators and students in training alike to

feel a sense of control over difference performance genres, to pick up, discard, play and take risks with them, and even to go beyond them through improvisation, collage and carnival. (Kenway et al 1994, p205)

Not least such an approach might allow for explicit reflection on the affective consequences of the selves we produce, the pleasure and the pain of different subject positions. So to challenge and subvert 'normal' classroom practices is threatening for teacher and student alike and, to complete the circle, will only be considered possible by a teacher educator who herself is able to assert her world view with the authority of self and reason. Moreover, her epistemological perspective will entail a constant demand upon herself to regard as fixed neither that world view nor her own identity but to be continuously involved in deconstructing her own practice and the discourse(s) of which it is a part.

A curriculum based on dialogue

I have claimed in Chapter 10 that dialogue is an essential component of an emancipatory mathematics classroom. It is also an essential component of a teacher education classroom predicated on a critical epistemology. Dialogue, conversation, articulated reflection allow the reconstruction of the self. They militate against fragmentation and, by allowing reintegration and the ownership of ideas, reinforce the sense of oneself as actor, agent and constructor and therefore are potentially liberatory. As well as validating personal authority, talking also helps in the process of jumping outside given frameworks, including our own. We rationalize by compartmentalizing experience and our understandings of our own behaviour and values; one result of talking to one another is to help break down those compartments because the boundaries we have thus created are not necessarily recognised by others (Marston 1993). It is important that learner teachers have the opportunity to 'face their own practices and other people's reactions to them *through their own thought frameworks*' (Busher et al 1988, p95, my emphasis) but also that, through 'real talk' (Belenky et al 1986, p144), they have the opportunity to critique those same frameworks. It is worth repeating here the difference between 'real talk' and didactic talk.

In didactic talk, each participant may report experience, but there is no attempt among participants to join together to arrive at some new understanding. "Really talking" requires careful listening; it implies a mutually shared agreement that together you are creating the optimum setting so that half-baked or emergent ideas can grow. "Real talk" reaches deep into the experience of each participant; it also draws on the analytical abilities of each. (Belenky et al 1986, p144)

Such open and collegial talk also helps in understanding ourselves as located in and by a variety of positions. Students who are to become teachers working for change must be able to sustain the paradox of understanding the constructed and contingent nature of knowledge on the one hand with the capacity to be committed on the other (Perry, 1970). Belenky et al (1986) in their study of women found a pattern of such development being dependent upon and flourishing as a result of sustained discussion over time with sympathetic peers. I suggest

that much of the same pattern of development will be true of other learners who are not part of the hegemonic group and who have had to struggle to find an authentic voice. Such students are well represented on courses of initial teacher education, which recruit large numbers of women and students from families with a working class background. Fostering their sense of themselves as being a learning *group* where the development of the individual enhances the development of the group, where ideas are exchanged and respected, where expertise is gradually developed and experienced as a group attribute, will contribute to their capacity to become authoritative knowers. It is my thesis that this in turn allows their development as critical, democratic teachers. (In teacher education, there is also the task of helping the development of such a way of talking, listening and knowing in the hegemonic group if its members too are to become teachers working for change.)

The role of subject studies

I have raised, in Chapter 9, the question of distinct subject sub-cultures within initial teacher education and questioned whether or not we have given them due significance. Here I offer some speculation about the two year PGCE route to qualified teacher status. I conjecture that it is not chance that the three teachers working for change were each members of a (different) two year cohort.

The two year route at the northern University they attended is structured in the following way. The first year is largely devoted to subject studies (although there is a small school experience component which allows them twenty days in school during which time they observe teachers and individual school students, work with small groups and, if they wish, have an opportunity to work with a whole class). Most of these subject study units are taught by tutors who are mathematics teacher educators, almost all of whom would espouse 'progressive educator' (Ernest 1991) values and some of whom, myself included, would also be striving to attain an emancipatory mathematics curriculum. (For a discussion of some of our practices within mathematics units, see Povey 1995, reproduced in Appendix 22, and Povey in press, reproduced in Appendix 23.) I have claimed elsewhere (Povey in press, see Appendix 23) that

some of our students have some of the time been successful in meeting our aims for them - being in control of their own learning, taking risks, negotiating with other learners, acknowledging the personal, 'discovering' the rest of the class, acknowledging passion (cf Giroux 1992, especially chapter 3). Some of them have challenged their existing understanding of the nature of mathematics and mathematical knowledge.

I was very sceptical ... but the amazement and sense of satisfaction I got ... quite astounded me ... motivation can stem from being an active learner. (James, mathematics diary)

My attitude to mathematics is showing itself. I have not thought very deeply about the way I think about maths. That is, one of my misconceptions was that if you can't do maths you can look it up in a book and see how someone else has done it. They will have been examining the problem from exactly the same perspective but they are cleverer and have managed to work out the solution. I think that this point of view is attributable to my mathematics background where most of my experience of maths is algorithmic 'quick fix' solutions to standard problems. For some reason, I had disassociated mathematical thought from eg sociological thought. I had assumed that for maths problems there is one way of solving problems leading to correct answers. By doing this course I have discovered the *obvious*. That is, problems can be approached in many different ways and conclusions can be challenged. This is the first time I have concentrated on problems in maths for so long and I have learned that maths problems are like other problems - sometimes the solution might be a new set of questions and the reward isn't necessarily in the solution - but in finding out the *way(s)* that a problem can be tackled. (Michael, mathematics diary)

one thing seems to lead to another ... Each problem solved raises new questions whose answers raise even more questions ... no matter how fast or slow you are ... there are always new questions arising. (Seema, mathematics diary)

When I embarked upon the PGCE I imagined that the first year would be a straightforward revision of maths; a subject which I considered to be elegant, objective and 'issue free' ... It is impossible to exaggerate the revolution that occurred in my thinking and outlook as a result of the teaching I received in the Maths Education Department ... it was particularly fascinating

... to debate whether maths can be said to have any objective reality ... I now believe that the neglect of the history of ideas is one of the greatest downfalls of current teaching. Children are too often presented with a *fait accompli* such as Pythagoras' theorem without any mention being made of its development and significance in a variety of cultures ... Having discovered that maths was more than just elegant I was then to discover that it is far from 'issue free' ... the way we were taught, the resources we used, and the reading/reflecting we were encouraged to do all stimulated thought and I now see how many questions were planted during the first year which I have never stopped considering. (Frances, final Education assignment of PGCE, sent to me after the interviews)

There are strong suggestions here, then, that the influence on the students of themselves pursuing subject studies under the tutelage of a staff group many of whom espouse an 'inquiry maths' perspective is significant.

There are other possible explanations for the willingness of students on this particular course to rethink their understanding of the nature of mathematics and mathematics learning. For example, it may be that mathematicians are particularly likely to have an absolutist view of knowledge and that mathematics convertees, because of their previous subject allegiances, enter the university already predisposed to less absolutist ways of thinking; or it may be that convertees have a personal history of comparative failure in mathematics and therefore are more able to distance themselves from the prevailing, subject-based ways of thinking; or it may be that that distance is a function of having previously had a different subject allegiance. Any or all of these might, if researched, prove valid. Nevertheless, the perception of at least some of the students is that studying mathematics within the teacher education context, rather than outside it, has been significant in shaping their understandings of the nature of mathematics and of teaching and learning.

If these perceptions were to inform our practice in teacher education, we would no longer be happy with the mode of preparing to teach, prevalent in the United Kingdom, of subject studies of an appropriate length and to an appropriate standard being undertaken *before*

embarking on professional training. Such a model of initial teacher education is favoured not only by, for example, the Centre for Policy Studies which advocates separating training from academic study.

Whereas the individual subjects which teachers will teach require academic study, the skills of teaching are essentially practical ones. (Lawlor 1990, p8)

Such a view is also espoused by, for example, the National Commission on Education.

Once trainees have become secure in their subjects as we recommend, classroom skills are at the heart of teacher training. (National Commission on Education 1993, p214)

Within courses of initial teacher education which already include a subject studies element (two year PGCE, two, three and four year undergraduate courses), present national structures allow, although they do not require, the integration of professional and subject studies. This can be used to provide rich opportunities for students to rethink their understanding of the nature of mathematical knowledge and their ways of knowing related to teaching and learning based on their own practices as learners. Students can also be encouraged, of course, to mine the practices of their tutors for the practical help (see Sikes 1993) essential in implementing a liberatory mathematics curriculum; but my thesis is that unless such practice takes as fundamental the fostering of an epistemology based on the authority of self and reason it will not support the development of teachers working for change.

No such opportunities exist on the one year training route which takes 'subject knowledge' as a prerequisite. The single year is already too full adequately to allow students the opportunity to stand back from their practice and as such seems to discourage student reflection: there is simply no room to expand this curriculum to include a significant element of subject studies. I did not set out to research the issue of subject studies in initial teacher education and further work needs to be done. However, on the data presented, the hypothesis that re-viewing

subject studies as important to the epistemological perspective of the becoming teacher seems plausible. If these observations are sound, then it will not be surprising if initial teacher education through the one year route does not have much success in enabling students to become teachers working for change. It also implies, unsurprisingly, that an emancipatory mathematics education as described for school classrooms in Chapter 10 must become a reality for mathematics classrooms in teacher education too.

Further research

I have at various points in this thesis suggested areas in which further research is required and have embedded those comments in the context to which they are relevant. I attempt here to draw some of those threads together. The first three areas of further research all relate to pedagogical theory and practice, the first two of these to the teacher education curriculum and the last of these to the school classroom. I also consider the need for further research into emancipatory research *praxis* - what methods and methodologies support critical research? - in each case pointing to two particular examples. Finally, I indicate the need to deconstruct the work of this thesis itself.

Action research on the professional teacher education curriculum

The epistemological model I have elaborated may contribute to a framework for developing a critical teacher education curriculum. However, as with gender work in schools, the need remains to refine both thinking and practice by considering

the ways in which our work is received and rearticulated by our students and our colleagues. Trying to understand why they respond in the ways that they do and connecting this to what we do, as well as to their discursive histories is essential. (Kenway et al 1995, p25)

How does our students' response relate to what we do in the professional teacher education classroom? For example, how does our current hidden curriculum support, in unintended ways, 'higher education's fundamentally conservative teaching and learning practices' (Leonard

1989, p26)? Does 'negotiating the curriculum' (Povey 1992) help develop personal epistemological authority? Can students be encouraged to re-interpret pupil behaviour in potentially emancipatory ways along the lines, for example, suggested by Sikes, Measor and Woods?

Pupils are part of society, and attitudes change as the social climate changes. Some current deviant behaviour may simply be an expression of their impacting against an outmoded role - that of the 'proper teacher' - founded on a system of honour and allegiance to inhuman structures and traditions. (Sikes, Measor and Woods 1985, p242f)

(See, also, Mac an Ghaill 1994, p78f for the challenge offered by middle class mothers to a school's dominant, unchanged gender practices.) Would sharing Lacey's analysis of teacher socialization strategies (Lacey 1970), by helping students see behind teacher practices, support their ability at least to comply only strategically with aspects of schooling they wish to oppose? Would our best efforts be most productively employed in enabling students who already want to work for change rather than attempting to move those who do not (yet) wish to do so? How can we use autobiography (see Abbs 1974, Aspinwall and Drummond 1989, Norquay 1990) to enhance liberatory potential?

Autobiographical method shows the author of the piece the way in which he has construed his experience and reveals the ways in which curriculum has invaded his own perceptual lens. It reveals that this apparent subjectivity is a highly socialized one, and carefully tailored to the assumptions about time and space, community, knowledge, and power that are the dominant ideologies of our society. (Grumet 1981, p128)

Has role play a useful place, especially in the exploration of conflict? Can video recordings be used to unsettle/upset 'metaphoric images' of teaching? In what ways might innovative curriculum practices - collaborative assessment, peer teaching, learning logs and so on (Dart and Clarke 1991) - support emancipatory teacher education? How might such practices be re-

written by our students? How do we in our pedagogy adequately take note of 'such concepts as pleasure, nurturance, pain, blame, shame, risk, investment, fantasy and positionality' (Kenway et al 1995, p24)? Lastly, and very importantly given current arrangements for teacher education in the United Kingdom, is it possible to reconceptualize the partnership between the University and schools to their mutual and emancipatory benefit? (See Jaworski and Watson 1994 for a thoughtful contribution.)

Subject studies

The second area of further research in the teacher education curriculum concerns the role of subject studies (as discussed earlier in this chapter). Does pursuing subject studies with teacher educators who are committed to an epistemology based on the authority of self and reason support the development of students becoming teachers working for change? Does previous personal success as a learner in didactic encounters with mathematics make it more difficult to challenge those practices? As Leone Burton has noted, if prospective teachers

come from successful experience of didactic learning, very likely for example in the case of the Postgraduate Certificate of Education (PGCE) student who has already gained a degree in mathematics, and their teaching practices are within the same mode, any questioning of its efficacy by the teacher education institution is more likely to fall on deaf ears. (Burton 1992c, p380)

What practices in the mathematics classroom encourage the development of an emancipatory epistemology in student teachers? What devices are there for articulating such practices and making them explicit objects for reflection? (See Povey in press, Appendix 23, for a contribution to this research.) How do our students rewrite those practices and how does this relate to the discourses within which they are positioned and within which they position themselves?

'Control' in the classroom

The third area of further pedagogical research concerns 'control' in the classroom. In this research I came across hints that the issue of classroom control may be significant in understanding the difficulties that (many) teachers experience in implementing an emancipatory curriculum. For example, consider Simon who seemed to have redefined himself as now being not a teacher working for change. (See Chapter 11.) He wrote

I didn't expect to become quite the authoritarian I am now. It became obvious to me though after a few months of teaching that I needed to feel in control. It makes me feel better when I know that my classroom is a safe place ... (Simon)

There is a need to ask

... what [is it] about control which makes us so scared of losing it. Who really needs the control - is it the teachers or the learners? Children seem to live comfortably in confused chaos from an early age. They cope with multiple disordered stimuli by ignoring most of the chaos and stressing only a small section which they then choose to work on ... If we accept that tightly controlled classrooms have been inhibiting learning, should we not also consider the possibility that learning cannot take place unless there is confusion and conflict? (Breen 1990, p39)

How do teachers conceptualise 'control'? What does 'control' have to do with learning? What has teachers' control to do with students 'being in control of their own learning'? Is being out of control the opposite of being in control? What is the relationship between (good) order and control? What are the various discourses of which 'control' is apart? How should these be deconstructed? My conjecture is that working on these questions will tell us more about emancipatory education.

Methodology and methods

It has been my intention in this thesis also to contribute to the development of critical research methodology and associated research methods. There is much scope for further research: I

draw attention here to two issues amongst many. One of the areas which needs considerable further work (and which is contemporarily an on-going theoretical concern for feminists) is that of *difference*, an issue which has not been addressed within this research. Part of the tangle here is to value diversity and to understand that the construction of a false homogeneity contributes to the production of hegemonic discourse whilst at the same time allowing for the possibility of inter-subjectivity and non-oppressive dialogue.

The occasional experience of radical incommensurability should not obscure the much more important point that, despite enormous diversity, our ways of thinking and speaking about our world also exhibit striking commonalities. (Burbles and Rice 1991, p408)

I have acknowledged within the research the limitations of its scope with respect to locality but I have not, in any satisfactory way, positioned myself and the model I have developed in its wider historical and cultural location. To do so would increase the possibility of 'dialogue across differences' (Burbles and Rice 1991, p393) and would contribute to the task of developing an emancipatory politics of location. What is needed is a two-sided strategy which allows for the use of the construct of, for example, 'emancipatory practice' without essentializing particular actions, which avoids 'cultural relativism, liberal pluralism and anything goes-ism' (Kenway et al 1994, p206) whilst at the same time not constructing a false universalism that fails to recognise difference in positionality. We need an understanding of difference which permits also of a shared vision and some common foundations for action while at the same time avoiding a fiction of unity. (See Kenway et al 1994, especially p206-207, and Lennon 1995 for two recent contributions to the debate.)

There is also a need for further work in exploring how it is possible both to continue 'to wrestle with the postmodern questioning of the lust for authoritative accounts' (Lather 1991, p85) whilst at the same time also interrupting this with emancipatory thought and action. Is research possible which does not entail the production of 'authoritative accounts'? How, if at

all, is it possible for me to speak out without being authoritarian? Is this the same question or a different one? In turn, is emancipatory research possible? It would seem to demand

dialectical practices [which] require an interactive approach to research that invites reciprocal reflexivity and critique, both of which guard against the central dangers to praxis-oriented empirical work: imposition and reification on the part of the researcher. (Lather 1991, p59)

Does this mean that the scope of emancipatory research is limited to those arena in which all the participants have the resources and the inclination to engage in 'reflexivity and critique'? Does all other research necessarily involve us as 'the intellectual who both objectifies and speaks for others' (Lather 1991, p15) and leave us charged with political vanguardism?

It is also the case that much further work is needed in developing the methods of democratic research. Such work will not be separate from the theoretical considerations above (and others) but will involve the development of *praxis*. Again, briefly, I offer two examples. First, as I discussed in Chapter 2, I found comparatively little guidance on using group participation within research. For convenience, I repeat here some of the questions I asked there. What is the significance of the other roles the group participants play for each other? Is it particularly significant if those other roles are part of a hierarchical structure? Is it possible to bring to the group setting any sense at all of equality if, outside the group, relations of dominance exist between the members? What is the impact of a perceived difference in knowledge base between the participants, and especially between the researcher(s) and the rest? How is interviewing a group different from a group conversation? How else might the group task be described/analysed? If the researcher(s) have an agenda of enquiry, in what sense, if at all, can the agenda be understood as democratically negotiated if not every member of the group sees themselves as a researcher? What is the significance of how and by whom the group is instigated? Do the *feelings* of the researcher(s) offer any information? Does a group setting offer any protection against over disclosure? Or, conversely, does the group setting put pressure on the members to disclose more than they otherwise would? Is this pressure

illegitimate? Who decides? What methods of recording are legitimate or helpful or appropriate? In the *Afterword and commentary*, I experimented both by introducing the participants to each other and also by invoking their critique of the (almost) final research 'product', not with a view to *incorporating* their reflections but endeavouring to have their critique stand alongside my work. Does either aspect of this experiment offer any insights into working with research participants as a group?

Second, I have also experimented modestly with aspects of form in the writing of and in this thesis with various intentions, including that of destabilising the academic reader/writer couple and of making explicit some self-reflexivity. What ways of reporting on and writing about research might contribute to a critical purpose? Has any of the devices I have employed effectively addressed either of these aims? How, if at all, can such academic writing defend itself against the charge of being simply a mannered conceit, part of the 'dangerous game' (Hill and Cole 1993) of a (decadent) postmodernism? How, if at all, can I use text, contrariwise, to mitigate 'my own inescapable complicity in practices of cultural production' (Lather 1991, p85)?

Deconstruction

Last, but not least, there is the need to deconstruct the model I have produced, to understand how I have been seduced into participating in patterns of dominance, how I have conspired with the technologies of power despite (partially) critical intentions. The model I have created like

... each new theory produced has to be subject to a deconstructivist critique from its own marginalities, in a process without closure or finitude. (Lennon 1995, p141)

Such a deconstruction will help alert us to emancipatory discourses' own 'particular dominating tendencies; to their potential dangerousness' (Kenway et al 1995, p1, after Foucault).

Working for change in teacher education

There is no reason to suppose that current policy makers will have any sympathy with the thrust of this research. We know little as yet of the philosophy of teacher education held by the current Secretary of State for Education and Employment nor that which will underpin the Teacher Training Agency; but it seems reasonable to assume that they will not deviate significantly from that previously adopted by the current administration as expressed by the Prime Minister,

I also want reform of teacher education. Let us return to basic subject teaching, not courses in the theory of education. Primary teachers should learn how to teach children to read, not waste their time on the politics of gender, race and class.
(Major 1992)

and echoed by his then Secretary of State for Education.

Just as we need to ensure that our children are well taught, so we need to be certain that our teachers are practically trained - not with the discredited theories of the 1960s, but as much as possible at the chalkface, in the classroom. (Patten 1992)

Discussing the work of Bourdieu, Giroux describes the view that

Education is seen as an important social and political force in the process of class reproduction ... it is precisely the relative autonomy of the educational system that ... [enables it] to conceal the social function it performs ... (Giroux 1983, p88)

However, it is also this relative autonomy that allows for the possibility of change. Moreover, although the dominant discourse is always likely to be antithetical to destabilising the *status quo*, the notion of hegemony

does not entail that the ensemble of descriptions that circulate in society comprise a monolithic or seamless web, nor that

dominant groups exercise an absolute top-down control of meaning. On the contrary, 'hegemony' designates a process wherein cultural authority is negotiated and contested. It presupposes that societies contain a plurality of discourse and discursive sights, a plurality of positions and perspectives from which to speak ... conflict and contestation are part of the story. (Fraser 1992, p179, quoted in Kenway et al 1994, p190)

Returning to where this thesis began, there is no reason to suppose that change in educational practice is easy. Not least should we heed the warnings given by Madeleine Grumet who advocates rooting out optimism, resisting integration and being suspicious of solutions and of 'our most cherished and most comfortable ideologies' (Grumet 1981, p122). She continues

The problem of studying the curriculum is that we are the curriculum. It is we who have raised our hands before speaking, who have learned to hear only one voice at a time, and to look past the backs of the heads of our peers to the eyes of the adult in authority. It is we who have learned to offer answers rather than to ask questions, not to make people feel uncomfortable, to tailor enquiry to bells [and] buzzers ... (Grumet 1981, p122)

Nevertheless, it seems that we can do *something*, albeit in contradictory and limited ways, in striving to challenge the dominant discourse of education, to wrest some discursive authority - that is, to ask who controls the agenda (Weiner 1994, p100) - from the supporters of the *status quo*, to construct, in part, a counter-hegemony (Weiler 1988). Gaby Weiner has pointed out that

belief in state policy as a means of addressing equality (let alone feminist) issues is at an all time low. What is, nevertheless, important to remember is that alongside current official curriculum discourse which cannot be viewed as other than regressive, interest and commitment to eradicating inequalities in education goes on ... (Weiner 1994, p48)

It is, of course, necessary to be realistic about how much impact an initial teacher education course can have on behaviour in classrooms. It is bound to provide, at best, only the first

steps on a pathway. (To continue the analogy, if that pathway later peters out, it does not mean that the first steps should not have been taken. Rather it means that bulldozers need to be employed to take it further!) Nevertheless, for me it is the site in which I find myself and thus becomes the arena in which I attempt to express my 'faith in the necessity of struggling to create a better world' (Giroux 1983, p242). I know that the work of this thesis has been a catalyst (Lather 1986) for the development of my *praxis*: I hope too that it has made a contribution to the working lives of those who have participated in it with me. Perhaps it may also make a small contribution to the community of those who embrace a commitment to social justice, who have a belief that things might be other than as they are and who nourish a hope that they will be so.

Afterword and commentary

The *Afterword and Commentary* is intended as an attempt to subvert 'the researcher's ability to police knowledge' (Lather 1991, p100). A good indication of my intentions is given by a letter I wrote to my supervisor after I had finished the draft of Chapters 9, 10 and 11.

I am thinking about going back to my three teachers working for change and asking them to read [these three chapters] and then to meet together as a group with me and discuss it. This would not be in the spirit of a 'member check' and would not be intended to cause me to rewrite (though of course this will be bound to happen to a greater or lesser extent). Rather it would be an attempt to engage with issues of honesty, to mitigate in some small way the objectification of the research participants that I have failed to avoid and to raise, again in some small way, some issues about narrative, text and the construction of meaning. It would be offered in the spirit of a postscript, coda, comment on the research. (personal communication, May 1995)

To my delight and terror the participants all agreed and met at my house one summer evening. The record of the conversation between myself and the participants is based on audio and video tapes and is a transcription constructed by me: it contains minor editing of repetitions, grammatical slips and so on; occasional editing for brevity; and some loss of dialogue due to poor recording. Otherwise, the text is an attempt to re-present to you the conversation as I heard it when I replayed the tapes.

Hilary The reason I wrote to each of you and asked you if you would be prepared to meet each other and also to talk about what I'd written was because I found it very very strange to go and meet people and talk to them and talk to them for a

long time and then to go away and write *about* them. It just felt a very distorted kind of relationship ... it feels like making people into objects when you go and talk to them and talk to them for a long time and then you go away and you're the only person, you make this *thing* up about them ... I'm not intending ... to really rework what I've written. I intend to leave that to stand and then to say yes but look here, there's this other point of view ...

John [It was very strange reading the transcripts.] It just seemed like a jumble of stuff that didn't seem to make a great deal of sense at all, that's not what I thought I was saying at the time, I think the essence of it is there but it seems strange.

Matthew But your two were a lot less jumbled than mine. That might be a subjective ...

John I think it probably is .. What I thought was there was more of you two [in the chapter] than there was of me so that yours made more sense than mine but I thought yours two looked quite unjumbled so maybe it is purely subjective, you like to come across as more sophisticated or whatever ... but it seems alright to me, the quotes ...

Matthew Unless the bits quoted are the best bits.

Frances There's an awful lot between the quotes, that's what I was thinking, there's all the other stuff that you said in between the little bits that've been picked out.

John But even those bits ... don't seem to make sense. They obviously made sense to you otherwise you wouldn't have put them in, would you?

Hilary No

Frances Its very strange to hear yourself speak which is sort of what you do when you read through the transcript and think 'Is that what I sound like?' and 'Do I really think that?'

John I went through paranoid episodes when I thought 'I used to sound more eloquent than that, I must have done myself some damage, lost a few brain cells. But perhaps not, if everyone else feels the same. That was the main thing I found with it. It seemed quite jumbled ... it didn't seem to portray exactly what I was trying to say, although I think that the quotes that you've chosen are very relevant and I would say them again ...

Frances When I read the chapter, I felt quite pleased, I thought I'm happy to be slotted into that model (laughs). I'm not sure that's really what I live up to at all but it definitely appealed. But I feel quite pleased about the transcript now, having all that written down, because when I read it again I thought 'Hmmm I'm not sure what I think about some of these things now'. It was just nice to have it as a record really of where I was at at that time, like finding old letters and thinking 'Hmm how have I moved on or changed or what were the things that were significant then?'

- John Yes that's true ... and it depends what sort of day you've had, what mood you're in at the time, there's a lot of things - maybe it doesn't change your beliefs or your ideas but it may change the emphasis you put on things. Some of the things that I said perhaps I would have said differently had it been a different time.
- Matthew I thought that as well. When I was reading it I felt 'I remember what I was thinking and feeling in that week' and some of the things that had happened two and three weeks previously, particularly things at that particular point in time - and although, underlying it, yes, I think it's what I believe in, and still do, perhaps it'll change a bit, the emphasis ...
- Frances Yes but one of the characteristics might be that you might be the sort of person who *does* change their underlying theories -
- John - yes that's true -
- Frances - that experience affects you.
- Hilary Did you have any sense about this thing of being kind of objectified? Or did it not feel like that when you read about it? ...
- John I didn't think it was a problem at all. I didn't feel [like that]. I think probably I felt flattered that I was one of the three teachers - particularly when you read what we said in contrast to the other people.
- Frances It's interesting, though, because you wonder if someone else had had all the transcripts and some different ideas that they wanted to express about teachers whether I could have been in a group with two completely different teachers and you could have been in another group with some other teachers and they would have sort of set up a model and used our quotes, just completely different quotes but to fit it with a different sort of structure.
- John Yes I know what you mean.
- Frances So to a certain extent it's picking things to fit an argument or a way of looking at something. It just happened to be a way of looking at things that I feel quite comfortable about (laughs).
- John Yes that's true, you obviously looked for quotes which backed up what you wanted, you used the quotes to inform what you wrote ...
- Matthew I found it very flattering, and in fact it's probably had quite a positive effect, in fact I can feel it's having a positive effect at the minute already in a couple of ways. When I read it, I felt 'Hey there are people thinking similarly to me' and that was very positive and really good and then - it's flattering and there's a sense of me thinking 'This is like [there's something of] the emperor's new

clothes about it, like 'This is the sort of teacher I am' and someone else will be saying 'You're naked!' -

(all laugh)

Matthew - because its not like that really at all. But there's things in there to aspire to and in that sense, when you said 'Do I feel like an object?', you came to interview me and that was nice and at the time I found it useful to have an opportunity to think about what I was doing and then I forgot completely about it. And then, when you said 'Can I send you the transcript?', that was the first time I thought about it ... It's not been a one way process, I've benefited from having a look at those [things]. It's changed me, it's altered me, being interviewed by you changed my practice - I think - and then reading the transcript has changed my practice, looking at [the chapters] has changed my practice, so that's not a person who's just being an object, is it?

Frances No, I agree ...

Frances It also makes you wonder to what extent the staffroom is a safe environment for talking, because you think 'Why haven't I had some of these conversations in the staffroom?' ...

Hilary What do you think about what I claim? Do you think it makes any difference at all what people think truth claims are based on? Because I am suggesting it matters.

Frances Yes I think it matters.

John Yes I think it matters as well ...

Matthew It's quite unusual even to think about it. If you actually consider the question 'Does it make a difference?' then that automatically means you are thinking about it in a certain sort of way anyhow ...

Frances I think it definitely, definitely must affect how you teach. I suspect that a lot of teachers fall into the category of never [being aware that they] think that you know things because someone else has told you them, because it seems that [would be] such a fundamental threat to our education system. Probably if you're the sort of person who thinks that you know things because that's how you feel, I suspect quite a lot of those people become casualties of the teaching profession and give up because it must just be so desperately upsetting all the time that the feelings of the people in front of you just will not conform to how you think it should be.

John We're bound to think it matters, aren't we, if we're this sort of teacher?

Matthew I wonder what sort of difference it makes. I mean I'm not actually sure that I do ... that I necessarily actually think like that ... It's a lot more unconscious than that and just trying to let things happen really and see what happens. [It's]

more relaxed than that and more unconscious. But in terms of 'How does it make a difference?', it's quite hard to see really because on one level you can look at perhaps two classes and their teachers are working in very very different ways and they're getting the same results ...

Frances What do you call a result?

Matthew Academically. It feels like it ought to make a difference, it feels like it ought to be a better way to teach and that ought to lead to greater motivation and that ought to lead to other things, but I don't know. On an individual level, I can see that it does make a difference, there was a girl this week who was very upset about her SATS result ... but I'm not sure what I do in the classroom all the time makes a difference. I don't know, is that too negative?

John If the whole of your attitude is along those lines then presumably it's possible it might make a difference, if you've got that approach all the time, that it'll make a difference, that something will stick. But you can't guarantee it, you see them for an hour and a half a week or whatever, but I don't think it's a reason for giving up because if you only just change her opinion of herself, the way she views things -

Frances I think that as they go around the day, trolling from one part of the school to another, I think the kids are really aware of how the different classrooms with different teachers have a completely different feel to them, different things are expected, you feel differently, you behave differently, the whole set up in different teachers' classrooms is different. I think they're acutely aware of that.

John Yes I think they are as well.

Frances I'm convinced of it ...

Frances How you're teaching and how you think they're learning does just affect dramatically what happens in the classroom and what they think about it.

Hilary May I ask you a bit about how I tried to describe what I called the way of knowing that I thought linked to 'inquiry maths' and which I thought were sometimes your ways of knowing ... I'm describing you very much as individual, as though there's no - reducing the kind of social context ... it's very kind of like personal, individual.

Matthew There's like this sense that you go along this path and you go through these stages of different, inferior ways of knowing and then eventually you get this revelation called the 'authority of self and reason' and it's like - I feel a bit sceptical really, I'm not sure it quite works that way. And also there's this little suspicion - is that being held up as being the best way of looking at the world because that's the way that most academics look at the world (laughs).

Frances I liked the idea that in different areas of your life or possibly even in one area of your life you could know different things in different ways, that you could

actually be all four of those things simultaneously or go in and out of them and that there are times when you might, in one area of your life, you might be able to take things from outside and take things from inside and do all kinds of juggling with them and feel very at peace and comfortable and in another area of your life feel completely silent and as though you don't know anything ...

Matthew If there's something in common between the four of us then maybe there's a commonness in having a curiosity about wanting to know about why things happen rather than just simply accepting them, and that's not necessarily true for everybody and I'm not sure - and I know that you say it's a model of knowledge and so in that sense that's fine - but I'm not sure that it's generally true for everybody ... for them to actually express themselves, the question of *knowing* about things isn't necessarily the most important thing ... and the thing about it not being an endpoint, about changing and about different parts being in different ways - is that, maybe, it's very natural for people who - that restlessness.

Frances I'm not sure that everybody puts themselves in positions that are going to challenge themselves. I think some people run a mile. But everybody or nearly everybody has to make decisions, and to make decisions you have to decide that you *know* what the best thing is to do in that situation, whether that's in the classroom or in some other part of your life. Therefore you have to have some way of saying 'This is how I know this is what I should do' even if all that way is that I don't know.

John That depends on whether you believe in determinism or free will ...

Matthew Do you believe that?

John Determinism? No I'm not a determinist but I don't believe entirely in free will either ...

Frances But you still think you're making the decision.

John You have the illusion that you're making the decision.

Matthew People making history but not in circumstances of their own choosing ... People do make choices but, as you say, it's within constraints ... the idea of what you should be doing and actually what you can do because - and that I thought was missing - you have to be aware of the circumstances and it almost was like there was this model of this wonderful emancipatory education and its like 'What?' (laughs). End of the 20th century, end of 16 years of Toryism.

John I thought maybe the model was too limited because I heard ... that, for instance, in Thailand they never, ever make decisions based on logic, they always base it on feeling ... so what you've said may be true for this particular culture but there's more to it than the western view of things, it may be [some people] have a different way of reaching decisions.

- Matthew There's an implication that it's not just a description of us ... its also meant to point to a way forward, this is perhaps how teachers should be classed in terms of learners ... I'm not sure - this relates back to what I said before about the classroom, how much difference does it make? I'm wondering how much difference the way that a course is structured makes anyway, maybe it's a much more personal thing. Reading some of those things there, it almost seems incidental that we're teachers and maybe if we were all doing something else we'd all have similar attitudes about that. I'm less dogmatic than I have been in the past, even the recent past ... but that isn't anything to do with - I wonder how much that has to do with - say, a teacher training course.
- Frances I think it's true that some people will enter something like a training course with ears to hear and some people less so. But even so I would have thought you could structure the course to encourage people to question what they're going to be doing just as you can in the classroom or you can structure it to say 'This is what maths teaching needs to be like so we'll give it you on day one and see if you can be like that by the time you leave'.
- John If we all change a bit, or if it only affects four people out of the whole course [it's still worthwhile].
- Matthew There are also points at which it seems change is more possible, although it's not necessarily predictable although certain environments, certain situations help it. Maybe it's worth thinking about how you create opportunities for those sort of changes to occur, they're not going to happen all the time, but those opportunities for people to say 'Hey'.
- Frances And you have to accept that there are going to be some people who are going to resist that. There was even one person on that course who, with quite a startling degree of self knowledge in a sense, would say 'I would like to think like that, I would like to have those kind of ideas and views and try to do those kinds of things, but I just don't think I can'.

Both Frances and Matthew have asked to read the whole of the thesis (perhaps John felt less the need to do this having participated in Phase one and Phase two as well as in Phase three) and have expressed interest in and a commitment to themselves researching their *praxis* and the nature of schooling. (Matthew has also written to me about his response to Chapters 9, 10 and 11. Extracts from these form Appendix 15 and see below.)

I have tried to stay faithful to my intention to allow the *Afterword and Commentary* to stand alongside the rest of my text, to still the dialectical, reflexive process. There are two exceptions to this. I made changes to the introductory section of Chapter 9 and, most of

Chapter 12 being written after the conversation took place although before this coda was constructed, the conclusion to the thesis has inevitably been influenced by their reflections. It seems appropriate to finish with a further comment from Matthew.

A methodological puzzle for you:- being interviewed by you and now reading the interviews undoubtedly has led me to reflect more on the issues you are concerned with and so change my ideas and practice (and vice versa?). If it doesn't sound too pretentious I would say that it's a wonderful example of the dialectical relationship between observer and observed/ objective and subjective.

A solution? I came across the following quote (or rediscovered it) through interest in other matters and it made me think of conversations I have with K_____ and also of my feelings about being an 'object' of research.

Objectivity does not mean detachment, it means respect; ['to be able to see it as it exists according to its own nature'] that is, the ability not to distort and to falsify things, persons and oneself. But does not the subjective factor in the observer, his [*sic*] interests, tend to distort his thinking for the sake of arriving at desired results? Is not the lack of personal interest the condition of scientific inquiry? The idea that lack of interest is a condition for recognising the truth is fallacious ... What matters is not whether or not there is an interest but *what kind* of interest there is and what its relation to the truth will be. (Erich Fromm, *Man for Himself*)

I began this research thinking within an action research paradigm and about my own practice and that of my colleagues as teacher educators. Working with John, Frances and Matthew; discussing the thesis with a past teacher education student now research colleague and friend; noting (small) changes in the self I construct; and this *Afterword and Commentary* give me courage to believe that the work has had, at least, catalytic validity (Lather 1986), both for me and also for them as teachers and as (practitioner) researchers. I hope that it will have such validity for you, the reader, and perhaps (who knows?) also some members of the wider community.

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Appendices

Appendix 1

Research participants and nature of participation

Individuals mentioned in the empirical research by pseudonym, giving nature of participation. Cohort is given in brackets: 1 1989-90, 2 1990-91, 3 1991-1992, 4 1993-94.

Phase one			
	TP questionnaire	Interview	TP file
Sandra (1)	*	*	*
Pete (1)	*		
John (1)	*	*	*
Mick (1)	*		
Andy (1)	*		
Richard (1)	*		
Mary (1)	*		
Carol (1)	*		
Joanna (1)	*	*	*
Kevin (1)			*
Wayne (1)	*		
Bob (1)	*		
Carrie (1)	*		*
(Mavis) (1)	*	*	

Phase two

John (1)	school visits and interview
Joanna (1)	school visits and interview
Wayne (1)	school visits and interview

Phase three

John (1)	interviews, video taped discussion
Kevin (1)	questionnaire
Wayne (1)	telephone conversation and brief interview
Janet (2)	questionnaire
Beth (2)	school visit and brief interview
Simon (2)	questionnaire
Sara (2)	conversation during training
Matthew (3)	school visits and interviews, correspondence
Frances (4)	school visit and interviews, university coursework, video taped discussion
Seema (4)	mathematics diary
James (4)	mathematics diary
Michael (4)	mathematics diary

Appendix 2

Interview schedule for Phase one

SEMI-STRUCTURED INTERVIEW SCHEDULE

Ask permission for the interview to be taped. If the interviewee declines be prepared to take notes and for these to be validated at the end by the interviewee. (It will be much better if the person can be persuaded to be taped!)

Before the first question check that the tape recorder is working correctly and that the recording level is good quality. This will depend on the position of the tape recorder and how loud the voices are. Your voice needs to be heard as much as the interviewees. Please don't forget that the recording has to be transcribed by a secretary who has to have the clearest possible recording to hear properly.

1. What subject/age phase are you taking on the PGCE?

2. What did you do before you came on this course?

3. Were you one of the leaders of the student led seminars on gender.

4. How would you rate your awareness of gender issues in education before the beginning of the course.

very high? high? quite good? medium? low?

5. Do you think the amount of time spent on the course was

Far too much Too much About right Too little Far too little

Prompt: Any distinction between parts of the course eg App.Ed?, Subject?
In what ways was there (too much/too little etc.)?

6. What specific input have you had on gender a) in Applied Education
b) in the rest of the course

7. What factual information about gender issues have you learned during the course.

8. Compared with all other influences how much do you think a person's gender determines their achievement in school?

a great deal/ quite a lot/ as much as anything else/ not much/ not at all

Prompt: Once they have chosen ask for clarification.

9. Are there any aspects of this issue that the course ignored or failed to cover adequately?

Prompt: Why do you think they should be included?

10. Are there any aspects that you have been involved in that you would recommend to be used with other students in the future?

Prompt: Be precise. Why would you recommend it?

11. Are there any aspects of the course that you think should be discontinued?

Prompt: Be precise. Why would you discontinue it?

12. What does Equal Opportunities mean to you?

13. Have you changed your ideas as to what Equal Opportunities means?

Prompt: Do you behave/respond differently in any way now?

14. What has most affected your thinking concerning gender since September?

Prompts: a) specific formal inputs within the course?

b) other experiences related to the course?

c) experiences unrelated to the course?

15. What do you understand by positive action concerning gender in schools?

16. Will you take any steps to reduce gender bias when in your job next September?

Prompt: What steps exactly? Own classes only? In the rest of the school?

17. Do you think that sexism affects or has affected you?

Prompt: As a woman? As a man?

18. Is there anything that you would like to say that you have not had a chance to say so far?

Thank you for taking part in this interview.

Appendix 3

Teaching practice questionnaire from Phase one

PGCE LATER YEARS MATHEMATICS

During the holidays we would be grateful if you would complete the details below.

Name:

1. List the criteria you yourself used to evaluate your performance during TP with respect to Equal Opportunities (Section 12 on the proforma).
2. Write down your evaluation of your performance in this category with respect to the criteria you have identified in Qu.1.
3. Give specific examples, if you can, of observations you made while on TP of sexist behaviour and/or materials in use in mathematics lessons.
4. Give specific examples, if you can, of actions you took while on TP to mitigate against sexism in mathematics lessons.

5. Give, if you can, specific examples of how in retrospect you could have modified something you did whilst on TP to reduce the effects of gender bias in mathematics teaching.
6. Which, if any, issues relating to gender and mathematics do you feel more conscious of now that you have been on TP. Why ?
7. Before TP we asked you to complete a sheet about your own mathematical expertise/qualities. Did you try to use this with children during TP ?
8. Hilary set up a classroom monitoring activity with you. Did you participate in this during TP ?

If so,

(a) What did you monitor ?

(b) What were the outcomes ?

(c) How, if at all, would you modify such an exercise in future ?

What further input on Gender issues would you like to see in Maths ?

10. Next term we would like to address other Equal Opportunities issues with you in respect of mathematics teaching and learning.

(a) What other EO issues do you feel should be addressed ?

(b) What sorts of inputs would you like to see ?

(c) What can you offer?

If you feel there are other comments you would like to make about the EO component of the Course, your own feelings /attitudes etc please add them below.

Many thanks

Appendix 4

Responses to teaching practice questionnaire from Phase one,
section 9

Replies to teaching practice questionnaire, section 9

in relation to girls needing more of a discussion approach - I feel I could benefit from more work on how to promote mathematical discussion (Sandra)

resources without gender bias (Mavis)

more hard facts where they exist and something on the hidden curriculum and teacher behaviour (Pete)

suggestions for lessons and sessions confronting the issues enabling attitudes to be expressed, discussed etc. (John)

any - possibly how to tackle sexism with colleagues coupled with sexism in the institution of the school (Mick)

advice on ways to encourage girls to have greater confidence on computers (Carol)

any further means of reawakening the interest of girls who have switched off (Joanna)

how to encourage girls who only have a very narrow view of their future and think mathematics is only for boys (Wayne)

more practical help. I feel I am fairly aware of the problems girls face with maths but find it difficult to counter these (Bob)

need to read up myself really - not sure how profitable work in the group would be, although might be interesting to get other perceptions now we've all had some experience (Carrie)

Appendix 5

Draft timetables from Phase one

9/1	Course planning	TP feedback	12/1	DIFF. APPROACHES	12 TOPICS.
14/1	DIFF. APPROACHES TO TOPICS.		14/1	TUTORIAL	T.P. FEEDBACK
23/1	LOW ATTAINERS + MIXED ABILITY		26/1	G.C.S.	E.E.R.
30/1	LOW ATTAINERS. MIXED ABILITY		2/2	NOTES OF ADV. J. SMITH - GUEST SPEAKER	LEARNING, CAN BE ORGANISED
6/2	A.P.O. C.S.M.S. ETC.		9/2	MORE ON	MICRO'S (SOFTWARE)
13/2	ALTERNATIVES TO S.M.P.		16/2	TUTORIAL	PRE-ASSIGNMENT PANIC/HELP ETC.
20/2			23/2		
27/2	SETTING EXAMS/COURSEWORK		2/3	ASSESSING COURSEWORK	
6/3	EQUAL OPPORTUNITIES		13/3		
13/3	MATHS ACROSS THE CURRICULUM		16/3		
20/3	TUTORIAL DISCUSS REVIEW OF ASSIGNMENTS		23/3	PASTORAL/COUNSELLING	PTD
27/3			30/3	5 MIN	FILED.

9/1	Course planning	TP feedback	12/1	Oft. L.	
14/1	GCSE.1.	Diff Appendix Prep for School ex	19/1	11:45 on TP report ext. Tutorials	
23/1	APU. 1	"	26/1	5 minute files	Diff Appendix
30/1		Diff Appendix	2/2	Diff Appendix	Low attainers (1)
6/2	Maths Across Curric.		9/2	GCSE (2)	
13/2	APU. 2	Practical & I	16/2	Logo + other Micro	
20/2			23/2		
27/2	Models of learning \Rightarrow		24/2	Maths Across Curric.	
6/3	Assessment - making tests.	Hands On. + Micro.	9/3	Practical & I	
13/3	Tutorials Feedback on assignments		16/3	Assessing Coursework.	
20/3	Low attainers (2).		17/3	IF finished early we can go home	
27/3	Xira bits.	The return of minute files	23/3	Student feedback on assignment next (in group)	Execution of further elements need before TP, as indicated on 14/1
			30/3	X	X

9/1	Course planning	TP feedback	12/1	
14/1			14/1	GCSE
23/1	FORWARD EXAMS — (A' LEVEL, AS) INCL. TUES. ETC.	— (A' LEVEL, AS) INCL. SYLLABUS, COURSEWORK, ASSIGNMENT	26/1	TUTORIALS
30/1			2/2	MATHS ACROSS THE CURRICULUM
6/2	— A PU CSMS & Cognitive Theory →		9/2	MODELS OF LEARNING CAN BE ORGANISED (questioning / groupwork)
13/2	— DIFFERENT APPROACHES TO TOPICS →		16/2	— LOGO — X — USEFUL SOFTWARE
20/2			23/2	
27/2			2/3	INVESTIGATIONS / OPEN-ENDED TASKS — types of task, assessing, including feedback from those involved in investigation work on school visits
6/3			9/3	PRACTICAL STEPS ON ELO →
13/3	TUTORIALS		16/3	— LOW ATTAINERS →
20/3	PREP. FOR FIVE MINUTE PRESENTATION OF FIVE MINUTE FILLS		23/3	ASSESSING COURSEWORK
27/3	ASSESSMENT AND TESTING.		30/3	PARTY, PARTY, PARTY!!!

9/1	Course planning	TP feedback	12/1	OFH	
14/1	Alternatives to SMP	ex. SMILE.	19/1	TUTORIALS	
23/1	APU & EACSMs.	Cognitive theory.	26/1	Low attainers: strategies & within mixed ability	
30/1	Pinget & other learning theories esp. w.s.c.t. Maths		2/2	computer sessions: Different software & use in real classroom situations	
6/2	Different Models of learning can be		9/2	organised	eg. Questioning (Mike Smith) etc
13/2	Assessment of UETs	and investigations	16/2	TUTORIALS	
20/2			23/2		
27/2	Different approaches for each one.	to topics: 1 topic each	2/3	session with different	set of approaches
6/3	links across the	circic	9/3	Equal Opportunities. (Race) (Practical classroom Sep.	(ii) Readings (C.F. Gledhill Session Term I).
13/3	TUTORIALS		16/3	(iii) Discrimination/ disadvantage.	(iv) Bilingual: practical experience . . .
20/3	GCSE & relationship to NC	[.5 minute fillers I]	23/3	TP related planning	
27/3	Assessment and setting tests.	[5 minute fillers II]	30/3	etc.	

Appendix 6

Self assessment in mathematics questionnaire from Phase one

As a mathematician, please rate your abilities as listed below by ticking the appropriate box.

My ability to...

is

[illegible]

Think logically

Work systematically

Be creative

Think intuitively

Produce elegant solutions

Think quickly

Work carefully

Present work clearly

Tackle open ended tasks

Use standard routines

Generate/extend problems

Work numerically

Work geometrically

Work algebraically

See the essence of a problem

Remember things

Consider before 'leaping in'.

'Leap in' and deal with the outcomes

Work on my own

Work with others

Explain my thinking to others

Please complete the following statements about yourself in the context of you doing mathematics.

1. I feel successful if ...
2. I feel confident when
3. I lack confidence when...
4. I am bored if ...
5. I am enthusiastic when...
6. If I don't understand something I usually...
7. I get frustrated if...
8. If I am successful it is usually because...
9. I hate situations where ...
10. I wish I were more ...

Circle the statements which are true about you (mathematically)

- | | | |
|-----------------------------|----------------------|--------------------------|
| I am confident | I enjoy maths | I am interested in maths |
| I am successful in maths | I work hard at maths | |
| I am thoughtful about maths | I find maths easy | |

Appendix 7

Letter to headteachers in Phase two

Dear [REDACTED]

25 April 1992

I am employed as a lecturer at the Mathematics Education Centre at [REDACTED] and am the Subject Leader for the mathematics component of the PCGE Later Years course. I am currently undertaking a research study designed to enable us to have a better understanding of how to make our course of long term relevance to our students. We are very concerned to address not just their short term needs but also to provide a basis in their initial training for the many years of school teaching which we hope lie ahead.

With this in mind I am presently following up those PGCE students who were studying at [REDACTED] during the year 1989-90. One of these ex-students, [REDACTED], is a member of your staff and I would very much like to visit him in school. I have written to [REDACTED] and he is happy for me to do so. Would you be willing for me to visit [REDACTED] in school and perhaps to observe one or two of his classes (simply as a 'friend' in the classroom)? If you are willing for me to do so, I shall contact the Head of Mathematics and, assuming there are no problems, arrange a suitable time with him and [REDACTED].

In addition, I am hoping very much that either you or your deputy with responsibility for probationers or both might be able to find the time to talk to me briefly about the school (its ethos, aims etc.) and about how new teachers are inducted.

I should like to emphasise that any material collected, whether through interview or observation or by any other means, will be treated in the strictest confidence and, should any such material feature in the final report, it will do so completely anonymously.

I shall be in touch by telephone within the next few days when I hope we will be able to discuss this further. I should like to thank you in advance for your consideration - I know that schools are increasingly busy places and that any intrusion such as this creates extra pressure.

Yours sincerely

Hilary Povey

Appendix 8

Interview schedules for Phase two

What do you look for in new appointments?

What are the aspects of schooling that you encourage probationers to work on?

How would you describe the overall approach of the department?

How do you support probationers and induct them into the ways of the department, how things are done?

How do you convey to probationers the values of the department? Equal opportunities?

How would you describe the ethos of the school?

What about equal opportunities here?

What are the aspects of schooling that you encourage probationers to work on?

How do you induct new teachers?

What do you think maths education is about now?

How much is this view shared by the department? What is the departmental view?

What have been the most significant learning experiences here?

How does the department fit in with the school? How much do you share this?

How did you find out "what was done" here?

If, when, you haven't agreed what have you done?

How have you changed? expectations, views, attitudes, outlook, (skills?)

Appendix 9

Letter to new participants in Phase three

Dear [REDACTED]

24 March 1994

I am currently engaged in some research which involves me in following up a sample of PGCE students into their work as school teachers and I am writing to ask if you would be willing to be one of the sample.

I am interested in finding out what beginning teaching is like for you. I want to find out what connections exist or do not exist for you between the work we did together in college and life for you in school. I am interested in general issues; in issues specifically to do with mathematics teaching; and in the equal opportunities aspects of either of these.

This is an outline of what would be involved if you agreed. Firstly I should like to visit you in school for a day, for most of it accompanying you as you went about your business. If possible, I should also like to talk to the head of department and someone from the senior management team, preferably the person with responsibility for new teachers. I should also like to interview you about your perceptions. Secondly I should like to do two or three follow up interviews of about an hour each during which I would explore your personal history and your ideas about knowledge, teaching and learning.

I do hope you will say yes. I am very keen to include someone like you in the sample. If you are willing to participate, I will approach the school and the department to seek permission for the visit.

I am going on holiday tomorrow for two weeks (lucky me). I'll give you a ring when I get back to see what you think.

Best wishes

Hilary

Appendix 10

Interview schedules for Phase three

- R1 After I spent two days in your school, observing and talking to you and other people, I went away and tried to draw a portrait in words of you and your school. What do you think about what I wrote?
- Which bits rang true?
 - Which bits were false?
 - Which bits of my interpretations were suspect?
 - Were any of them insightful?
 - Go through any bits of my description that haven't been covered.*
 - What would your description of your school be?
- R2 I have written that there was/was not a strong consensus in the maths department you were in. Is that true?
- Do you think that it's a good thing when that happens?
 - How do you feel at school when someone disagrees with you?
 - What happens when people in a school disagree with one another?
- R3 I wrote that your professional development was effective in terms of some routine skills but generally poor. Do you think your professional development was poor?
- What was good about it?
 - What would have made it better?
 - What involvement have you had with outside groups?
- R4 I tried to describe how you relate to theoretical frameworks and descriptions. How would you describe how you relate to theoretical descriptions and frameworks?
- What inspires you to change and improve your practice in teaching?
 - What sort of things excite you?
 - Do you get excited by ideas? Tell me about an idea that has excited you.
- R5 It has been suggested that it is the teacher's role to be a 'pupil-mincer', adapting pupils for their role in capitalist society. It is also suggested that the pupils don't submit lightly and that the result of their resistance is the they become, in turn, 'teacher mincers'. Have you been 'minced'?
- What's your view of the continuity/change I claimed to find?
- People say that beginning teachers are obsessed with survival. Do you agree?
- Were you? Describe what it was like.
- I wrote that I didn't think you'd lost your vision, although you might be more realistic about what you were actually going to achieve. Do you think your vision of teaching has changed? In what way?

- R6 I have used a quote to the effect that I found teachers who were able to resist at the level of ideas but not at the level of action. What do you think about this?

Extra questions

- E1 Have you been blocked since you entered teaching? Did you anticipate being blocked when you entered teaching?
- E2 How would you describe the way we worked at maths ed?
What do you think we expected from the students?
How do you think we worked together?
What impact do you think this had on you?
- What was the most interesting thing you did with us at the Poly?
Tell me about something you did in maths ed.
Get full details of the incident.
What were the feelings that you experienced at the time?
Does this mean that you are most comfortable/excited/... when ... , that
you learn best when ...
- E3 What do you think the point of initial teacher education is?
What do you think it should be?
- E4 It has been suggested that new teachers adopt social strategies of three different types when they start teaching. These are
- (i) *strategic compliance* in which individuals comply with the authority figures' definition of the situation and of the constraints, but retain private reservations about them, adapting themselves to the demands placed upon them but without accepting the values and norms that they represent
 - (ii) *internalized adjustment* in which the individual complies with the constraints and believes that the constraints of the situation are for the best, willingly adapting to the demands made and accommodating them both in their behaviour and also in their attitudes and values
 - (iii) *strategic redefinition* of the situation in which the demands and constraints are (partially) redefined by those who do not have the formal power to do so, in this case new teachers. "They achieve change by causing or enabling those with formal power to change their interpretation of what is happening in the situation.

Do you think that you have used any or all of these social strategies?

Give details of examples of each used.

Why did you adopt this strategy?

How do you feel about this incident/issue?

- B1 Can you tell me something of your own personal history, take me through your life story?
- prompts childhood
 schooling
 family life
 family occupations
 family politics
 experience of discrimination
- B2 What stands out for you in your life over the past few years?
What kinds of things have been important?
What stays with you?
- B3 Tell me something about what your life is like right now.
- B4 How would you describe yourself to yourself?
If you were to tell me who you really are how would you do that?
Is the way you see yourself different now from the way you saw yourself in the past?
What led to the changes?
Have there been any other turning points?
What do you care about, think about?
What matters most to you? Why?
- B5 Why did you decide to become a teacher?
Tell me about one thing that happened that was really important in making you decide.
- B6 Do you think you have been fairly treated at work?
Do you know anyone who hasn't been? Why do you think that was?
What would count as being unfairly treated?
- B7 Where do you expect to be in ten years time? What do you think you will be like then?

- K1 What sort of teacher are you?
What has made you into that kind of teacher?
What sort of teacher did you expect to be before you started teaching?
Are you that sort of teacher?
How would you describe a 'proper' teacher? Are you like that?

- K2 I'm going to show you and read out some things that have been written about mathematics.

Mathematics consists primarily of human mathematical problem posing and solving, an activity which is accessible to all.

Do you agree? What do you think this means for the classroom?

Mathematics is part of human culture, and the mathematics of each culture serves its own unique purposes, and is equally valuable.

Do you agree? What do you think this means for the classroom?

Mathematics is not neutral but laden with the values of its makers and their cultural contexts, and users and creators of mathematics have a responsibility to consider its effects on the social and natural worlds.

Do you agree? What do you think this means for the classroom?

- K3 Everyone has the experience of being in situations in school where they had to make a decision but weren't sure what was the right thing to do. Can you describe a situation where you weren't sure what was the right thing to do?

What was the situation?

What was the conflict for you in the situation?

In thinking what to do, what did you consider? Why?

How did you weigh each alternative?

What did you decide to do? Why? What happened?

Looking back on it now, did you make the best choice? Why/why not?

Thinking back over the whole thing, what did you learn from it?

- K4 I'm going to give you one person's way of characterising different outlooks on maths and maths teaching. I'd like you to mark in green any of the sections that you think fits you well and to mark in red any of the sections that you think is definitely not you.

Social group	Industrial trainer	Technological pragmatist	Old humanist	Progressive educator	Public educator
View of mathematics	Set of truths and rules	Body of useful knowledge	Body of structured knowledge	Process view, personalised maths	Socially constructed
Mathematical aims	Basics, numeracy	Useful maths to appropriate level and certification	Transmit body of mathematical knowledge	Creativity, self-realization, through mathematics	Critical awareness and democratic citizenship via mathematics
Theory of Learning	Hard work, effort, practice	Skill acquisition, practical experience	Understanding and application	Activity, play, exploration	Questioning, decision making, negotiation
Theory of Teaching Mathematics	Transmission	Skill instruction, motivate through work relevance	Explain, motivate, pass on structure	Facilitate personal exploration, prevent failure	Discussion, conflict, questioning of content and pedagogy

Which was the bit you felt happiest with? Why? How does this connect with your classroom?

Choose one bit where the decision wasn't obvious. Why was it difficult to decide?

K5 Tell me about something that was a critical incident in framing your views about schooling.

What do you value about your present school? If relevant, your past school?

What do you dislike about your present school? Your past school?

What have you tried to change? Why? What success and failures have you had? Why?

K6 Why do children fail?

K7 When learning about something you want to know, do you rely on experts?

If not, who or what do you rely on?

If so, what do you do if the experts disagree?

What do you do if you want to know something about mathematics?

What do you do if you want to know something about teaching?

What did you learn in your first year at the Poly?

What did you learn about maths?

Was it skills and knowledge?

Did your vision change?

K8

Looking back over your whole life, can you tell me about a really powerful mathematical learning experience that you've had, in or out of school? Good or bad.

Tell me about it in detail.

What was special about it?

What were your feelings about it?

Do you think it has any general implications for learning? For schooling?

- F1 How would you describe yourself to yourself as a teacher?
 What sort of teacher are you?
 What has made you into that kind of teacher?
 What sort of teacher did you expect to be before you started teaching?
 Are you that sort of teacher?
 How would you describe a 'proper' teacher?
 Are you like that?
 Did you change during the course?
 If so, what changes has that made to your classroom practice?
- F2 How would you describe the way we worked at maths ed?
 What do you think we expected from the students?
 How do you think we worked together?
 What impact do you think this had on you?
 What was the most interesting thing you did with us at the Poly?
 Tell me about something you did in maths ed.
Get full details of the incident.
 What were the feelings that you experienced at the time?
 What does this mean about you as a person?
 What do you think has stayed with about your experiences at the Poly?
 Did being there change the way you think about yourself or about the world?
 In your learning there did you come across any ideas that made you see things differently or think about things differently?
- What was most helpful to you about the place?
 Are there things that weren't provided that are important to you?
 Are there things that you would like to have learnt about that you didn't learn there?
- What do you think the point of initial teacher education is?
 What do you think it should be?
- F3 People say that beginning teachers are *obsessed* with survival. Do you agree?
 Were you? Describe what it's like.
 What are the implications of this?
 Do you think your vision of teaching has changed? In what way?
 What are your feelings about this?
 Are you being 'minced' by the pupils?

F4 Have you been blocked since you entered teaching? Did you anticipate being blocked when you entered teaching?

When you have encountered things that were different from what you thought you wanted, what has happened?

strategic compliance?

internalized adjustment?

strategic redefinition? (achieve change by causing those with formal power to change their interpretation of what is happening in the situation)

Do you think that you have used any or all of these social strategies?

Give details of examples of each used.

Why did you adopt this strategy?

How do you feel about this incident/issue?

F6 How have you developed professionally since leaving the Poly?

What has been good about it? What has helped your professional development?

What has been bad? What has hindered it?

What would have made it better?

What involvement have you had with outside groups?

Tell me something important you have learnt.

F7 What inspires you to change and improve your practice in teaching?

What sort of things excite you?

Do you get excited by ideas? Tell me about an idea that has excited you.

F8 What seem to you now to be the central issues about gender, maths and schooling?

What are the implications for the school?

The maths department?

Your classroom?

F9 How much are your views overall shared by the department? What are the departmental policies, attitudes, values?

How did you find out "what was done" here?

How does the department fit in with the school? How much do you share this?

F10 Is there a strong consensus or a lot of disagreement in the maths department?

Which is better? Why?

How do you feel at school when someone disagrees with you?

What happens when people in a school disagree with one another?

If, when, you haven't agreed what have you done?

F11 What have been the most significant learning experiences here?

F12 How have you changed? expectations, views, attitudes, outlook, (skills?)

- B1 Can you tell me something of your own personal history, take me through your life story?
- prompts childhood
 schooling
 family life
 family occupations
 family politics
 experience of discrimination
- B2 What stands out for you in your life over the past few years?
What kinds of things have been important?
What stays with you?
- B3 Tell me something about what your life is like right now.
- B4 How would you describe yourself to yourself?
If you were to tell me who you really are how would you do that?
Is the way you see yourself different now from the way you saw yourself in the past?
What led to the changes?
Have there been any other turning points?
What do you care about, think about?
What matters most to you? Why?
- B5 Why did you decide to become a teacher?
Tell me about one thing that happened that was really important in making you decide.
- B6 Do you think you have been fairly treated at work?
Do you know anyone who hasn't been? Why do you think that was?
What would count as being unfairly treated?
- B7 Where do you expect to be in ten years time? What do you think you will be like then?

- K1 I'd like you to tell me something about the nature of mathematics.
 human?
 problem posing and solving?
 accessible to all?
 part of human culture?
 each culture serves its own unique purposes, and is equally valuable?
 laden with the values of its makers?

What do you think your view means for the classroom?

- K2 I'm going to give you one person's way of characterising different outlooks on maths and maths teaching. I'd like you to mark in green any of the sections that you think fits you well and to mark in red any of the sections that you think is definitely not you.

	1	2	3	4	5
View of mathematics	Set of truths and rules	Body of useful knowledge	Body of structured knowledge	Process view, personalised maths	Socially constructed
Mathematical aims	Basics, numeracy	Useful maths to appropriate level and certification	Transmit body of mathematical knowledge	Creativity, self-realization, through mathematics	Critical awareness and democratic citizenship via mathematics
Theory of Learning	Hard work, effort, practice	Skill acquisition, practical experience	Understanding and application	Activity, play, exploration	Questioning, decision making, negotiation
Theory of Teaching Mathematics	Transmission	Skill instruction, motivate through work relevance	Explain, motivate, pass on structure	Facilitate personal exploration, prevent failure	Discussion, conflict, questioning of content and pedagogy

Which was the bit you felt happiest with? Why? How does this connect with your classroom?

Choose one bit where the decision wasn't obvious. Why was it difficult to decide?

- K3 Everyone has the experience of being in situations in school where they had to make a decision but weren't sure what was the right thing to do. Can you describe a situation where you weren't sure what was the right thing to do?

What was the situation?

What was the conflict for you in the situation?

In thinking what to do, what did you consider? Why?

How did you weigh each alternative?

What did you decide to do? Why? What happened?

Looking back on it now, did you make the best choice? Why/why not?

Thinking back over the whole thing, what did you learn from it?

- K4 Tell me about something that was a critical incident in framing your views about schooling.

What do you value about your present school?

What do you dislike about your present school?

What have you tried to change? Why? What success and failures have you had?

- K5 Why do children fail?

- K6 What do you do if you want to know something about mathematics?

What do you do if you want to know something about teaching?

When learning about something you want to know, do you rely on experts?

If not, who or what do you rely on?

If so, what do you do if the experts disagree?

- K7 Looking back over your whole life, can you tell me about a really powerful mathematical learning experience that you've had, in or out of school? Good or bad.

Tell me about it in detail.

What was special about it?

What were your feelings about it?

Do you think it has any general implications for learning? For schooling?

What do you look for in new appointments?

What are the aspects of schooling that you encourage probationers to work on?

How would you describe the overall approach of the department?

How do you support probationers and induct them into the ways of the department, how things are done?

How do you convey to probationers the values of the department?

Equal opportunities?

What does equal opportunities mean to you?

Does the department provide equal opportunities? How?

What work has the department done on equal opportunities?

How would you describe the ethos of the school?
What about equal opportunities here?

What are the aspects of schooling that you encourage probationers to work on?

How do you induct new teachers?

What work do you do with them on equal opportunities?

Appendix 11

Edited transcripts from Phase three: John, Frances and Matthew

11.4.94

(transcribed from the tape)

What comments have you got on the earlier portrait?

[What I have to say], it depends on what sort a day I've had, on how I'm feeling at the time so its very difficult to be completely and utterly honest about things.

Different people may give a completely different picture, just talking to one person you just get one person's opinion.

It does ring true, there's nothing there that I wouldn't agree with or that I think's a surprise.

[I contribute a summary of received wisdom about teacher socialisation, including my claim that it doesn't happen to all teachers.]

It'd be a bit hard to be general if you're talking about me specifically because I've got lots of ideas, developed ideas before I started on the course and so it wasn't for me finding out for the first time ... I feel for a lot of people particularly younger middle class kids ...

I have a theoretical framework on which to base it on whereas the impression I get from talking to other people is that they haven't got that, they haven't got any historical understanding so their understanding is pragmatic. It must be hard for the people who don't have that understanding to be consistent ... It would be easy for them to forget about it, to act in the same way as they did before they went to the Poly. Presumably some people take away those ideas and work on them. If teacher training did open up teachers' eyes to these issues then schools wouldn't be like they are, would they? There'd be strong equal opportunities policies, there wouldn't be any talking about the kids, everybody would be batting on the same side, we wouldn't have all this trauma of people like me going into school, because all those people have been through training presumably. The influx of new teachers would not only keep that ball rolling but would make it more so.

I find whenever people get together in school to talk about a large issue it always comes down to talking about little details. When we're trying to deal with a global issue we end up talking about the minutiae ... It seems to be if you try to talk about something, people just haven't got that breadth of vision, or if they have it's easier to home in on something you can manage, so I don't know how these big issues do get addressed. I thought GNVQ it was an opportunity to rethink everything to do with the school but other people couldn't cope with the concept because it's too far away from what they're used to.

[I'm going on a course for people responsible for Y7 maths, I'm looking for ideas, for advice in sympathy with] an approach where you start the kids off with some ideas and let them run with it for two weeks and see where they get to, obviously more structured than that but that's generally the way I think we should be working with them.

We are interested in using a spreadsheet as a tool, not just now we'll do spreadsheets.

25.4.94

I think in terms of the global issues of equal opportunities I haven't done anything. I wrote a Y7 policy statement for the inspectors I mentioned it but I didn't say how we'd go about it, but personally I always make sure that my worksheets have a variety of names and I make sure I always use the word person and I've been thinking about the time I spend with girls and boys.

Why did the girls do better than the boys at your last school?

Well it's hard to say isn't it? There's all the research that's been done showing that girls do achieve better than boys at that age, that girls are better at learning $4+4=8$ but when conceptual things come up the boys start to take over ... I think a lot of it's to do with behaviour, it tends to be girls who sit down to their work, work all lesson and then say can I take it home. The boys tend to get there on being good at maths and having a good maths background so you can just tell whereas with girls you sometimes find out at the end of year test... The girls tend to stay on course better than the boys, generalising massively.

I think we could solve all our problems if we went in for a properly differentiated curriculum.

The whole ethos of the school has got to be EO minded and the department's got to be. I don't know what else you do ... I spend a lot of time picking up boys on things they say to girls and how they treat girls. The major thrust of EO work is trying to deal with the problem and the problem is boys... or men, again I don't know what you could do on a big scale, I don't know if management could have an initiative. Staff training would be a good start to get them aware of the issues. Girls feel comfortable about discussing things to do with peer relationships, once they are enabled they have a very strong opinions about... I don't know if it changes their view of things but they can talk about it but an unfortunate bi-product is that you tend to be putting the boys down all the time, which may be hardening their resolve to be masculine, don't let them get away with this, kind of thing. The girls understand what's happening.

You do get very bogged down with the day-to-day doing of the job. The meeting tonight was supposed to be about us standing back and deciding what we really do want, but we end up discussing minutiae ... People get together and it's far easier to talk about [minutiae] because you focus on some small thing you can do but then you never go on. The major thrust of any day is how do I get from 9 o'clock to 3 o'clock without having too stressful a time.

I was responsible for Y7, I knew what I wanted to do but I didn't feel very confident about discussing it with the head of department because I thought he probably wouldn't agree with it, so I just said I'm in charge of Y7 and did it anyway, just keeping him informed.

If you haven't got authority, do you just go along with whatever is said?

No I get frustrated and probably do my own thing anyway but say like Ralph decided to put all the boys in the top set, then I would argue against that at the departmental meeting and put forward ways and reasons for not doing that and if it didn't change then I'd go to someone in management.

You have described being blocked. Did you think that's what school was going to be like?

No I didn't at all, I naively believed we'd all be pulling in the same direction.

What do you think now of your training?

The multi-cultural elective and going to the non-attenders unit showed me different ways of looking at things.

How would you describe the way we worked at the Maths Education Centre?

I found it quite a comfortable place to be because I could talk about things that were important to me. Because of the way the staff conducted themselves. I felt the majority would be sympathetic to how my way of looking at things, like Marilyn talking about EO or Colin or Pat talking about multiculturalism. The general way that Pat conducts herself. Not to hold exactly the same point of view but to be able to have a good discussion about it. Some people were letting us down by their way of teaching or imparting information, others by their practice were giving you some idea about how you might do things in the classroom. I'm just wondering how someone would feel who was in conflict with those views, how comfortable they would feel. But someone kept coming out with controversial views to the end.

Can you tell me something about your own personal history?

[Aspiring middle class, local boys grammar school, my parents left all the decisions to me, as I got older and as work got harder I just stopped working and eventually left with one GCE. I had a few jobs, there wasn't pressure then, unskilled labour from '69 to '72. Two years as a store-keeper. I got an A level in accounts and some other accountancy qualifications. Then I decided to go University, then the Lantern project, then there was nowhere to go in community work so I decided to go back and get some more academic qualifications. Then the information about the [course] came through the door so I did it, not a vocation or anything, fairly arbitrary but it had been a sort of an option. I'm glad it was a two year course because I wouldn't have had the confidence to teach after a one year one.]

[]

Why did you leave the Lantern?

[I started] to tell them where they were going wrong or rather to tell them where I thought they were going wrong. [Their attitude had become] we've got some good ideas, and we're going to impose those ideas on you and when you tell us that it doesn't fit in with your, that you don't want it, we'll do one of two things. We'll force you to do it or we'll give you the sack.

9.5.94

(transcribed from the tape)

You told me something about your schooling. Can you tell me something about the rest of your life?

[]

I think about people I know who have been brought up in a home where there's racism and sexism and they've kind of worked things out for themselves or at least from their later experiences that that's not right and I often wonder, would I have had the strength and the understanding and the knowledge to go against that. That's something I'll never know, so my ideas originally came from listening to me mum and dad and other people who came to the house. But I don't think at that stage I had any sort of theoretical foundation so I had ideas but I didn't have a framework within which I could justify, no explain those ideas. And then later going round to festivals and meeting peoples and discussing ideas. And really it was going to University that made me understand why I believed what I believed and it probably made me a bit more open minded as well, it meant a lot to me, the discussions and the ideas from the Marxist lecturers. I really began to understand things, discussing ideas with other people and so on, and then being more open minded ... I find it far easier to understand things and at least satisfy myself that I understand the reason for things and, of course, out of that comes the ideas of EO, multicultural, anti racism and trying to give kids a bit of... not to make generalisations about people.

Where I've reached now, although things may come along to undermine this, I've grown out of the need to be dependent on anyone else for physical and spiritual welfare. I think I'm quite an insecure person who needs a lot of reassurance. I feel a lot more confident than I used to be.

I don't very often let anything go by, like a sexist comment, certainly not in the classroom. I try not to give the kids too much of a hard time about holding these views that come from their parents.

6.6.94

(transcribed from the tape)

What sort of teacher are you?

I think I ... as far as possible I try to get the kids to be working in an atmosphere where they actually are wanting to do the work and try to get a nice atmosphere in the classroom. When they come in they should expect to put something in as well, I tend not to be strict in the sense of having their heads down, I'll have a little chat or sometimes something will happen that will change the whole purpose of the lesson.

After the election I decided to do a lesson on it, on majorities and so on, and the other teacher who teaches them humanities said why don't we team teach so about half way through the lesson we were talking about percentages because someone had 7% of the vote and one lad at the back said so how do we do that then. And I was just about to launch into well let's have a think about this, how could we do it when Norah says oh what you do is divide this number by this one and times it by a hundred. Afterwards I said that's not how I would have done that, I don't think they learnt that. I thought then that I didn't realise that there were other teachers who did that sort of thin, particularly because she doesn't come across as the sort of person

who would do that. I said next time we team teach we'd better discuss it a bit beforehand [laughs] because I try to get them to think about it a bit and not just tell them how to do it.

I was the rebel at school, I was the disruptive pupil so I understand a bit about how they feel when someone says do this. I try to avoid making the kids feel like that there's no justification for them being there.

That's something else I try to do in lessons, sometimes I have about 6 or 7 activities going at the same time because somebody's finished something and I'm chatting to them and as the result of talking to them they set off onto something else and there's another group who're working together and I'll really enjoy that when they're all working away on something that's been set up by me and by the kids and they're all working away on something, those are the best lessons. They try some of their own, they sometimes say can we try some of our own. I try to encourage that, for them to set their own problems.

I try to set their work in context. Like when their working on circles I try and say that like ten thousand years ago people were doing what you're doing now and they didn't have half the ideas that you're got about it or half the knowledge or understanding. And try and make it more human because you can see maths or you can teach it so like it's just learn this theorem and then this one and, apart from the few women that we know who have been credited with some mathematics mostly it's men, so there's bound to be a gender issue.

[]

I don't know why I have this reluctance to take people to the duty officer, to send kids to the duty officer but I do. I think it's because, what is the point a lot of the kids who go to see the duty officer see the duty officer everyday for months on end so it doesn't do anything, they get excluded and so on and have their parents up and then nothing's changed.

[]

... all this sets rubbish

Can you tell me how you decide what to do?

I don't agonise over making decisions, I sometimes I put them off but when the time comes I don't find it hard to make a decision, I might change my mind afterwards and change things but I don't worry about them, once I've made a decision I don't feel I have to stick to it, if it's wrong it's wrong.

Me and Chloe talk a hell of a lot, we're not discussing some decision we have to make but we are discussing something we're doing, something we're in the middle of.

20.6.94

Which things that you've marked with green do you think straightaway, yes, that's me?

'Questioning, decision-making, negotiation'... and this 'creativity, self realization', though I'm not sure it's just through mathematics... 'activity, play, exploration'... 'facilitate personal exploration' ... 'motivate'.

What are the implications of you making those choices for your classroom?

If you take this as being one extreme [points to column 1], you've got a set of truths and rules which you then transmit to a student which involves some kind of one-sided activity where the teachers doing all the talking or writing and the kids are just doing the examples, so though I'm sure we all use that technique from time to time. But this idea of socially constructed, it's, I would say there would be more discussion going on in my classroom than there would be in a classroom like that [gesturing towards column 1] and there would be more freedom for the kids to pursue something they were interested in than there would be in a classroom like that. Also implications for resources, do you have a computer at the back for the kids to work on if they want to or not? I would have a computer at the back for them to work on, and I mean do you allow them to explore something that they've found that might not even have anything to do with the lesson, that other model of teaching wouldn't fit in with that.

'Mathematical aims, basics and numeracy'. Well, I found that a bit difficult to decide on because some kids, well not some kids, in a lot of cases kids do need to have some sort of basic understanding of certain mathematical, socially constructed [laughs] ideas before they can say go on to something else. But I mean that's not all of it, is it, that would be a starting point perhaps but not even that's necessary. There's some kids who are very low ability who haven't got some of the basics but who are able to work at quite a high level if it's a self contained piece of work.

'Useful maths to appropriate level and certification'. Well, that's what we do, I mean that's part of the job isn't it to get kids to an appropriate level and to get them a certificate but I wouldn't like to underline that in green because I don't think that it's the be all and end all of teaching maths, perhaps it's part of it and you have to bear that in mind when your teaching or you're not being fair to the kids.

'Hard work, effort and practice'. Well I would agree if the kids are going to do well at anything, or if anyone's going to do well at anything, hard work and effort are two of the sort of the mainstays of doing well at anything but as a theory of learning it's a bit dodgy I think.

'Body of structured knowledge'. I've left out because I don't think I really know what that means. 'View of mathematics... a body of structured knowledge'. I suppose it is really.

I know why I left that one out, a 'set of truths and rules' because I don't think you can apply the word truth to mathematics, particularly as a lot of the axioms are being questioned so I don't think you can apply the word truth to any body of knowledge really.

And this one, 'critical awareness and democratic citizenship via mathematics', although it sounds quite a... a... a positive statement to make I would agree with the first bit critical awareness, I'm not sure about democratic citizenship through teaching maths. I mean it may come as part of something else but it's not, it may come about through something else, in the method of teaching it but I don't think you can, I don't know, I'll have to think a bit more about that actually.

I think sometimes kids can surprise you with the dedication they put into something and all that it does is enhance my view that it's the right way to go.

I don't think, I really don't think that I've had any large changes in direction really. I think it's just evolved really that I started off with a certain view that I wasn't always able to put into practice in the early part of my teaching and it's become easier and easier to put it into practice, it's developed and changed and probably my thinking's changed a bit but it's not been sort of chopping and changing it's just been a gradual evolution.

What do you value about your present school?

I value the pastoral side of things and the way students are looked after and considered and the support from management in terms of discipline. I value that quite highly. There are other things I appreciate but, the overall way that the majority of staff behave towards the kids. There's a lot of kids at the school with a lot of problems and the school has a way of dealing with that that shows a caring attitude.

Your past school?

At the school before I valued the expectations and the head of department but the school pastorally was no good at all. I don't see why the two things can't go together.

[]

What if you ask two people about something and they disagree?

Well I sometimes find myself being fooled [laughs] by that kind of thing, where I would ask one person, I would be discussing something with one person and they'd put forward their view point and I think that sounds reasonable and then I'd go and speak to somebody else and they'd say hmm I wouldn't do it like that and then I have difficulty in thinking well which one is right I agreed with that person and now I'm agreeing with this person, what do I believe? I sometimes have difficulty with that as well, actually knowing which of those two people's advice I should follow. I sometimes think that's because I'm not entirely sure about what it is that I want. I mean sometimes I feel to myself thinking which one should I agree with, I mean which one's the socialist and which one's, but that's not always a good way to decide. Probably I'd think about it myself and come up with a third alternative, and it may be the alternative that I thought of in the first place if you know what I mean. It might be that speaking to two people about it would, I'd probably end up adapting it a bit and getting a mixture of what I first thought and what the other two people said.

Can you tell me about a powerful mathematical learning experience you have had?

[Learning calculus.] Well I suppose the other thing is computers because I worked out that Pascal's triangle using a spreadsheet and it was easy to do, because it was just a matter of changing the formula to see what happened, just to see what happens. And the computer allows you, you might even think of the question but if you've got to work it all out by hand then you probably don't bother. I probably would have bothered in that particular case. But it is a handy tool. This fellow Barney whatever his name is started off by saying one of the

things we've got to do is to integrate the computer into your schemes of work but I said I don't think that's really what we're aiming at, what we're aiming at is getting the kids to use the computer in the same way that they use the calculator. It comes back to that list there doesn't it with basics and you know numeracy. [He was saying] you've got to teach someone to use the computer before they can [do anything with it].

[interruption]

I mean some kids have got, some kids buy a basic calculator and some kids parent's buy them scientific calculators and I don't very often show kids as a lesson what a scientific calculator can do, I wait until they ask me what are all these buttons for, and they I say well press that button and see what happens, the best way to do that is with the factorial because they can sometimes work out what's happening, because they put in 1 and press the factorial button and 1 comes up. So then I say what do you think will happen if you put 2 in and they say 2 and it does of course [laughs] so then we say we'll put 3 in and I mean that leads to sequences and all sorts of things but. It could be the same with the computer I think it's because it's the new technology most people feel uncomfortable with it. I think in spite of what I've said when I take the kids in the computer room I say this is a spreadsheet, this is how you use it, that is my mode of teaching but maybe if every kid had access to a laptop...

5.5.94

(transcribed from the tape)

What sort of teacher are you?

Disorganised ... over friendly ... nothing like what I want to be like [laughs] that's what I'm most aware of at the moment.

I'd like to have time to think about everything I do properly before I do it so that I am convinced that how I am doing it is how I want to do it. And that means time to think about the topics properly then trying to prepare the resources I'm going to use. And the sense of time in the classroom which I think if you are totally relaxed about the resources and what you're teaching and totally relaxed about knowing the students you're teaching then so that there's less of a sense of panic and dealing with things that you weren't expecting to happen and you can think about how they're actually learning. Most of what I've done so far really comes under the heading of pastoral things and that aren't not necessarily to do with maths but general learning things and that can be as banal as trying to persuade kids that coming with a pencil saves everybody a lot of bother or it might be slightly more involved than that, actually helping people to learn to listen and to get the information they need from what you're saying. But it's only really with one group, my top set, that I actually have a sense of who they are and where they're going and actually when I'm planning the work I'm actually thinking about individuals and I'm thinking about how they'll respond to things and what I can and can't do in lessons and that's the only group where that happens. And I'm sure that's because with all the other groups I'm just panicking all the time either because I know they're not going to be quiet, I've got to try and organise for them to learn without having to listen to me at all [laughs] or I know they're not going to have any equipment or any books and I've got to think how can I start the lesson so that it doesn't matter that they haven't got their books. Or just because of the groups, like my year 7 I know them so little and it's just a sort of blanket splodge out and it's difficult to know who on earth ... There's a woman who teaches history who's new to the school this year and who's been a sort of unofficial mentor and I get the impression, I mean I haven't sat in on any of her lessons, but I get the impression that everybody's calm in her lessons and that there's a sense of sort of space and time to think about what they're doing and to get the best out of the students that are there, and that's what I feel I haven't got at the moment.

I feel as though I haven't thought about the maths at all, there just hasn't been time, it's just been survival. But I suppose because when you are fresh from college you're more aware than at any other time of what you want to be like, I found that incredibly dispiriting because you know I'm always always aware that I'm not doing what I want to do [laughs], not teaching the way I want to teach, I'm not presenting the subject the way I want them to see it.

How do you want to present the subject?

I want them to feel it's worth doing, that it's worth their while trying to sort things out because they get a sense of satisfaction and confidence from it. Whereas it seems to me that they come, that a lot of them come with a sort of legacy of failure and fear of failure and that so

easily just perpetuates. They write themselves off very quickly as you say ... and it's ... some of the things I want to get across to them will be unsettling to them, that writing neatly isn't what it's all about, that I want to see their working, that I don't want it to be hidden, or just the idea that when they actually get things wrong that that process of getting things wrong and then sorting it out is actually when they're learning [laughs] that they're learning by getting things wrong and it's not something that they should tear the page out of their book and try to pretend it never happened. But unless you're calm confident organised and in control they're not going to be trusting enough to cope with those things. It seems to me that for a lot of them what happens, what their experience of maths is in secondary schools is that they get given things they can already do essentially because they get the satisfaction of doing it right and your classroom control is far far easier, and that for a lot of them they get a diet all the way through of things they can already do, to the extent that the worksheets in year 11 are the worksheets in a sense of year 7 really.

Looking back on the course, what do you think was helpful for the first year of teaching?

... crumbs ... It's hard to make it specific really because I can't imagine how I would have taught without the course. I can't imagine how I would have thought about things like, I don't know, mixed ability, or girls and boys, or anything really if I hadn't had the time to sit and think about it, particularly in the first year with that group of people. Occasionally there are really specific things even down to things that people have said or said on the course that I do actually remember that are really valuable. I suppose there are times when with particular issues you remember a conversation or whatever.

It's more an opportunity to learn maths and to talk about learning maths with the group of people that I was with who were, in a way, who had a whole range of ideas and backgrounds which made it even better, our reactions to learning maths were very different so we were able to sort of talk about ... and I suppose ... well it did change my view of maths quite a lot and I'm sure that must and definitely does influence what I'm like in the classroom although I still feel I've got an awful long way to go on that really.

Thinking about it now the biggest problem was that the time in the Maths Education Centre and the time out in schools are so completely segregated that they might as well have been in another year, they're irrelevant because there was never anybody with me on teaching practice who knew what was happening in the Maths Education Centre so there was nobody who knew what I was trying to do on teaching practice, because they didn't know the sorts of things we'd discussed, the sorts of approaches we'd taken and so therefore on teaching practice there was the sense that you're just, you're just stuck out by yourself and you do the best you can. Which was a huge lost opportunity really because in that time what you really want to do is to say well we talked about this last term and now I'm trying to do it and these are the problems I'm having and what do you suggest. But if you've got someone supervising you who (a) you hardly ever see them anyway but when you do see them they don't know what you talked about and if they haven't taught for a while, well ... you need the people that you've been working with while you've been in college.

Teaching practice is such an intense experience, you go from one intense experience to the next and you can't remember the one three experiences back, and you probably haven't time to write it down so that you can properly think about it afterwards. And that was really like the first term here, it was just like being dropped and I didn't know Mark that well to start with

and I found it quite hard to get to know him and I just thought aaargh [laughs] and you know here I am you know just to survive really with no support.

People say new teachers are obsessed with survival. Would you agree with that?

No it's the opposite. I am a perfectionist, I don't want just to survive, I want to do it the way I want to do it [laughs] which is probably why the first term was so awful. I mean a lot of the more experienced staff say just survive, just survive, all the first term is survival, if you can get through without having three weeks off being ill you'll have done well. But to me that's like you've done crap, that's nothing like good enough and I think that's the hardest thing, having to go home every night thinking that was useless absolutely useless that was even worse than teaching practice that was terrible and to somehow pick yourself up enough to go in the next day.

Do you think you are making progress?

I never have time to think about it ... it would be nice to have some time to think about that properly, to actually take some time out, but if I did think about it honestly and specifically enough then probably I could say then yes things have got loads better. But the trouble is that as soon as one problem is solved, you know, my sights just go higher and I become more aware of what I want to do, there's never a sense in which I think oh yes I've got that cracked, I'm immediately then looking at the next thing I want to do. It just carries on and on and on and I don't know when that process stops really.

Around you you can see a lot of people [laughs] where the process stopped when the classes would shut up. It must be tempting to just relax at that point ... but I don't think that'll happen, I think I'm going to be hell to live with forever as long as I'm teaching [laughs].

At the moment I can't do it, I feel it's too hard and I can't do it so it automatically becomes something I want to try to do [laughs] which is why I feel it's really hard when people say to me oh is that all you're doing, you're just a teacher, you just teach then. It's very strange I don't really know how to react at all, there's quite a lot of that among people I know, oh she's decided not to be a high flier, she's decided to be a teacher [laughs]. The other thing I've been thinking about this week is that all the things I should be associating with the people in my classes like feeling unconfident and vulnerable and et cetera are all things that I'm experiencing [laughs]. I feel it's really strange this double system whereby there's 30 people who are feeling unconfident about their learning and, you know, fairly vulnerable about you sort of getting at them and them being shown up or whatever and yet for me at the front of the class that's precisely how I feel, incredibly unconfident about what I'm doing and incredibly vulnerable to whatever they're going to say or do, that's probably why I have trouble with my Y10, they sense I'm not sure enough or confident.

I went to watch, there's a woman who teaches languages ... and one of the things that struck me most was how similar she was in the classroom to how she is in the staffroom, she was just herself in the classroom, I mean it wasn't identical obviously but it was very much Heather, there, the way she is in the staffroom and that really struck a cord that seemed right, that seemed good somehow.

It's been suggested that when pupils resist teachers (who are supposed to be pupil mincers) that they are actually being teacher mincers. Have you been 'minced'?

I don't know about that, I mean yes they do stop what I want to do because if none of them turn up with a pencil and if they refuse to sit down it's very hard to do what you want to do. But I'm not sure because I still think that they would rather be with a teacher who they feel is taking them somewhere interesting and is obviously in control and knows where they want to go... I mean it does feel as though they're mincing you [laughs] there's no doubt about it but [laughs].

I think the thing which in a sense is a sort of freedom and an opportunity although in another way it's rather scary is that I don't think the kids here don't really have much of a sense of their place at all. Perhaps the girls do more than the boys, have more of a sense of their future roles but the boys don't at all and I think that's why partly why they perhaps are scared because they don't know where they're going. I mean, I don't know, the attainment in boys is supposed to be dropping nationally and there are arguments that they should be better looked after in schools and given more of a sense of something to aspire to, when there isn't really anything for them to aspire to at all, certainly in Northam. There's certainly resistance to that idea in this school because it's felt that the girls have lost out for so long that we should continue to concentrate... when we had the take your daughters into work day I would like to have done a little survey because I suspect because more of the mothers work than the fathers here, try to take your sons into work day. A lot of the girls just, just?, went with their aunty who's a cleaning lady at Brook College or something which wasn't really as far as I could understand it the point of it.

One of my occasional fierce lectures when I get fed up with my years 10 and 11, is telling them there'll be nothing worse than finding themselves in a job where they're far cleverer than the person who's in charge of them, and they'll be very frustrated.

Perhaps we have very different expectations about the world of work, that it will be interesting, that we will have the chance to grow.

It's funny I've got this cartoon my sister sent me on the front of my file, it's got this disgruntled woman saying I'm fed up with my job perhaps I should have a baby and there a pushchair going past with a baby going WAAAAA, and my year 10s are looking at this and saying I don't get this Miss or whatever and I say well what would you rather do, spend the day at work or spend the day at home with a screaming baby and they sort of look and say spend the day at home with my baby, you know sort of how could there be any question [laughs].

Did you anticipate being blocked?

Yes I did, yeah, I don't think I thought it would be the case in most jobs but that was a bit silly really because given the departments I've seen it would make more sense to assume that yes most places it would be difficult.

It's been suggested that new teachers adopt three different types of social strategies: internal adjustment, strategic compliance and strategic redefinition. How does this relate to you?

Some things I have adjusted on, because I suppose you don't get to see the other things, you don't know if it will ever work in practice.

What?

[long pause]

I think I'm less certain about doing all your own resources now.

Have you tried any strategic redefinition?

Whether we should buy pritt sticks [laughs] that was a good row for a month. That was just that we can't afford them and that, that they shouldn't be allowed to use them in [maths] lessons and oh I don't know a whole great thing and then it turned out that there had been some money to spend and that Roger had spent it buying inflatable globes which we've never ever used and how many pritt sticks make up an inflatable globe?

The grading on reviews, the setting.

Have you had any success?

One fortnight pack that I managed to get scrapped which was basically just drawing pretty patterns and I expect I only got it scrapped on the understanding that I rewrite it, there's a few things like I've said look, at the end of each topic we ought to be getting the students to look back over the topic and do some self assessment and that's been a case of well if you want to do it then you do it.

Didn't you say something about the micros?

We just kept on about it and one just appeared, I don't understand how decisions are made [laughs].

And where are you just holding back?

Well there's big areas that I think are very worrying like algebra which I haven't dared mention to him yet, I think we need to review the whole thing. There's things like reviewing the ways girls and boys are doing in tests and even testing, when we test and how we test and how often...

How have you developed since leaving the Poly?

A lot of it's [laughs] making mistakes and thinking hell I'm going to have learn to do this better. My actual written evidence of what's happening in the classroom is appalling... I've got to find some better methods of recording what is happening in my lessons because there are instances when you get a really clear view that somebody's sorted something out ... I've got to find a way. I've recognised a need for it.

I've learnt to avoid confrontation whenever possible, if there's a way to sort things out without confrontation.

The LEA days were brilliant because I spent all the time talking to Sam and Helen. That was really interesting for insight into the classroom. We were reasonably polite when [the tutor] was giving her spiel but then we just ignored the exercise and talked about what we wanted to talk about. And in Y10 there's a group of girls who for the last month have been completely obsessed with one of their birthday parties and they have lists out and this is their agenda and they couldn't care what I say and it was interesting to behave in exactly the same way myself. [It was great] actually seeing people and you know Helen teasing Mary because she had a year 7 class she couldn't control or whatever. It was all really light hearted and nice but it was really good to talk about the things that we couldn't do and that chasing up homework dominated your life and I think we all had an overwhelming sense that we weren't doing what we wanted to do and it was nice to know that everybody else felt the same way.

There's no doubt that in the end that's where your support comes from.

What inspires you, excites you?

I've been excited with my top set, seeing them change, seeing them change their views, seeing them occasionally say something or produce a piece of work that I'm sure they wouldn't have done at the beginning of the year. I gave them, the first thing I gave them practically was an investigation and almost none of them wrote anything, they just handed me back the books and didn't know what on earth they were supposed to do and then at some point last half term I gave them a problem to do with fractions and chocolate on tables and so on and they did some brilliant work on it and I gave them two weeks to do and they kept coming and talking to me about it and that was a massive change, you know that was really nice, really nice.

Where do your ideas come from?

[Some from college, even from TP] not so much, I don't have access to resources in school in the same way as at college, there are not many resources in school. Partly through talking to Mark, he's quite a good source of ideas, um I used to be able to dream up ideas really easily all the time [laughs] it used to be no problem but now I'm too tired, I don't dream them up.

26.5.94

What seem to you now to be the central issues about gender, maths and schooling?

There's some things that I've heard about before and read about that I think I would agree with to an extent that I have actually now experienced, such as a lot of girls assume they'll not be able to do things ... There's always a kind of assumption that they have that they didn't expect to be able to do it in the first place, they expect to be stuck. With some of them I sort of feel I've almost been able to almost tease them out of it, and their confidence has grown, but it's hard to do that on a grand scale or at least I haven't quite worked out how to do it on a grand scale. There are definitely boys who always assume that they'll always do it and always get it right, who are over confident and when they can't do things they are [laughs] horrendous because they want to cover up and they want to do all sorts of awful thing to cover up. But all those things I've read about before and have definitely see those things happening. But equally I suppose I still feel more strongly that there are personalities in the room rather than that there are boys and girls.

There seem to be huge differences in motivation, in years 7 and 8 the girls take everything very very seriously, they don't want to stand out for anything, good or bad. The ones who do stick out seem to me to get quite a hard time at school, but in year 10 and 11 it almost seems as though it's gone the other the way and the girls don't even seem to take themselves seriously any more, they seem to have given up in some way in some sense. I suppose I think, I'd like to think that's something we do to them, I don't want to think it's something that inevitably happens in some sense. It's a fact that the girls at our school are very very unambitious, there's a couple of girls in Y7 that have actually said to their parents that they'd like to go to university but you wouldn't know that really from the way they behave in class. And it will be interesting to see if they still think that when they're in Y10, but then there's very much a culture of 'swots' and the last thing you want to be is a swot so whether the girls just decide that it's not in their interest to work hard at school.

Do you think coursework assessment potentially makes a difference?

They're concerned about presentation, they're concerned about finishing things, they have some sort of concern about the totality of the piece of work which boys just don't seem to have at all. The girls will often ask me what we are going to do today ... The statistics show that they are better at coursework and I can believe that, that they are willing to take something on and see it through.

One of the things I want to encourage is for them to do longer term pieces of work, I've started doing that with my top set for homework saying they have two weeks to work on it and I want them to keep coming and talking to me about it as and when. A lot of what they do is disjointed and quick and doesn't come together.

One of the issues I've got more and more certain about is that thing of children not being able to learn if they feel very very insecure for one reason or another, that you've got to bend over backwards for them not to feel worried or frightened or undermined. I mean this week I had two classrooms that were so alive with anger and fury because I was told to set a test with my Y10 sets and it was GCSE questions on topics that they hadn't necessarily covered, maybe not even this year let alone recently, and it was real photocopied GCSE papers which is quite threatening and it was the same test for [all the] sets and the same amount of time and they did appalling badly [] and each time when I gave the papers back it was just awful and it was even more awful because I was on their side and I understood entirely why they felt the way they did, I totally sympathise and yet from their point of view they just got at me with fury for the whole lesson. And I just felt very sad and thought why on earth are we doing this and I worry that there is, even if it's not intentional, there just seems to be so much that sets them back all the time and I wonder that any of them get anywhere. And you have to work so hard to counteract that. And we've been talking in the staffroom quite a lot about where the school is going. The school is very good at its pastoral side, at making the students realise that they matter, that we're concerned about their attendance and we're concerned about their social skills and how they are part of their form or their year but we're not very good at having any sort of academic aspirations for them at all.

[]

It's all too much to take in, that's the trouble. You can't think about it all enough. I mean I did a lesson a while back, a week or so ago when I had three different activities happening and I got into the staffroom after and I was exhausted and I said to the head of Y7 I've had the sort of lesson that I used to have all the time on teaching practice and I realised that I just never do that anymore. And he just said 'and no doubt you realise why' and when I think about how much thought on teaching practice you put into everything you do and there afterwards how much time you spend ruminating over it and now it's just a whirl.

What else have you had confirmed?

I suppose I've had confirmed that standing up at the front of the classroom really doesn't do anybody any good whatsoever, [laughs] that it's a fairly useless teaching method to be honest and that I'm not sure that anybody really gets taught anything and that the things that are the most valuable are the hardest to manage and time consuming to prepare [laughs].

I think I've been surprised how much influence you can actually have when you keep at it, and you are consistent and determined with people that you do get through sometimes or even that quite often you do get through.

I knew on teaching practice and it's confirmed that I'm desperately bad, desperately bad at starting things calmly, in an ordered way and that's made this year quite hard and quite a lot of the kids I teach this year can't cope with that. I think I probably praise my students more than a lot of other people and that just seems to happen which is nice.

(notes made after tape switched off)

Shall I stay or shall I go? I don't see why I should be pushed out - the longer I stay the more loyalty I develop towards the kids. Where are all the people that think like us? All the people who write all those articles in magazines? [laughs]

16.6.95

(transcribed from the tape)

Can you tell me something about your own personal background?

I don't know where to begin, my dreadful parents I think. Neither of my parents went to University and I think that's been an incredibly significant thing in my childhood ... It was something that had to happen to us at all costs. [] I went straight through the grammar school and it wasn't till the second year that I found my firm friend and it was alright after that, things went from bad to worse at home and school was quite a nice place to be with lots of opportunities to succeed and we did lots of nice interesting things [] and the work wasn't a problem [] I had this idea that if only I could just get into Oxbridge then my parents would be so happy that suddenly everything would be alright again, which was naive in the extreme really [] for 13 weeks before the Oxbridge exam I hardly left my room and just slogged and slogged [] the A level time was horrible because my mother would live in the house during the week with her boyfriend and then on Friday she would make sure there was absolutely no food in the house and no money anywhere and then she would go off for the weekend and dad

would arrive and spend the weekend with us and make sure on Sunday night there was no food in the house [].

Finals was a really horrible time I mean about as extreme as you could possibly get in terms of how not to assess people really, morning and afternoon six days a week, its crazy and in the end I just totally flipped really and lost confidence and was really scared, terrible. And poor old Grace often gets blamed for this. After one particular paper... more than a surprise when I found out I was pregnant and I suppose that that was when my whole world fell down because up until then it seemed as though I was doing the right sorts of things and even if my parents weren't keeping their side of the bargain [laughs] I was keeping my side of the bargain and doing what was expected and I suppose that was more like changing than ever anything had been and having to face, having to face the barrage of people who the only thing they could say was don't throw your life away don't throw your life away have an abortion don't throw your life away and because my parents had got married when she was pregnant and that had ended so badly I suppose for them it was freaky, it was like horrible this is all happening again and so they were absolutely vile to me, totally unsupportive, they were horrible, really horrible [] being single, pregnant and unemployed in Deptford delivering leaflets and cleaning posh people's houses is more than an eye opener and we went to see a woman who was a Christian marriage guidance counsellor and it was very interesting. [] I did a course in contemporary Christianity paid for by a friend's mother who was worried about me. I read Germaine Greer and she made the point that we have made it as awful as we possibly can for women to bring up children, we've isolated women, we've put them down, we've made it seem as though it's the most pathetic and belittling thing you can do to go off and have babies and that there's no value at all in being at home with children and I suppose that awakened a whole bloody minded counter-suggestive thing in me or put into words things that I'd been aware off. So we decided we'd go ahead and get married with six weeks left to prepare. My mother was very upset.

It was very very very scary living in West Camford because all the women around with me had five bedrooms and a nanny and were very very confident and assertive about what they did and it was a very undermining society to move in. The ones that were at home with their children had such strong ideas about what you should and shouldn't do with children, a bit scary in fact this last Saturday, I saw a woman who I hadn't seen for years. [] I'd taken Grace round to play and endless awful things had happened. Grace had just done all the things that children shouldn't do including throwing a chair down the stairs on top of this woman's child [laughs]. I can remember very distinctly just how terrified I felt that afternoon and how unconfident and awful, I couldn't say anything, my sentences all came out wrong, it was pathetic and seeing her last Saturday I realised just how much I'd changed but... I started, I attempted to write an article for that column [] because it seemed that for some reason suddenly a lot of people were writing about abortion [] it seemed to be that all I read for a week anywhere that in fact a lot of women graduates had had abortions in the few years after graduating and there were a lot of quotes along the lines: 'I was just setting out on my career', 'I was just about to do this', 'it would have ruined my life' and I mean I'd intended to go to Africa, that had been my plan to go and work in Africa, and reading all those things very much, it really really stings and I still feel very ... very much like the person who did the wrong thing the person who loused it up, the person who made a mess of all the opportunities they had ... and that this isn't just second best it's supposed to be a hundredth best ... and when I started work at Mount Sylvan the first week I literally just wanted to go into Northam city centre every night and just stand there yelling 'I work', I really did, I just felt like for the first

time since leaving university that I was doing something valuable and it's just so sad, it's so sad. It frightens me and it angers me because when I can be logical and rational about it I think that it didn't really matter a bit that I was pregnant after university. Yes financially it was a real hassle and logistically it was a bit daft but there wasn't anything so pressing that it could never be done again. And I suppose I hate my parents for making me feel so bad about it, so bad and I'm sure that affected my relationship with Grace in that it's always been very very hard and ... It seems very strange to have been a freak for so long. Someone rang me up from school out of the blue [] she discovered that I was 'just a teacher' and she was very surprised because she'd expected me to be prime minister at least by now and so I didn't go to the reunion because I thought I would be trying to justify myself to strangers, and I think Alex feels the same in many ways, perhaps even more so in a way because it was an even bigger deal for him to go to university.

27.6.94

How would you describe yourself to yourself?

I suppose I always describe myself to myself as not what I want to be really.

It's very strange being in school with 250 people watching you in a week because you suddenly start to think well I wonder what they think of me and it's very different to thinking what your peer group thinks of you because you have some idea what your peer group is likely to think of you because it's what you think of them, you know vaguely how they're likely to judge you, and it's easier to come to terms with that. But I don't really know how the kids in school judge me, what they think of me except that I think it's probably quite important to them what their teachers are like, maybe even more so because they perhaps don't think of school in the way that I thought of school which was mainly in terms of what I was going to get out of it and... Am I too inconsistent and am I too soft. It's one thing coming to terms with the fact that I don't have a great deal of respect for me as a parent but I can live with that and no-one's paying me to do that anyway [laughs] but it's different in a sense of school because I feel much much much more conscious of the fact that I am something at school, that I am a teacher much more than I feel I am a mother; there's something much more to look up too. [] I think my gut reaction would be just to be myself. [] I find it a bit odd sometimes, assuming a role.

[]

I think I want to be able to be myself in the classroom and I don't think it's right right now and I don't know whether that's because I'm not confident enough about teaching or I don't rate myself as experienced enough or whether I'm still conscious that there are too many situations in which I don't know quite what to do and perhaps I have some sort of default mode which is to be, to act a teacher in those situations or how I think a teacher should act. [] Yes since [we talked about Heather] I've seen another person in the classroom, and she was even more herself she was totally, she was so relaxed, she had exactly the same style of humour as she has in the staffroom.

Why did you decide to become a teacher?

I had in the back of my mind that I might do a PGCE and I was really tempted by the first year of the course which wasn't going to have much to do with teaching and I suppose I thought that during that year I would decide if I definitely wanted to carry on in teaching, so in many ways in was just lots of things falling together.

What made you decide to carry on?

It's always people that convince me of things [] it's very rarely events [] but if you see people and listen to them who are doing something very well and give it a lot of credibility then for me anyway I instantly think that there's something worth doing and I'd like to try and do it so I suppose really that a collection of staff in the Maths Ed Department that really convinced me that it was something worth doing and that there was a lot more to it than I'd anticipated so... It would be difficult in interesting ways and that really tempted me I suppose.

Where do you expect to be in ten years time?

I'm anticipating that I'll still be in teaching though I can see that it's actually quite hard to plot out some career path now [] obviously it would be nice to have some responsibility [] so wouldn't it be nice to be head of maths somewhere but I don't know how realistic that is.

Tell me something about the nature of mathematics.

Do triangles exist? [laughs] I started to think about the difference between maths and science. [] You always hear it quoted that maths is a tool, maths is a tool [] and starting the course at the Poly neatly disposed of that idea and the maths became something in itself but it wasn't science and it wasn't like science so what was it? was it something that was objectively out there and you had to discover it which I suppose is more like science so do triangles exist in the universe and human beings have got to find them or is it just totally made up by people right from the start. And I think I'd been holding onto the idea that its totally made up by people right from the start for a very long time until I came across, back to pi, and then I found myself saying this is the only bit of maths that I think is like science because pi is just there and people found it and I don't think I think that people made it up at all, it just seems to be there but that makes it stand out from the rest of maths. So maybe it isn't maths, maybe we should get rid of pi out of the maths curriculum, it's not allowed to count, so I still think about that because there are other things like pi really, geometric things and number patterns. But then I don't know about number patterns because you wouldn't have the number patterns if you hadn't decided on the numbers in the first place which is quite a, if you could get people to sit down and think about it, is quite an exciting thing really because if you start off by saying that we're going to count because counting is useful and serves a lot of purposes so we devise a system of counting or tallying in some sense but you then discover that all these strange amazing things happen with these numbers that you've devised and where do the strange amazing things come from. And that's a lot of why small children like maths, I think, are intrigued by maths because all these funny things turn up and it can be, it can be like a different world really that you can mess around with.

I often say in the classroom when I'm presented with beautifully neat books usually the girls' with beautifully neat answers written and there's a pile of stuff in the bin, that the stuff in the bin is their maths and I don't want to see the beautifully neat answers so then they get cross with me. Because all the scribblings and the crossings out and the getting it wrong and doing

it again is their maths, it's the process of thinking it through and starting on a track and giving it up and going down a different track.

Here's one person's way of characterising different outlooks on maths and maths education. I'd like you to mark in green any of the sections that you agree with and in red any that are definitely not you.

Very into preventing failure at the moment [underlines 4d]. We had an interesting debate over the weekend about this [points to column 5] because I thought you would have an axe to grind but Alex didn't agree. I have a soft spot for useful maths [underlines 2b], sometimes useful maths is a good thing. I don't think that maths is a body of knowledge [underlines 2a] so I can't transmit it [underlines 3b], set of truths and rules well .. no I'm not even sure about that [underlines 1a], I have problems with motivation but I'm going to underline it anyway [underlines 3d, laughs] I can't seem to motivate anyone. That's Mr Gradgrind isn't it hard work effort and practice [underlines 1c].

Choose one thing that was difficult to decide about. Why was it difficult?

Well [column five] is the hardest. 'Critical awareness and democratic citizenship via mathematics', I must say I find very difficult to think about. Because I know the idea of fostering critical awareness hasn't really dawned on me in terms of my maths teaching and I can't decide whether it should have done or not [laughs] because it's something that I associated so strongly with other areas of the curriculum that I find ... but then I've changed my mind about so many things to do with maths that maybe I'm going to change my mind about that one as well but 'democratic citizenship' annoyed me, I don't know why ... in fact in [column five] you're not any different from [column one] except that what you're trying to squeeze the worms towards is something that in theory, that sounds rather nice and good but I'm not convinced, I think it's fishy, fishy.

I share with somebody else [] an incredibly difficult year 8 bottom set which is packed full of students with real problems, problems with having to sit on a chair [laughs] things like this and Mark and I have struggled with this group all year and in many ways we've actually made quite a lot of progress. Anyway it fell to me to teach this group on Friday afternoon after dinner and they're always difficult in the afternoons especially on Fridays. But to make it even more exciting at registration, in the mere 5 minutes of registration, they had just received a slip on which was a timetable for their activities week. Now unlike year 7 where the activities week has been entirely run and dictated by the students, nice contrast (!), in year 8 the activities week has been entirely run and dictated by the staff who've said exactly what they want to do, how long they'll do it for and who with and therefore a timetable has been put together by the staff and was given out to the kids at registration on Friday. So they arrived in my maths lesson clutching slips of paper, they were appallingly badly informed so they didn't know for example who would be in the group they'd be working with, which is a fundamental thing who am I going to be with all next week. Also on the timetable a lot of the, a lot of the activities had no explanation so for example one afternoon just said 'cathedral' or one whole day for some poor souls gave the name of an extremely unpopular science teacher. They also managed to suss out fairly quickly that they weren't all doing the same things so it wasn't like a round robin where everybody would have had the same experience by the end of the week. There was some good getting information from tables there, with the speed at which they

managed to do it, and they also realised that the girls went horse riding and the boys didn't, so the first part of my lesson was wrecked by the fact that there was a mass amount of information having to be exchanged and this was crucial and every new person who arrived late in the room had to go through you know this great long questioning who they were et cetera, et cetera but it was then followed up by a real underswell of growing resentment because they all felt that, I think mostly because they didn't really know what was going to happen, I think that was main, really if they could have been honest that would have been their main beef that they didn't actually know what was going to happen next week and that unsettled them. But they chose to express it as it's not fair because we're not getting the same experience, what does this mean et cetera, et cetera. Now because I'm not based with year 8 this week, I'm with year 7, I couldn't supply the information they wanted, I didn't know what this science teacher was going to do with them all day [laughs] or indeed any of the activities at all and so I was faced with this decision. It was the last day before project week so therefore there was a feeling of end of termishness about it, we'd been struggling through 2 dimensional representation of 3 dimensional shapes and Mark had had two really good lessons with them in which he had pursued a particular thing, but Mark, oh, I don't know, it's very difficult to communicate exactly what you've done in a lesson and we don't have a lot of time to do it and he usually gives me a general gist of what they've done and I almost always do something akin but not following on because it's very difficult to follow on because unless you were in the lesson you don't really know who's got where, but stupidly perhaps because I'd been very busy with the year 7 projects I decided I would try to follow on from his lesson setting of on a slightly different tack, which was in many ways a major, major mistake because they were half way through doing something with him and they didn't see why they should abandon that to do something which was almost the same but just slightly different right from scratch with me so it was an incredibly badly planned lesson ...

[]

Why do children fail?

Because we make it so hard for them to succeed. There's about 55 million ways they can fail, and it's an eye of the needle to succeed, it really is. In my, I don't know, my little philosophy I suppose, is that they have to be aware that there is somebody somewhere who wants them to succeed and it could be all sorts of people, it could somebody from home or it could be someone from school.

[]

Probably because we ask so much from them that's unfamiliar [] there's very few good reasons provided for doing what they have to do if any reasons at all.

[]

People are starting to address [the issue] [] because we're trying to bring back into school kids who truant an enormous amount and we're asking ourselves what are you going to offer them that's going to make them think it's worth while being in school.

What do you do if you want to know about something, in mathematics or teaching or anything?

I always ask someone [if it's about school]. I suppose I'd ask them and they'd give me their answer and I might discuss it a bit, and then I'd go away and think about it and then I might get back to them because I'd have to sort of yeah sort of assimilate it and compare it with all sorts of other ideas and things but I do change my ideas on things a lot. Sometimes I'm listening to somebody else and they have a completely different view to me and I argue dramatically against them and think what they are saying is rubbish, and then I get myself into another situation where somebody holds my view and I argue the person's point of view that I originally had the argument with and see how it feels arguing it from their view and then I tend to sort of come to some kind of middle, not always a middle ground because sometimes it's not something you can have a middle ground on but I then sort of come to some kind of conclusion but I feel as though I have to hold, I have to try holding the different views before I can decide. But to be able to do that you need a group of friends who can cope with having different views, who can cope with a range of opinions and views ... to say something totally outrageous and see what it felt like, and that's what I kept wanting to do ... I wanted to kind of say things that were not the kinds of ideas we were supposed to have and see what it was in them that might be appealing or at the very least to reject them properly. I mean that would be the nice thing about working in a school for quite a long time, you might actually build up relationships with other members of staff that would enable you to do that.

28.6.94

Interview 1 (transcribed from notes made at the time)

How would you describe yourself as a teacher? What sort of teacher are you?

It varies. Competent, good, lousy sometimes.

Are you the sort of teacher you expected to be?

Not yet. For example, compare today and yesterday with that Y10 group. Yesterday we were going over the exam paper so it was necessarily didactic. Though, no, that's not true, there are a lot of different ways I could have done it. Anyway, it contrasts with today which is a much more fluid lesson so the lesson this morning was much more like I'd like to be. I'm achieving this say 50% of the time

I intended to be a student-centred teacher always so I thought you just threw activities at the children and that was enough. Now I realise structure is needed. The role I am playing is different too, not just beforehand in preparing the materials but during the lesson too. I find it frustrating, the actual constraints - my time, if I don't like a class I don't prepare such interesting things, resources, class size. Plenty of kids in quite a few classes who can't cope with this open way of working given the class size, they require more attention. But now I'm thinking that as this pressure increases, you can retreat but it isn't a solution, a more discursive style is needed more or else you just get into a battle trying to get the kids to do things they don't want to do, you end up rowing and shouting.

Where did your ideas about how you wanted to teach come from?

In terms of a general outlook on life, in terms of the way things currently are, things are centred on things not people, not human. I reacted against school in quite a political way and it comes partly from a labelling from the other side, for example John Major wants to push back to a traditional approach so I want to resist this and so I think: that must be wrong, so what's right?

What has stayed with you from your experiences of the course?

I feel I sound pompous but the stuff about reflecting on the learning experience. I've tried to hold on to not to spoonfeed, not give things piecemeal in tiny pieces, what makes good activities, enjoyment, entertainment.

Did you come across any ideas there that made you see things differently?

Yes. Certainly in terms of mathematics. A very different way of learning maths. For example the tiling activity we did right at the beginning that very much went against [the idea that] maths is to do with algebra. Lots of other occasions. You can't rely on that intellectual approach, a more intuitive approach has value. That has personal implications about infallibility and about valuing intuitions and so on. A very strong message "It's OK to be wrong". This did come from the course.

Interview 2 (transcribed from the tape)

What should there be more of on the course?

Opportunities to see good teachers teaching. That's similar to the weakness of what I ended up with in terms of my own teaching was a bit like well if I've got the activity I can just throw it at the kids and the learning will somehow naturally arise.

What makes good teaching?

I was actually thinking more in terms of pacing lessons and structuring lessons so that learners are able to get involved in the activity and know what to do.

It's not like we have mathematics in there waiting for us to discover it, that isn't the way it works.

For me, teaching traditionally is I'd started like that [like I ended the lesson] and I'd said, Right what we're going to do now is a whole series of questions where you have to add a percentage to something and then you've got to take that percentage off something like that, it's very difficult to explain it. I'd have gone through some explanation, some of them might have understood it but they'd have ended up getting a method or a process, a series of steps to go through and now right do 40 of these. Now that to me is a traditional lesson, I think doing that [exposition from the board today] was generated by their own activity. The expected outcomes [for different pupils] were different but in a sense that typifies the sort of task-orientated, what-do-you-need-to-know-in-order-to-get-to-a-particular-goal which is the way my ideal about learning is moving which is much more about kids or individuals building a mathematical structure around them which isn't one that's discovered and it isn't one that's either discovered in themselves or discovered out there but it's a structure which is developed. And within that conversation and talk are really important.

[The message from the course was] mathematics is something enjoyable, that it should be displayed, that children's mathematics is enjoyable and should be displayed. You get a sense of there being some democracy in terms of the way things are decided within the [Maths Education] Centre. I think within that, in terms of relationships, with students there was efforts made to give a sense of equality, equal status.

What impact did this have on you as a teacher?

It was motivating and still is in the sense, in the sense that it's important to know that there are, that it's possible to work in that way. It's a big improvement to the relationship between the teachers and learners that you get in an average school and the relationship of workers in that workers' place, and that general message of valuing mathematics which can be very difficult to do when you're, you're not forced to but you end up finding yourself saying things like, when they say this is boring, you say I know but I'm afraid I'm going to have to make you do it, which, you know, is a terrible thing to be saying to children but it's something that I find I've said. The chances are you will work in an institution which is hierarchical to a greater or lesser extent and that raises questions, how do you cope with that hierarchy, how do you get change and create change.

[]

I'm quite argumentative and I argue my corner but there's definitely been a process where I feel I've had some sort of effect, I've mentioned the banding. But then realising that actually in terms of changing people's deep perceptions about, about mathematics, and so on, and about what we should be doing, hasn't really happened. At the moment I feel like what I'm going to be doing next year is working on what I'm doing and forget it you know. It's frustrating, I don't know if it's the course or whatever, why, but I feel I've got a very good understanding of some of the issues around assessment and around what a curriculum should be and in fact those curriculum issues and I feel frustrated that they're not necessarily valued because I'm the junior member of the department and it can't possibly be the case that I might know something more about assessment you know and those sorts of issues and for sometime I would argue my case and get some sort of change but I am frustrated about it and I think it goes beyond one particular department to the particular institution. So I've come much more to looking at finding an institution that would allow me to, a bit of scope to develop in the way that I want to.

[Changes in GCSE coursework requirements] coupled with the league tables means that you get a pressure right down through the years and I find if I'm pushing something forward in terms of what kids should be doing in year 8 in terms of the setting arrangements or the curriculum they should be following I know my arguments are more powerful if I can put them in terms of what will their GCSE success be. Some people might say that's right, that's the way it should be, that's what you're here to do, you're here to gain them GCSE grades but it certainly feels, I feel the pressure in terms of my teaching to do that. And again the path of least resistance is to revert to tried and tested, how you were taught, all that sort of stuff. I suppose in terms of the course, the course has given me a lot of options in terms of going back and saying hold on a minute this isn't necessarily the best idea in the long run or even in the shorter for that matter.

Did you anticipate these blocks?

I thought that the department I was coming to work in was more, was nearer to what I thought, I believed. And that was largely because they didn't do SMP and I equated SMP

with a certain style of teaching. The fact that this department isn't does mean that there are all sorts of options for, within one activity, to change things. So in terms of teaching and actually how you teach in the classroom you might have what is a textbook exercise and you can turn that into a discussion exercise, into an investigative, into them finding out for themselves or those positive things quite simply. And in terms of teaching techniques and teaching styles there is some value placed on that don't get me wrong. I don't want to put the department down but it's about, you get to a point and there's a certain tension there. And I want to teach in a school which in mathematics is much nearer to a mixed ability school and it seems to me it's going to get worse rather than better and that's what I dislike. You have to teach classes which aren't motivated and you're pushing them and pushing them and pushing them with that sort of philosophy or you get the classes which are completely demotivated and you end up being a policeman so [laughs] sorry I'm just getting that off my chest.

But in terms of expecting the blocks, I didn't, I didn't think it would perhaps be as important as it is. And it hasn't been because your issues for the first couple of years, in the first year it's surviving and it's classroom management and you learn to take everything off the department you can in terms of learning how to, classroom management. This year I've been seeing how the actual mathematics and the way activities are structured mathematically are essential to classroom management and that has been the strong learning point. And now I suppose I'm starting to look at the wider structure and it's becoming more important now. There are certain things I can't do because the classes are not structured in such a way, the course is not structured in such a way. So I can't for instance start with the topic of say, suppose we're doing some work on circles and I start with the topic of that and have some doing some work on, you know, just drawing circles, circle patterns, others finding out something about pi, others finding out something about the area of a circle, and have that full range and start with a topic and just go with it. Because it's split up into small chunks in each year and there's certain things you can do but there are limits whereas if you say had half a term you could really do something with it, you could.

Certain principles I keep coming back to and that I think are worth defending, principles of fairness and equality, that every person's worthy of respect, those sort of ideas, then they really inform my motivation to carry on saying I don't want to see streaming and I don't want to see setting. I'm considered in the department to be well read on educational matters [laughs]

What seem to you now to be the central issues about gender, maths and schooling?

I think that I was reasonable at thinking about how to encourage girls in terms of contributing or asking questions or whatever on a very sort of simple, questioning techniques and trying to be aware of what I was doing and of promoting positive images as far as I could. I don't think it's been a central strand by any means, interestingly though I'm starting to come to an alternative point, not an alternative point of view, but equality of opportunity here in this particular school means addressing the motivation of boys.

And that will have an effect on the way they hold back the attainment of girls anyway, but there's a real issue about boys who just give up, they don't want to work and the reasons for that. And the problem is something that's identified by a whole number of people inside the school in a whole lot of different ways, I don't think we've even started to address it. It's something we've talked about in the equal opportunities group but it's also there in terms of the maths department, so I suppose that's the issue that I'm thinking about at the moment.

Is that across whole attainment spectrum?

What tends to happen is that children conform to a number of stereotypes and the girls' stereotype is to produce nicely presented work which might be involving high level of mathematics or it might be nicely presented work that doesn't involve a great understanding of mathematics or easy mathematics if you like. Whereas the boys would not present the work at all well at any of the sort of levels, with exceptions obviously that's the trouble with generalisations, but the motivation, but that seems to be a symptom of a poor motivation which means that there are a whole number of individuals who are underachieving. Now that's generally true inside the school but it feels more like there are more boys who are underachieving than there are girls.

Is that true in the top set?

Not as much as in other classes, there's certainly a number of boys in the class who if they worked as hard as the girls, if they put the effort in and they got involved in the activity and so on who's attainment would be just as good and it's not. There are certainly some issues like that, [but] in terms of the top end it's not so much of a problem. The ones who are going to get As and Bs, there'll be very few of them, I'd expect them to be evenly spread and that is generally true if you go back over the last few years then that's been true as well. But there's a significant problem with kids who are capable of getting grade Cs. I mean they might very well be capable of getting more than that but in terms of we can identify them in year 8, year 9 to be potentially getting grade Cs and there's a big mismatch between boys and girls, there's a mismatch in every subject in the school and that includes maths.

Effectively what's happening is that the girls are responding to changes in the curriculum. Insofar as changes are being made, they are responding to those and going with them, the boys aren't. You can see it, you get to about year 8, year 9 and the motivation goes. But even younger than that, the year 7 class, there are some extremely bright lads who are very poorly motivated for year 7 kids. I mean if they were year 9 then that happens, you encourage them, you push them up a bit but in year 7. Now that's true, undoubtedly it's true but I mean there's all sorts of cultural issues as well in terms of the boys because the girls correspond more to the expectation of producing work in a certain sort of way, whereas the boys are rowdier, they don't correspond to how teachers want children to behave. But it's enormous cultural influences. I was on residential with some of the brightest lads in year 8, tremendous potential academically and in other ways as well, very

caring and supportive of girls in the class and other children as well so it's not unthinking. And you speak to them about what they want to be and 'I'm going to be a joiner' and I'm not saying there's anything wrong with that. But their horizons are not academic and there's certainly an issue there which the boys are doing which is holding them back [which] is also having a negative effect on the girls as well because they don't get time to say what they want, the teacher's spending a lot of time dealing with naughty boys so they don't have time for the girls et cetera, which is interesting because that's not what I expected in terms of equal opportunities and gender the issues to be.

What did you expect the issues to be?

Rein back the boys, encouraging the girls and girl friendly mathematics and that sort of thing, in terms of as a school we are not good by any means at addressing equality of opportunities issues. It's only just starting to happen. There isn't a culture which very easily, it's developing. So challenging sexism, they tend to be more those sorts of things. Individuals within that, others will let things go by. Interestingly this year I've heard less comments like 'you stupid woman' since we have started to address the issues properly and so on and discuss them with kids. There's less of those comments made which that was a very common one with year 7 and year 8. That was the way to put down one of the other boys to call him [a woman].

18.7.94

(transcribed from the tape)

Tell me about your own schooling.

Primary school I enjoyed. I always attained well at school. Secondary school I went to a boys' comprehensive school which had a girls' school next door, which, yes, it was not bad. It was a setted school, 1 to 7, and invariably I was in set 1 but my friends were drawn much wider than that. I mean I say I was happy at school and I enjoyed school but I truanted quite a bit, more than the odd day.

Why?

It's very difficult to look back at it now through teacher's eyes and say the explanations we had. It wasn't that I was bored at school but I could get away with it, I think if I couldn't've got away with it like in terms of keeping up with the work [I wouldn't have]. I often truanted because of homework, because of not having done homework so it was easier not to go in.

Did you accept the norms of the school by and large?

No, no. It was a school that had very strong uniform. There were times when teachers and senior teachers tried to actively discourage me from keeping the friends I did both in

terms of friends I had in other years who were older than me but also in terms of when it came to options I didn't want to do French ... I made very political statements about not accepting the regimentation, not accepting those sorts of strict structures but at the same time it wasn't conflicts with teachers personally.

Did you feel critical of what other kids got out of schooling or did it not occur to you that sort of way?

Oh yeah, yeah it did occur. I was precocious politically, it seemed like a very political time. I mean there were people in the British movement. [It was] the late seventies, early eighties in Leicester, there was quite a lot of conflict in the playground and also in terms of youth culture. There were all the ideas of anarchism and so on floating around so things like regimentation at school, a sense that things didn't have to be like that. We had a school strike and things like that.

But that didn't put you off becoming a teacher?

No, I suppose for a long while even after it I used to say very flippant things like teachers are agents of the state and that, basically just social control, soft cop. And I suppose there's an element where I still see that. I had to think it through, it's not as simple as that.

Are there any teachers in your family?

Me mum was an adult education teacher.

What do you think mathematics is?

What I think today, and I might not think it tomorrow, is: it's a game. You play your game with symbols and ideas by moving symbols and ideas around, so I suppose that's seeing it as something that's independent of us but dependent on us as well. So it's obviously got some independence, it's an objective description of something and helps to describe the world around us, a language that helps to describe the world around us and that's objective but at the same time that description has a particular bias and so on.

Does your view of mathematics affect what you do in the classroom?

It must do and it does at all sorts of levels. It affects it in terms of trying, where possible, giving problem solving tasks, goal orientated so you've got some problem to solve and you get the maths along the way in the process of solving the goal so in that sense the kids are constructing the mathematics. But at the same time it's to do with describing or trying to solve a problem in the world, the outside world. That's on a very deep level. On a more basic level, I try and get them to puzzle, to think, answering questions with questions and so on.

Here's one person's way of characterising different outlooks on maths and maths education. I'd like you to mark in green any of the sections that you agree with and in red any that are definitely not you.

[points to 1b] 'Basics, numeracy', well you don't get a certificate if you don't get GCSE. My feeling is that [points to column 5] if that's true, then working class kids, all kids, all people have got to have a certain level of skills and knowledge, it makes that [points to 5b] more likely to realise that people need at least to understand what's going on around them. If we want to empower individual children then getting certificates is quite a good idea for them. In terms of life skills I think that's a right [points to 1b] people have a right to learn skills that they'll use in everyday life. I wouldn't say it was a good thing, a mathematical aim, I'd say that every person is entitled to that, that's what I'm being paid to do. [crosses out 1d, laughs] But that's not what I want to do, but often if, when they ask me why do I have to learn this I'm quite honest with them and say it's because there's something called the government and the government has got something called the national curriculum and so you've got to learn it, if you've got any complaints you have to write to John Major [laughs]. I think in terms of what I do in the classroom at best there's discussion with them to try and motivate, discussion of targets and goals [underlines 3d, 4d and 5d] but that's a goal [circles 5c]. I wouldn't say that's what I do at present.

Why do children fail?

We live in a crap society basically. They come into an institution which has as its primary goal reproducing the attitudes which are suitable for good workers, doing what you don't want to do, doing what you're told to do, working to bells. As teachers you're in a hierarchical institution with kids at the bottom of the heap so again they fail because it ain't set up for them to succeed, that isn't the objective of school. I mean it is in one sense, it isn't in the sense of really wanting them to achieve because if it was then it would have to be a very different sort of place. And also the consequences wouldn't be liked. I mean there was an education official back in 1986, 87 something like that when they were first starting to introduce the national curriculum, chief principle officer in the Department of Education and Science and no doubt he was saying what the thinking of the government was, and he said, he said this at a conference 'the thing is nowadays the people have to be educated to know their places'. Well that says it all really. I think if you compare the curriculum and the sort of education that's offered to working class children, and middle class children come to that, to children in private schools there's a big difference. I'm not saying that that's a perfect model by any means obviously but 'cos that's trying to train them to do certain sorts of jobs and be a boss and whatever, but it's small classes and they have all sorts of interesting subjects on the curriculum, archaeology I mean where's archaeology on our curriculum.

How do you find out about something you don't know about, about how to teach fractions, say?

If it's something that's got a specific answer to, I just go and ask someone who I know's got the information that I want. For instance, am I supposed to be telling these kids that bar charts should have gaps or not? and then find out what other people are doing and then carry on doing what I was doing in the first place anyway [laughs] because it seems to me that that's much more sensible anyway.

I suppose that going and asking somebody and then, and then, but there are plenty of other instances anyway where on points of information, what I call a technical question really, or look it up in a book or whatever, [and then use] somebody else, [like for] how far on the national curriculum are they, the mark for a piece of coursework.

What do you do if two people differ?

Probably ask a third person. Or if I've gone to that trouble and I don't like the response of one because if I'd liked that response I probably would just accept that first person anyway and why ask a second person if I think that it's right. In terms of wider questions which aren't technical I suppose it's, in that sense, I wouldn't go and ask somebody how to teach fractions. More the sort of question I might ask is, have you done this yet and how did you do it and then pick ideas from them.

Suppose you were asked about, say, setting up single sex maths groups in year 9, how would you decide about your response?

I would have to think very carefully about what I thought about it in the first place, the issues, so with something like that I would be starting from not having a particularly fixed position, and I'd want to hear what other people have to say. I think I'd probably come down to the point of view that it wasn't a good idea on an ongoing basis, but I imagine I'd have lots of discussions with everybody in the department but particularly with people who I felt were closer to me in terms of the way that I'd be looking at it. [If it was something that I didn't agree with] I'd canvass for a position, think about what position could I actually win, be political about it I suppose.

Would you do any reading?

I might do, well yes, yes, yes in order to like get the arguments.

How would you decide?

It's what promotes certain sorts of values or certain sorts of outcomes. I mean certain issues like ones to do with gender are very political issues and therefore I would go and talk to people I knew politically who are nothing to do with teaching about what they think as well, and try and step outside it and not look at in educational terms but actually think about what the context is.

	1	2	3	4	5
View of mathematics	<u>Set of truths and rules</u>	<u>Body of useful knowledge</u>	Body of structured knowledge	<u>Process view, personalised maths</u>	<u>Socially constructed</u>
Mathematical aims	Basics, numeracy	Useful maths to appropriate level and certification	Transmit body of mathematical knowledge	<u>Creativity, self-realization, through mathematics</u>	Critical awareness and democratic citizenship via mathematics
Theory of Learning	Hard work, effort, practice	<u>Skill acquisition, practical experience</u>	<u>Understanding and application</u>	<u>Activity, play, exploration</u>	<u>Questioning, decision making, negotiation</u>
Theory of Teaching Mathematics	<u>Transmission</u>	<u>Skill instruction, motivate through work relevance</u>	<u>Explain, motivate, pass on structure</u>	<u>Facilitate personal exploration, prevent failure</u>	<u>Discussion, conflict, questioning of content and pedagogy</u>

	1	2	3	4	5
View of mathematics	<u>Set of truths and rules</u>	<u>Body of useful knowledge</u>	Body of structured knowledge	Process view, personalised maths	Socially constructed
Mathematical aims	Basics, numeracy	Useful maths, to appropriate level and certification	<u>Transmit body of mathematical knowledge</u>	Creativity, self-realization, through mathematics	Critical awareness and democratic citizenship via mathematics
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Theory of Teaching Mathematics	<u>Transmission</u>	Skill instruction, motivate through work relevance	Explain, motivate, pass on structure	Facilitate personal exploration, prevent failure	Discussion, conflict, questioning of content and pedagogy

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Theory of Learning	Hard work, effort, practice	Skill acquisition, practical experience	Understanding and application	Activity, play, exploration	Questioning, decision making, negotiation
Theory of Teaching Mathematics	Transmission	Skill instruction, <u>motivate through work relevance</u>	Explain, motivate, pass on structure	Facilitate personal exploration, prevent failure	Discussion, conflict, questioning of content and pedagogy

Goal

Appendix 13

Questionnaire for Phase three

PGCE Follow up Questionnaire

July 1994

How would you describe yourself to yourself as a teacher?

What sort of teacher are you?

What has made you into that kind of teacher?

What sort of teacher did you expect to be before you started teaching?

Are you that sort of teacher? Why or why not?

What do you think has stayed with about your experiences at the Poly?

Did being there change the way you think about yourself?

In your learning there did you come across any ideas that made you see the classroom or pupils differently?

If so, what changes do you think that has made to your classroom practice?

How would you describe the way we worked at maths ed?

What impact, if any, do you think this way of working had on you?

- 3 You have now been through a course of initial teacher education and had some experience in school. What would you now say is the purpose of initial teacher education?
- 4 People say that beginning teachers are *obsessed* with survival. Do you agree?
Were you? Describe what it's like.
What are the implications of this for teacher's development?
Do you think your vision of teaching has changed? In what way?
What are your feelings about this?
- 5 Has anything blocked you since you started teaching? Did this surprise you?

6

What do you value about your present school?

What do you dislike about your present school?

What have you tried to change? Why? What success and failures have you had?

7

What have been the most significant learning experiences in your school(s)?

In what ways have you developed professionally since leaving the Poly? Has anyone in particular contributed to that?

8

What, if anything, inspires you to change and improve your practice in teaching?

Can you think of something that has excited you with respect to teaching?

If so, please describe what that was.

Do you now think that gender, maths and schooling are related? Why do you think this? In what ways do your views on this affect your classroom, your department, your school?

10

I would like to ask you one or two things about your biography and schooling.

Were you yourself happy at school? Why or why not?

Is anyone else in your family in teaching?

Why did you decide to become a teacher? Tell me about one thing that happened that was really important in making you decide.

11

What does mathematics mean to you?

What do you think mathematics *is*?

How does this affect your classroom?

Below is one person's way of characterising different outlooks on maths and maths teaching. I'd like you to mark in green any of the sections that you think fits you well and to mark in red any of the sections that you think is definitely not you.

	1	2	3	4	5
View of mathematics	Set of truths and rules	Body of useful knowledge	Body of structured knowledge	Process view, personalised maths	Socially constructed
Mathematical aims	Basics, numeracy	Useful maths to appropriate level and certification	Transmit body of mathematical knowledge	Creativity, self-realization, through mathematics	Critical awareness and democratic citizenship via mathematics
Theory of Learning	Hard work, effort, practice	Skill acquisition, practical experience	Understanding and application	Activity, play, exploration	Questioning, decision making, negotiation
Theory of Teaching Mathematics	Transmission	Skill instruction, motivate through work relevance	Explain, motivate, pass on structure	Facilitate personal exploration, prevent failure	Discussion, conflict, questioning of content and pedagogy

Which was the bit you felt happiest with? Why? How does this connect with your classroom?

Choose one bit where the decision wasn't obvious. Why was it difficult to decide?

13 Why do children fail?

14 What do you do if you want to know something about mathematics?
What do you do if you want to know something about teaching?
Who or what do you rely on?
What do you do if those sources disagree?

Thank you very much for taking the time and trouble to reply. Please include anything else that you think would be relevant.

Appendix 14

Letter to John, Frances and Matthew after Phase three

16 May 1995

Dear

I am writing to you again to ask if you would participate a little further in my research. There are several things I want to ask you to do and I am aware that each of them will take up some of your time. I should be very grateful if you were willing to participate but, naturally, will understand if you haven't the time (or the inclination).

(i) I have produced an edited transcript of the interviews we made last summer. Would you read this and let me know if I have made any errors, as you remember things? Have I your permission to quote (anonymously) from these transcripts? Have you any other comments you would like to make on the transcripts?

(ii) As a result of all the experiences I have had whilst engaged in this research, I have produced a model of teachers' ways of knowing. I have then used the material from the transcripts to illuminate that model. Would you be willing to read these chapters of my thesis? Would you be willing for the other two major contributors to read these chapters too, even if it meant that they could/might be able to identify you? And, finally, would you be willing to meet the other two and spend some time together discussing the model and the illustration of it? I am imagining an hour or two, probably at my house, and perhaps video recording the discussion.

I know that this is asking a lot and I shall quite understand if you don't want to be bothered. I have enclosed the edited transcripts in the hope that you are willing to OK them.

Best wishes

Hilary

Appendix 15

Extracts from Matthew's letters after Phase three

I have transcribed Matthew's letters with very minor editing of practical details and some changes to the punctuation.

25 June 1995

Dear Hilary

Thanks for the letter and transcripts. I found reading the transcripts initially shocking - do I really speak like that? I talked to K_____ about this and she assures me that I am not the only one whose speech transcribes as gobbledegook. It's caused me to think a lot about the nature of meaning in spoken and written form.

Of course I will be willing to continue to be 'researched'. It's a two way process and I found the transcripts very useful and challenging so I am sure I will get a lot out of reading your thoughts on the issues you refer to.

As to the other questions you ask:-

I include some reactions to the transcripts.

Are there any errors? - I do not know. I can see in the text what I wanted to say but I am not sure that is how someone else would interpret it.

...

A methodological puzzle for you:- being interviewed by you and now reading the interviews undoubtedly has led me to reflect more on the issues you are concerned with and so change my ideas and practice (and vice versa?). If it doesn't sound too pretentious I would say that it's a wonderful example of the dialectical relationship between observer and observed/objective and subjective.

A solution? I came across the following quote (or rediscovered it) through interest in other matters and it made me think of conversations I have with K_____ and also of my feelings about being an 'object' of research.

"Objectivity does not mean detachment, it means respect; ['to be able to see it as it exists according to its own nature'] that is, the ability not to distort and to falsify things, persons and oneself. But does not the subjective factor in the observer, his [*sic*] interests, tend to distort his thinking for the sake of arriving at desired results? Is not the lack of personal interest the condition of scientific inquiry? The idea that lack of interest is a condition for recognising the truth is fallacious ... What matters is not whether or not there is an interest but *what kind* of interest there is and what its relation to the truth will be."

Erich Fromm

Man for Himself

Cheers

[Matthew]

25 June 1995

General thoughts

The interviews are a snapshot. One year on my concerns/interests have developed and changed although I recognise a continuity.

Would I have answered the same way if you had interviewed me 1 week or 1 month before or after?

If answering many of the questions today I would point more to externalities - class size, national curriculum, testing, league tables. These have had a marked effect on my teaching. For example in spite of all my efforts I have taught one class this year who I have failed with ... (I do not use the word failure lightly.)

Structure

In responding to the question about 'good teaching' I talked a lot about structure and the need to ensure the learner knows what to do. I think I have moved on, or would modify my response now. The teacher cannot provide the structure each individual needs. The issue of choice is now I feel more important. Allowing children to choose. No matter how bad things get, can I give one child an opportunity to make a choice in each lesson - this is now my measure of success. The Carl Rogers 'sound bite' about not teaching but providing a learning environment comes to mind.

Gender

I didn't think I connected the question of gender with what mathematics is enough.

What is mathematics?

It's not what I teach.

Does my view of mathematics affect what [I] do in the classroom?

I think my answer to that question contained more bullshit than any others. I feel hypocritical. In the classroom I am pragmatic mostly - I want to survive the week.

Why do children fail?

This is my most coherent answer. It is the one which suffers less from the 'problem of transcription'. Why? Because it is a political statement and not spoken for the first time.

If you had asked me "How do teachers fail children?" I would have been stuttering and my thoughts would have been jumping about all over the place - a much less comfortable question.

28 June 1995

Dear Hilary

...

I enclose a response(s) or thoughts that have arisen whilst/after reading the chapters that you sent me.

I would like to read the rest if possible as it is a bit strange being part of 'phase 3' without knowing what phase 1 and 2 were. (I feel that I'm getting more out of this than you are getting from me!)

Best wishes

[Matthew]

28 June 1995

Some (disjointed) thoughts on 'teachers working for change'

Personal: A lovely feeling of not being alone.

Your model of what a mathematics teacher could do is inspiring/ and frightening. Funnily enough some of my first reactions would be characterised by your model as a 'silent' way of knowing - or put more simply 'wow'!

I don't feel deserving of the title a 'teacher working for change' as I'm not sure I am doing that much to change things (on a class level, I hope the way I speak to children individually is different ----- it is!)

I'm not so much a teacher working for change as a teacher trying to be who I am.

When you interviewed me (us?) perhaps you missed the most important question - who are you trying to be or what do you think is a good way to live. (It struck me that for all 3 of us teaching was fairly incidental, we stumbled on it almost by accident - so is your model generally applicable?)

I recently told you I wanted to teach something else - a different subject. I said that partly for 'shock value' but also I think I was expressing my pain and frustration at the gap between what I want to do and what I believe I actually am doing. This frustration has been increased by recent pastoral work with my form. For example, sex ed and residential experience where what I have done is much closer to what you call emancipatory education.

Last week my form had a taste of equality and freedom on residential. Teachers have been complaining to me of how 'rude and 'cheeky' some of them have been. I've had to be pragmatic and have tried to explain/discuss the school as an institution with my form.

Conclusion structure is very important.

Change is collective (implies dialectically that change is individual too).

Teaching another subject?

But reading the chapters you sent ... reminded me that during the PGCE course I found mathematics uniquely self developing.

Why? (1) Maths is at the sharp edge, it has been a symbol of an oppressive curriculum, a bastion of male 'educated' middle class understanding.

(2) Process and skills needed to do inquiry maths is useful for self inquiry as well.

(3) At the end - or at points during - of being engaged in mathematics it is possible to ask what have I learnt in a way it may not be with other subjects - encourages self enquiry.

(4) Mathematics empowers: you can know that you are correct by introspection.

(5) Mathematics is democratic to an extent (less reliance on standard English).

* Thank you for the distinction between school maths and inquiry maths.

Constructivism, relativism and post modernism

You seem to imply that [I] hold a view of maths that is social constructivism and that my view of the nature of maths is unresolved. I've always had an opinion even if it has changed. My view is more complicated as I imply in the quote you use. There is an underlying structure to an objective reality that mathematics helps to describe/is related to. Our knowledge is socially constructed but in relation to a objective reality.

(Do you see my marxism as being the views of a 'dogmatic rebel' - I wouldn't be offended - aha!)

This relates to my general response to your model. What you refer to as the authority of self and reason seems to imply relativism especially picking and choosing models as appropriate. [I know that is a crude interpretation but I'm being polemical.] But for me overcoming dualism is not simply a matter of seeing both sides but is integrating them into a larger whole and appreciating the interrelatedness of opposites - this is very hard. (Incidentally this is not some dogma about 'big events' but for me a practical guide to day to day living.)

I believe that there is an objective underlying structure to reality which is dialectical (the dialectic 'is in nature' not just in our knowledge of it).

eg Mathematics is not simply constructed. It must be tested against experience (empirical or intellectual). This implies a philosophy of praxis (crucially testing with other people). Objective reality is historical and so our knowledge must take this into account.

Is your model a little ahistorical? How does our society effect (*sic*) these ways of knowing?

(The authority of self and reason is set up as one end point - a best way of knowing - is this intellectual prejudice? (I don't believe this but it needs justifying.))

I think the links/support networks we have need exploring. Authority of self and reason yes but a social self and a social reason, reasoning in a social language.

Contradictorily/dialectically the individual is very important. Can the model be fine tuned to take account [of] our predisposition to express our 'inner self'?

Sorry if this is very confused but I am trying to grasp at half thoughts.

Appendix 16

Resolution of the European Council (85/C 166/01)

Resolution
of the Council and of the Ministers for Education
meeting within the Council of 3 June 1985
containing the action programme on equal opportunities for girls and boys in education
(85/C 166/01)

THE COUNCIL AND THE MINISTERS FOR EDUCATION, MEETING WITHIN THE COUNCIL,

Having regard to the Treaties establishing the European communities,

Having regard to the resolution of the Council and of the Ministers for Education, meeting within the Council, of 9 February 1976 comprising an action programme in the field of education,¹

Having regard to Council Directive 76/207/EEC of 9 February 1976 on the implementation of the principle of equal treatment for men and women² and in particular Article 2 (4) and Articles 3 and 4 thereof,

Having regard to the Council resolutions and those of the Council and of the Ministers for Education, meeting within the Council, dealing with equal opportunities for women,^{3,4,5,6}

Having regard to the Council recommendation of 13 December 1984 on the promotion of positive action for women,⁷

Having regard to the various European Parliament resolutions in favour of women,⁸ and in particular the resolution of 17 January 1984⁹ on the situation of women in Europe,

Bearing in mind that educational establishments are a particularly suitable forum for effective action to achieve equal opportunities for girls and boys;

Whereas education and vocational training are among the prerequisites for achieving equal opportunities for men and women in working life and whereas education should therefore contribute to eradicating stereotypes, encourage acceptance of the principles of fair sharing of family and occupational responsibilities and prepare young people adequately for working life;

Bearing in mind the importance of involving all participants in the educational process in implementation of any policy to foster equal opportunities in order to achieve the necessary change in mentalities and attitudes;

Whereas the decisive influence of parents is widely recognized in connection with stereotype-formation, the perception of social roles of men and women and also as regards the duration of schooling and educational and career choices;

¹ OJ C 38, 19.2.1976.

² OJ L 39, 14.2.1976.

³ Resolution on the promotion of equal opportunities for women (OJ C 186, 21.7.1982).

⁴ Resolution concerning vocational training measures relating to new information technologies (OJ C 166, 25.6.1983).

⁵ Resolution concerning vocational training policies in the European Community in the 1980s (OJ C 193, 20.7.1983).

⁶ Resolution on measures relating to the introduction of new information on technology in education (OJ C 256, 24.9.1983).

⁷ Resolution in action to combat unemployment amongst women, and in particular section II (b) thereof (OJ C 161, 21.6.1984).

⁸ OJ L 331, 19.12.1984

⁹ OJ C 50, 9.3.1984 and OJ C 149, 14.6.1982

OJ C 50, 9.3.1984.

Bearing in mind the commitment of teachers and their associations to the achievement of equal opportunities for girls and boys in the school system;

Whereas, in addition to policies concerning equal access for girls and boys to all forms and levels of education, positive action is necessary to bring about equality in practice;

Taking note of the report of the Conference on Equality of Opportunity for Girls and Boys in Education (Brussels, 27 and 28 November 1984), organized by the Presidency in conjunction with the Commission,

HEREBY ADOPT THIS RESOLUTION:

- I. The Council and the Ministers for Education, meeting within the Council, give their agreement to an action programme which will be implemented within the scope of constitutional possibilities and having regard to the economic, social and cultural context of each Member State, to the funds available and to their respective educational systems. The measures envisaged under this programme are necessary in order to:
 - (i) ensure equal opportunities for girls and boys for access to all forms of education and all types of training in order to enable each individual to develop his or her own aptitudes to the full;
 - (ii) enable girls and boys to make educational and career choices, in full knowledge of the facts and in good time, affording them the same possibilities as regards employment and economic independence;
 - (iii) motivate girls and boys to make non-traditional choices and to follow courses leading to qualifications so that they may have access to a far more diversified range of jobs;
 - (iv) encourage girls to participate as much as boys in new and expanding sectors, within both education and vocational training, such as the new information technologies and biotechnology.

The Council and the Ministers for Education, meeting within the Council, accordingly agree that these objectives can be attained if the educational and career choices of girls and boys are made without any restriction as to sex.

The action programme is as follows:

1. Promoting awareness among all the participants in the educational process¹ of the need to achieve equal opportunities for girls and boys
 - (a) Encouraging the eradication of sex stereotyping through coordinated action to raise awareness such as information campaigns, seminars, lectures, debates and discussions;
 - (b) encouraging exchanges of information on innovatory projects in this field and ensuring that it is as widely disseminated as possible;
 - (c) preparing and distributing at national level texts bringing together results of experience, recommendations and practical guidance aimed at achieving equal opportunities.
2. Educational and vocational guidance as a service to all pupils to encourage girls and boys to diversify their career choices

¹ In particular, children, parents, inspectors, heads of educational establishments, teacher-training staff, teachers, educational counsellors, guidance officers, local authorities.

- (a) Ensuring that information is given as early as possible on working life and delay the introduction of options, since premature specialization leads to a preference for traditional course options and maintains segregation;

ensuring that information, counselling and guidance services are available to all pupils throughout their school career and in particular at all the key points at which course options are decided;

making it possible to switch courses during the school career, e.g. by means of bridging classes;

- (b) encouraging diversification of girls' and boys' educational and career choices, particularly by:

- (i) introducing both girls and boys to new technology from the end of primary school in all educational establishments,
- (ii) training guidance officers in the specific aspects of educational and career guidance relating to girls (encouraging diversity of choice, in particular new careers connected with new technologies, and providing follow-up and support for girls who take non-traditional options, etc.),
- (iii) ensuring effective cooperation between school guidance services and parents and teachers as well as between school and vocational guidance, training and job-vacancy services.

3. Opening up schools to working life and the outside world, in particular by organizing, at all levels, pupil contact with working life, especially where non-traditional work for women is being promoted, and with the outside world in general (associations of young people, occupational bodies, etc.).
4. Extending the possibilities for effective access by both girls and boys to all vocational training options and supporting, through suitable measures, girls and boys who have chosen non-traditional openings.
5. Including the question and pedagogics of equal opportunity in teachers' initial and in-service training. Teachers' courses could for instance include the components needed to encourage girls to take up the natural sciences and mathematics, and information on the vocational opportunities offered by these disciplines.

6. Reinforcing coeducational practices in mixed educational establishments

In mixed educational establishments encouraging all pupils to participate in school and extra-mural activities, including activities traditionally considered as being either for the male or female sex and stimulate in particular equal participation by girls and boys in technical and scientific options.

7. Developing a balance between men and women holding positions of responsibility in education

Encouraging children to develop a positive perception of equality of the sexes by promoting a balanced distribution of men and women working in the educational sector; to this end, encourage action aimed at improving the balance in terms of postings, promotion and training. This improved balance should cover both the subjects taught and the levels of the posts occupied.

8. Eradicating persistent stereotypes from school textbooks, teaching material in general, assessment materials and guidance material

(a) Creating structures or using existing structures for equal opportunities for girls and boys with a view to establishing criteria and drawing up recommendations aimed at eliminating stereotypes from school books and all other teaching and educational material, with involvement of all the parties concerned (publishers, teachers, public authorities, parents' associations);

(b) encouraging gradual replacement of material containing stereotypes by non-sexist material.

9. Special measures helping the underprivileged, particularly girls who receive very little encouragement from their families to pursue school activities and the children of migrant workers (prevention of illiteracy, language training). These measures are aimed at pupils, teachers and parents. They are particularly concerned with informing migrant workers of the educational options available in the host country.

10. Introducing specific measures to encourage the promotion of programmes for equal opportunities for girls and boys, with a view to:

(i) encouraging the implementation in schools of specific measures based on guidelines agreed at national level;

(ii) drawing up annual reports on action taken;

(iii) encouraging the training of school advisers specifically appointed to make recommendations, give advice, suggest initiatives and assess measures taken;

(iv) reviewing the text of regulations (such as circulars) with a view to eradicating discrimination and stereotypes from them;

(v) encouraging the use of existing agencies with expertise in matters concerning equal opportunities for girls and boys in monitoring progress in this area.

II. The Commission of the European Communities will take the necessary measures to:

(i) promote the principle of equality between girls and boys in all Community action and policies connected with education, training and employment policy, and in particular promote a spirit of enterprise among girls as well as boys in order to facilitate their transition from school to working life,

(ii) extend the programme of study visits to include teacher training staff, guidance officers, inspectors and administrators with particular responsibility for equal opportunities for girls and boys at school, in order to broaden their practical and vocational experience,

(iii) provide supplementary data, particularly through studies on equal opportunities for girls and boys in education, circulate the results and improve the exchange of information on positive action by using the Eurydice network,

(iv) ensure close cooperation with teachers' associations organized at European level in implementing and promoting measures for equal opportunities for girls and boys,

(v) in collaboration with parents' associations organized at European level, launch information campaigns on the choice of school courses and the division of tasks between girls and boys and aimed at eliminating stereotypes,

(vi) set up a Working Party composed of those having responsibility at national level for matters concerning equal opportunities for girls and boys in education and of representatives of the competent bodies (experts, equal opportunities boards) to pool Member States' experience and follow up and assess the implementation of the action programme; this Working Party to report to the Education Committee,

(vii) support, on the basis of specific criteria (e.g. transferability to other Member States), certain action undertaken by Member States, particularly the launching of innovatory programmes of projects, and actions which foster exchanges between Member States,

(viii) support Member States in drawing up and circulating practical recommendations aimed at achieving equal opportunities, particularly by preparing Community guidelines.

- III. The Council and the Ministers for Education, meeting within the Council, call upon the Commission to give careful consideration, in the framework of the rules governing the Social Fund, to applications relating to the training of instructors and guidance counsellors undertaken in the context of positive action to ensure equal opportunities for girls and boys in education.
- IV. The Council and the Ministers for Education, meeting within the Council, call upon the Education Committee to submit, in two years' time, a first progress report on action taken by the Member States and the Community to foster equal opportunities for girls and boys in education.
- V. Community funding of the action outlined in section II and the extent thereof will be decided in accordance with the Community's budgetary rules and procedures.
- VI. This Resolution will be forwarded to the European Parliament and to the Economic and Social Committee.

Appendix 17

Invitation to join the equal opportunities support group in Phase two

Equal Opportunities Support Seminar

Proposal

During last year on the PGCE course, a number of us were involved in a project which focussed on the need to provide equal educational opportunities for boys and girls. Undoubtedly this will continue to be a central theme in the course this year. We sought to provide research findings and information, opportunities to explore our own attitudes and perspectives, and practical advice and suggestions about how to implement equal opportunities in school. I became very interested in the issue of why we sometimes find it difficult to match our attitudes and perspectives to what actually happens in our classrooms and I would like very much to spend time this year exploring that further.

With this in mind, I decided to offer an additional element in the course this year: an equal opportunities support seminar, meeting approximately once a fortnight during the course. You are free to choose whether or not you wish to join the group. If you do decide to attend, then a regular commitment would be appreciated to ensure the coherence and continuity of the work. The focus of the group will be to explore some of the specific difficulties we face and to try to offer each other practical and personal support in overcoming them.

In addition, I should like to collect data from and about the group and its workings and also, from time to time, from everyone on the PGCE mathematics course. This would, of course, be only with your consent and all the information would be treated as strictly confidential. My current intention is that the material should form part of the basis for a research degree. From a methodological point of view, I am committed to research that does not treat the researched as objects but includes and awards status to their perspectives and that also seeks to gain access to understandings through interaction and shared experience. I shall myself be fully participant in the group and not in any sense an outside observer.

Hilary Povey
September 1990

Appendix 18

**Conclusion to mathematics report on action research project
(Phase one)**

What did we learn about and through the process?

We have already said elsewhere that we believe that involvement of all staff in the planning of their own equal opportunities work is a vital part of successful practice. Our experience confirmed this.

The pedagogic style we adopted with its emphasis on personal involvement and participation was central to our work. We believe that some ways of working are more conducive than others to giving the participants a sense of ownership and that this sense of ownership brings a deeper commitment and a willingness to ask and answer challenging questions.

The students' participation in planning their own curriculum entailed their taking responsibility for it.

For equal opportunities work to be successful, it needs to permeate the curriculum. We discovered that when it does, and is perceived to do so by the students, then the legitimacy of the issue seems to be endorsed by them rather than, as might have been expected, a sense of "overkill" being evoked.

The students commented on the fact that an atmosphere of support and trust enabled them to explore issues which otherwise might have been left unexamined. They valued the opportunity which the emphasis on small group work gave for extended and frequent discussion with their peers.

The students took very seriously the need to address *practical* classroom issues. Within this context, however, they were willing to investigate relevant research material and to recognise that their own personal attitudes and values were a significant part of the equal opportunities agenda.

Appendix 19

Definitions of attitude measures from Lacey 1977

Definitions of attitude measures

Naturalism Naturalism presumes the existence of natural standards that reside within the child and emerge in a relationship with the child. It is therefore opposed to the imposition of external (absolute) standards in the moral, cultural or academic sphere (Lacey 1977, p59).

Radicalism Radicalism is concerned with the allocation of resources to and the distribution and availability of education. In general, more education, more equally distributed is at the centre of the concept (Lacey 1977, p59).

Tendermindedness Tendermindedness is *against* narrowly conceived vocationalism and instrumentalism in education and is *against* efficiency in fitting children into the 'system'. It is therefore a very negative concept and can only be conceived of as protecting children from demands of the future and the 'system' (Lacey 1977, p60).

Liberalism Liberalism is for pupil participation, against competition and for the unequal division of resources in favour of poorer areas (Lacey 1977, p11).

Progressivism Progressivism stresses good relationships more than academic results and does not accept that distance or hostility are inevitable in the relationship with children (Lacey 1977, p11f).

Appendix 20

Chart of intellectual development from Perry 1970

GLOSSARY

The following glossary is reproduced from the *Judge's Manual*. It provides a reference for certain terms appearing in the text, and on the Chart, to which a particular meaning is assigned.

Absolute

The established Order; The Truth, conceived to be the creation and possession of the Deity, or simply to exist, as in a Platonic world of its own; The Ultimate Criterion, in respect to which all propositions and acts are either right or wrong.

Accommodation

The modification or reorganization of a structure in response to incongruities produced by assimilations.

Adherence Chart code: A (contrast Opposition)

- 1) Alignment of self with Authority in a Dualistic structuring of the world; or
- 2) In parentheses: (A), a "conservative" preference in a relativistic structuring of the world.

Assimilation Chart code: parentheses ()

The connection of a new percept to an extant structure. This may require various degrees of subordination of the implications of the new percept to the demands of an extant structure, and/or various degrees of accommodation of the structure.

On the Chart, the quantity within the parentheses is to be read as assimilated to the structure preceding the parentheses; for example, 4A(M) reads "Multiplicity assimilated to Adherence in structure of Position 4."

Authority (upper-case A)

The possessors of the right answers in the Absolute, or the mediators of same (as viewed in Adherence); or the false or unfair pretenders to the right answers in the Absolute (as viewed in Opposition).

authority (lower-case a)

An aspect of social organization and interaction in a relative world, with many differentiations (e.g., power, expertise, etc.).

Commitments Chart code: C

An affirmation of personal values or choice in Relativism. A conscious act or realization of identity and responsibility. A process of orientation of self in a relative world.

The word Commitment (capital C) is reserved for this integrative, affirmative function, as distinct from 1) commitment to an unquestioned or unexamined belief, plan, or value, or 2) commitment to negativistic alienation or dissociation.

defensive (adjective descriptive of Adherence or Opposition) Chart code: Ad or Od

Adherence or Opposition functioning in internal structures of emotional control so as to produce high resistance to qualification, ambiguity, or change.

Dualism or Duality (upper-case D)

A bifurcated structuring of the world between Good and Bad, Right and Wrong, We and Others.

Complex Dualism — a Dualism in which one element is itself dualistically structured.

dualism or duality (lower-case d)

Any binary function in a relative world, e.g., the right/wrong quality of a proposition in a specified context

Escape

The denial of the implications for growth in Positions 4 and 5 by Dissociation or Encapsulation in the structure of these Positions.

Dissociation Chart code: D

Sustained opportunistic denial of responsibilities implied for the self in Multiplicity or Relativism.

Encapsulation Chart code: E

Consolidated assimilation of Multiplicity or Relativism to a Dualistic structure, projecting responsibility on Authority.

Growth

Progression from one structure to a higher structure as defined in the scheme.

Multiplicity Chart code: M

A plurality of "answers," points of view, or evaluations, with reference to similar topics or problems. This plurality is perceived as an aggregate of discretes without internal structure or external relation. In the sense, "Anyone has a right to his own opinion," with the implication that no judgments among opinions can be made. (compare Relativism)

Opposition Chart code: O (contrast Adherence)

- 1) Alignment vs. Authority in a Dualistic structuring of the world; or
- 2) In parentheses: (O), a preference for change and experimentation, as opposed to conservatism, in a relativistic structuring of the world.

Position (1 to 9 etc. on the Chart)

That structure representing the mode, or central tendency, among the forms through which an individual construes the world of knowledge and values at a given time in his life.

Relativism Chart code: R

A plurality of points of view, interpretations, frames of reference, value systems and contingencies in which the structural properties of contexts and forms allow of various sorts of analysis, comparison and evaluation in Multiplicity.

Retreat

An active rejection of the implications for Growth by entrenchment in a defensive variant of Position 2 or 3.

Structure

The relational properties of a world view, with special reference to the forms in which the nature of knowledge and value are construed.

Temporizing

A suspension of Growth (for a year) without recourse to the structurings of Escape.

GROWTH

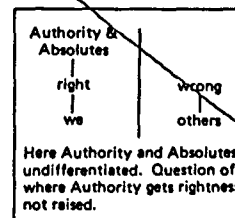
SIMPLE DUALISM

POSITION 1

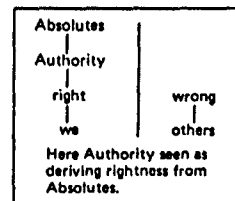
BASIC DUALITY

Assumption of dualistic structure of world taken for granted, unexamined. Right vs. wrong, we vs. others, good vs. bad, what They want vs. what They don't want. All problems soluble by Adherence: obedience, conformity to the right and what They want. Will power and work should bring congruence of action and reward. Multiplicity not perceived. Self defined primarily by membership in the right and traditional.

Form 1:



Form 2:



COMPLEX DUALISM

POSITION 2

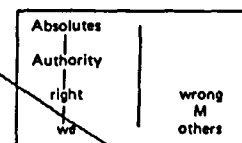
MULTIPLICITY PRE-LEGITIMATE

Multiplicity perceived, but only as alien or unreal. As alien it assimilates easily to error and otherness: "Others are wrong and confused (M)." Assimilated to Authority, it leads to Opposition: "I am right; They (Authority) are needlessly confused (M)."

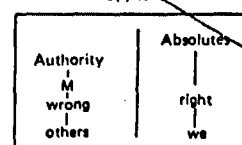
As unreal, M is a mere appearance, e.g.: "They want us to work on these things (M) to learn how to find the answer." Here Opposition sees Authority not as wrong but simply as failing in its mediational role.

In either case M is perceived but not as a signal of legitimate, epistemological uncertainty.

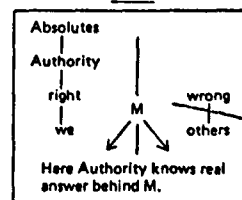
Align In Adherence



In Opposition



Unreal



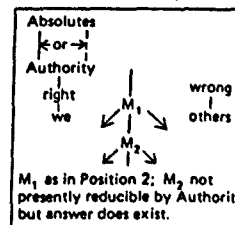
POSITION 3

MULTIPLICITY SUBORDINATE

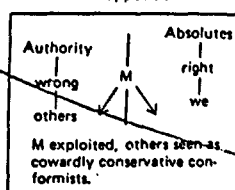
Multiplicity perceived with some of its implications. Authority may not have the answers yet on some of it, perhaps because the relevant Absolutes are not yet in view. But trust in Authority, at least in the ideal, is not threatened. Exercises in M may be enjoyed (A) or disliked (Ad); Authority is presumed to evaluate them on skill of presentation (not on structural properties). Ad may fear they are judged on glibness, influence, or pull.

Opposition here: "They judge all wrong." Self defined over against Authority and in similar structural terms.

In Adherence



In Opposition



RETREAT

Active Denial of Potential of Legitimacy in Otherness

(for variants, see box)

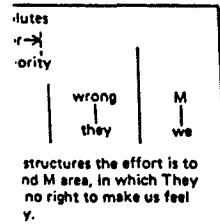
POSITION 4 MULTIPLICITY CORRELATE OR RELATIVISM SUBORDINATE

Relativism restructured in complex
is: right-wrong vs. M. Absolutes
may be doubted in M area
considered so inaccessible as
impossible to bring to bear
human affairs in any reason-
foreseeable future. In M,
therefore, "anyone has a right
to own opinions." M is ac-
knowledge as relevant to self,
being confusing, liberating,
going, etc.

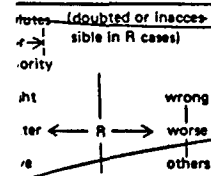
or

Relativism perceived in M and
related to Authority: A(R).
is: Authority can make
statements in M on discernible
grounds of propositions to each
other (coherence) or to deter-
minence. However, this is
"how they want us to think,"
rather than a consequence of the
reality of all knowledge.

Multiplicity Correlate:



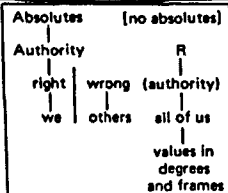
Relativism Subordinated:



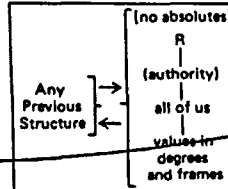
POSITION 5 RELATIVISM CORRELATE, COMPETING, OR DIFFUSE

Relativism perceived as way of
perceiving, analyzing and evalu-
ating, not because "They want
us to think this way," but in-
trinsically. Authority perceived
as authority in R. In R Correlate,
world divided into those
areas where Authority has the
answers (e.g. physics or morals)
and those in which R must be
used (e.g. English papers). In R
Competing, R perceived as ap-
plying to whole world (with
binary answers a sub-class), but
this world view alternates with a
previous one. In R Diffuse, the
most fully developed of these
structures, R is accepted gener-
ally but without implications
for Commitment.

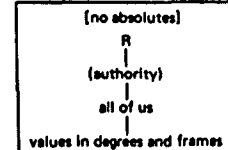
Relativism Correlate:



Relativism Competing:



Relativism Diffuse:

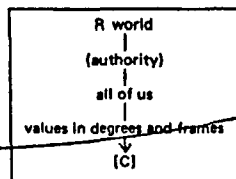


[A and O become conservative
or progressive styles in R-frame.]

POSITION 6 COMMITMENT FORESEEN

R accepted for all secular pur-
poses including binary judgment
and action. Commitment may
be perceived as a logical neces-
sity for action in an R world
and/or "felt" as needed (with or
without explicit statement of a
logical necessity). The realiza-
tion may bring various reactions:
eagerness, ambivalence, dismay,
sturdiness, turmoil, simple ac-
ceptance.

Commitment Foreseen:

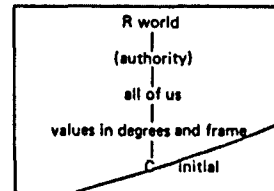


(C) added when a Commitment
sensed as near.

POSITION 7 INITIAL COMMITMENT

First Commitment(s) or affirmation(s).
Acceptance of their origins in self's
experience and choices, some intima-
tions of implications.

Initial Commitment(s):

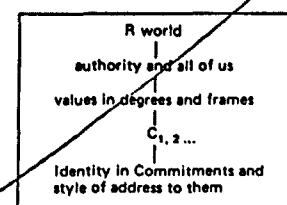


Note on religion: In Commitment
involving a religious faith in an ab-
solute, the same distinctions re
Commitment apply (cf. theologi-
cal distinction between belief and
faith). The structural solutions for
relating an absolute and relativism
are varied and not outlined here.
In all of them the crucial criterion
for the integrity of the R-orientation
is the attitude toward people
with other absolutes.

POSITION 8 ORIENTATION IN IMPLICATIONS OF COMMITMENT

Some implications of Commitment re-
alized: tensions between feelings of
tentativeness and finality, expansion
and narrowing, freedom and constraint,
action and reflection. Prospect of (or
even experience of) membership with
authority in areas of Commitment
(values, address to others, occupation,
etc.) Identity sensed in both content
of Commitment and in personal style
of address to Commitment.

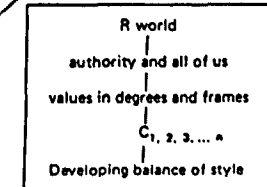
Implications Experienced:



Note: (D) may be added to any forms
of 7, 8, (or conceivably even 9), if
while advancing in most aspects of his life
the student has kept some aspect(s)
dissociated from the general advance without
appearing to have invalidated his central
growth.

POSITION 9 DEVELOPING COMMITMENT(S)

Commitments expended or remade
in new terms as growth. Balances are
developing in the tensions of quali-
tative polarities of style, especially
alternation of reflection and action.
Acceptance of changes of mood and
outlook within continuity of iden-
tity. Sense of being "in" one's life.



A
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VARIANTS OF RETREAT

"Reaction": High anxiety, complaint,
resentment vs. M.
"Dedicated Reactionary": Rightness,
hate of Otherness, no overt anxiety.
Has all answers for M.
"Negativism": Passive resistance vs.
Authority, but no "cause" of one's
own.
"Dogmatic Rebel": Identity in "cause"
without contingent judgment. "Cause"
determined by whatever Authority
does to be against.

VARIANTS OF ESCAPE

Multiplicity
Encapsulation of M (Identity limited):
Loose "tolerance" of M for Others
so long as it serves A purposes or
doesn't upset own A structures.
(Dependent) = Identity in carrying out assignments of external au-
thority by obedience.
(Outer directed) = Identity in carrying out assignments of external
authority (or peers) by performance.
(Inner directed) = Identity in autocracy. Moral problems all settled.
May also find Identity in performance.
Loose cynicism: uses M to defeat
all value statements (except affir-
mation of self as nihilist).
Dissociation in M (Identity dissolved):
Uses M to wash out self, no intel-
lectual exercise in process. Anything
goes.

Relativism
Encapsulation of R (Identity limited):
Relativism in M exploited for A
purposes but never turned on A
structure.
Rationalistic cynicism: uses R to
defeat all value statements (except
affirmation of self as nihilist).
Dissociation in R (Identity dissolved):
Uses R to wash out self. The intel-
lectual game, Commitment avoided.
goes.

TEMPORIZING

longed pause (full year) within any of the above Positions, without evidence of entrenchment through structures of Escape.

ESCAPE

A settling for Positions 4, 5, or 6 by denying or rejecting their
implications for growth.
(for variants, see box)

Note: Chart is abbreviated from the form used in Judges' experiments.
Its main outlines will provide the reader with the shape of the
scheme. Its details, discussed orally with the Judges, can be most
readily approached via the text of Chapter 5.

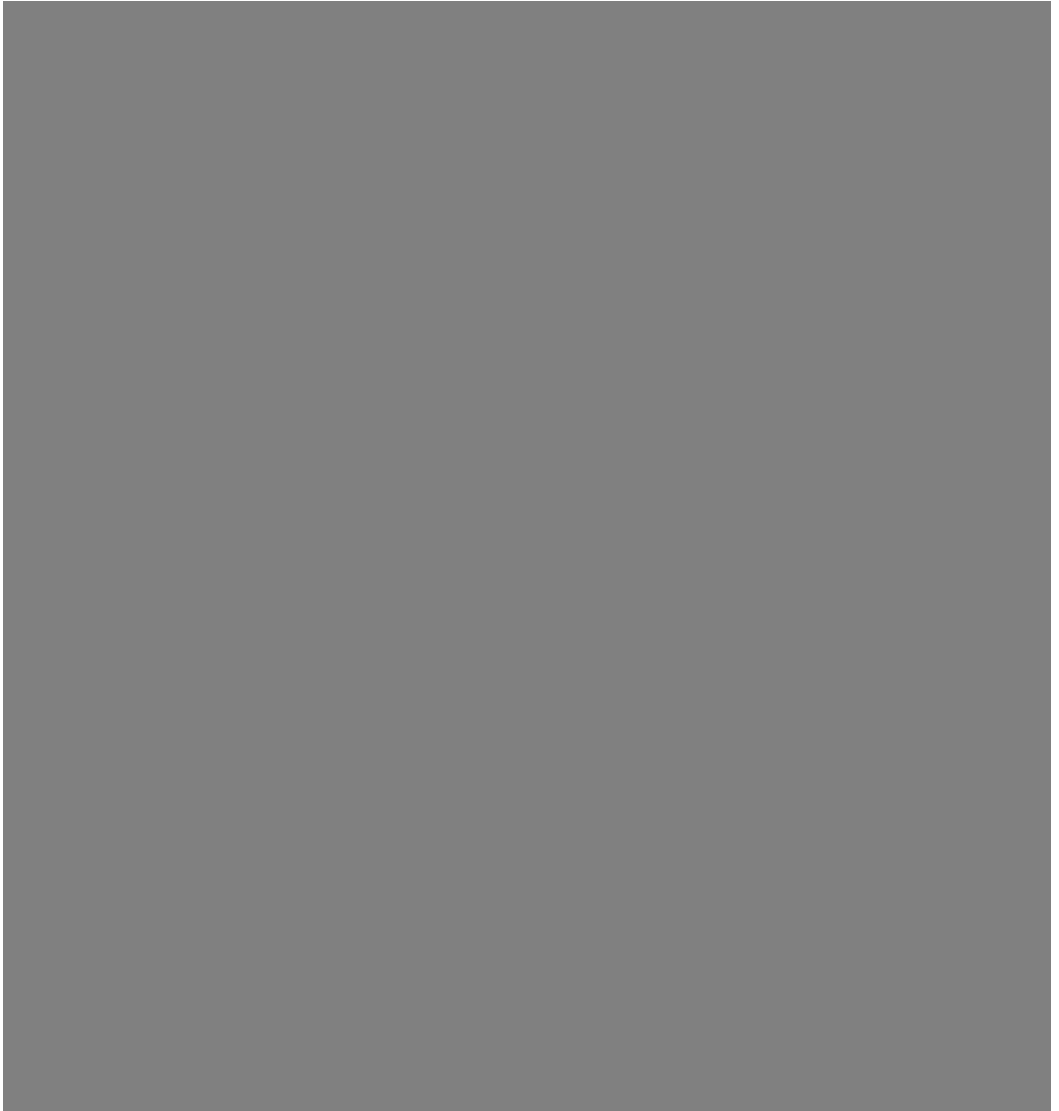
CHART OF DEVELOPMENT

Appendix 21

Interview schedule from Belenky et al 1986

Appendix A

Interview Schedule





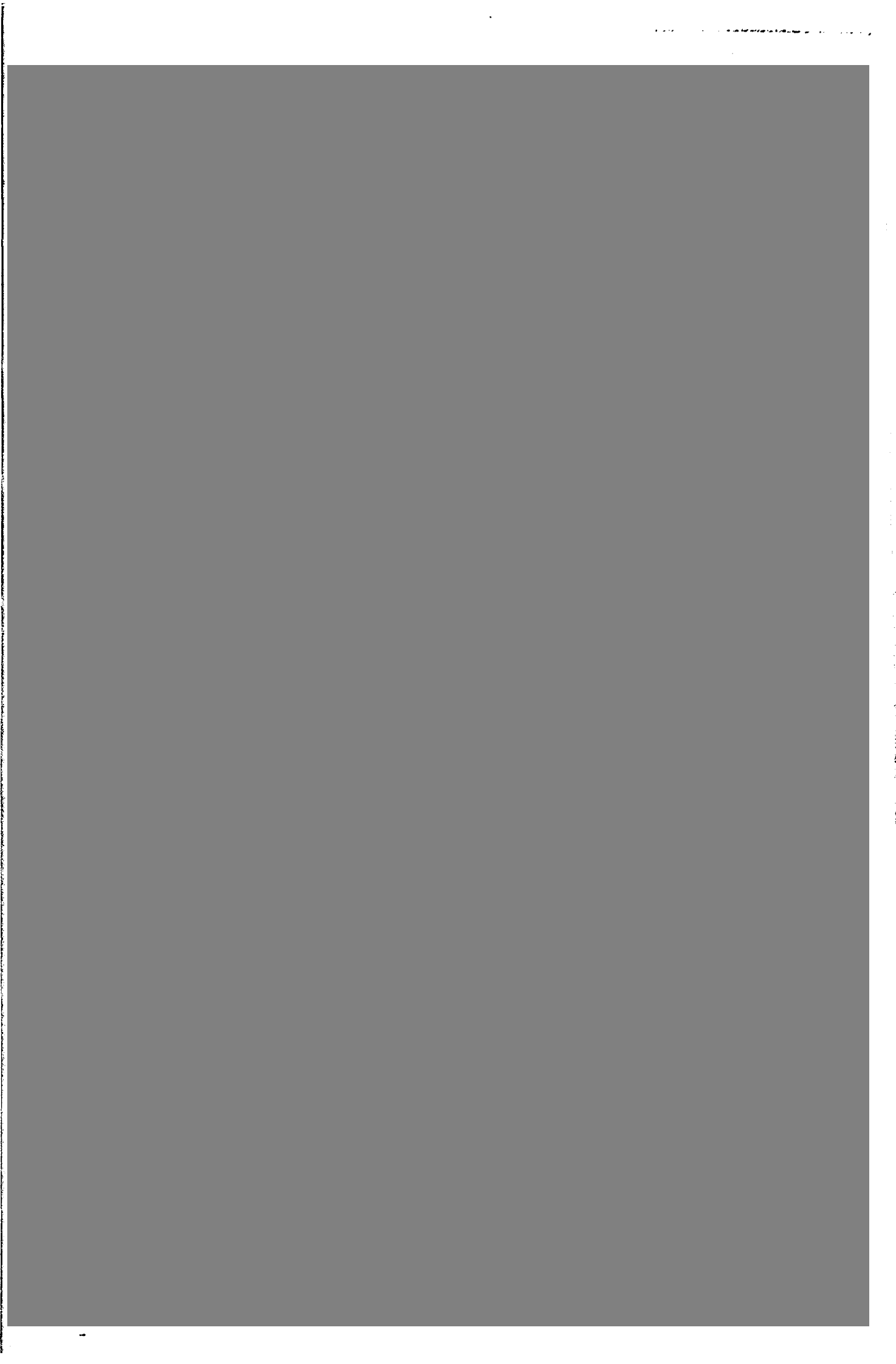


Appendix 22

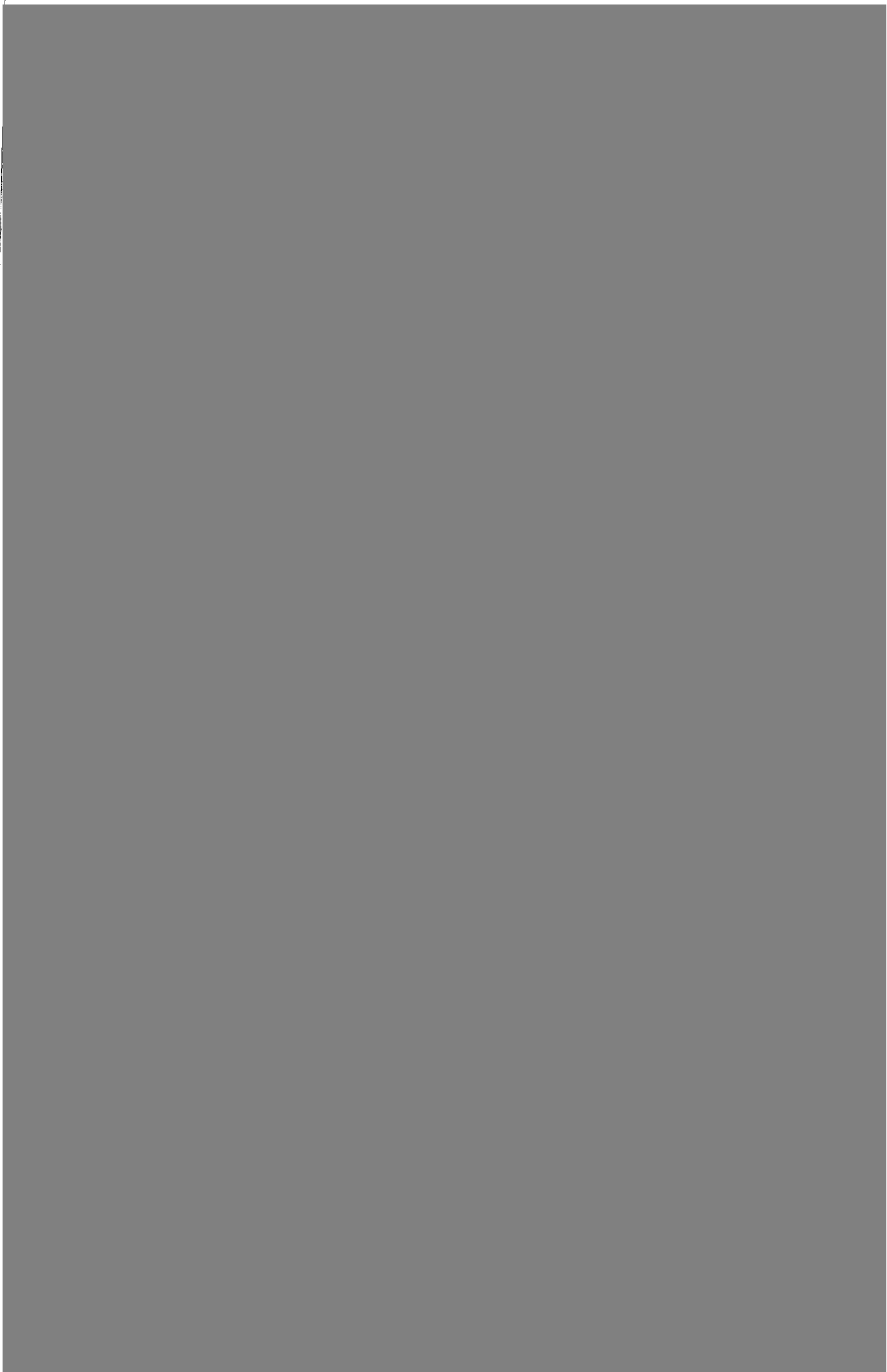
Text of Povey 1995

'The Big, Bad World of Computers': Gender, Micros and Mathematics in Initial Teacher Education

Hilary Povey begins her article with a brief discussion of some of the equal opportunities issues with respect to gender surrounding the teaching and learning of mathematics. The author then describes some of the work she and her colleagues have undertaken in mathematics classes with a particular group of students in initial teacher education at Sheffield Hallam University. When they introduced the Logo programming language into the mathematics curriculum of their students, they asked them to initiate their own projects, to work in pairs and to keep a diary of the work they did. The evaluation of this work, done by interpreting the diaries, is described in detail. The results were positive: learning styles often favoured by women were validated and the women students were empowered in their relationship with the new technology. The article concludes with some thoughts about the implications for future practice, both for the students as learners themselves and also for the students as teachers in training.

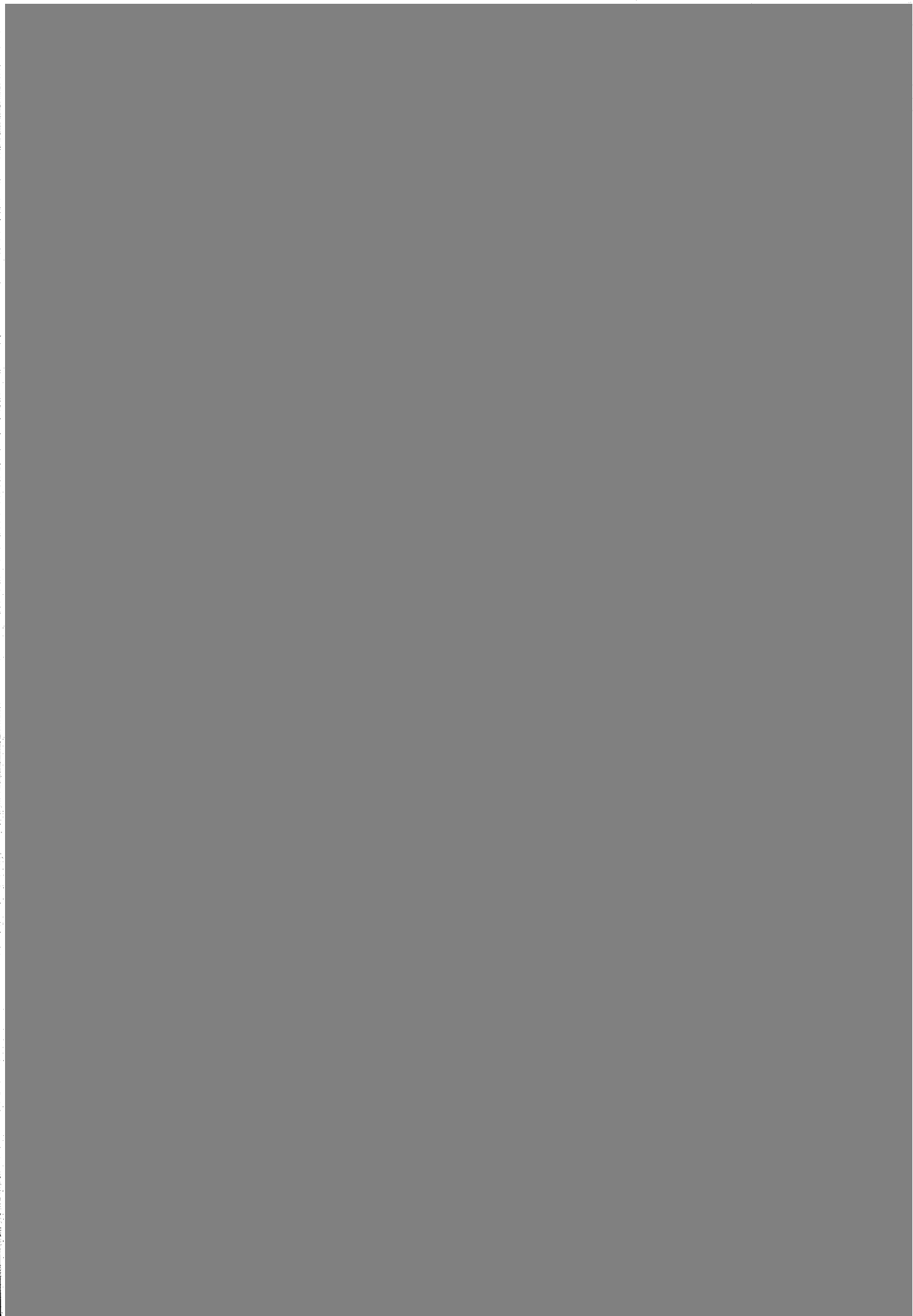












Appendix 23


Text of Povey in press

Working for Change in Teacher Education

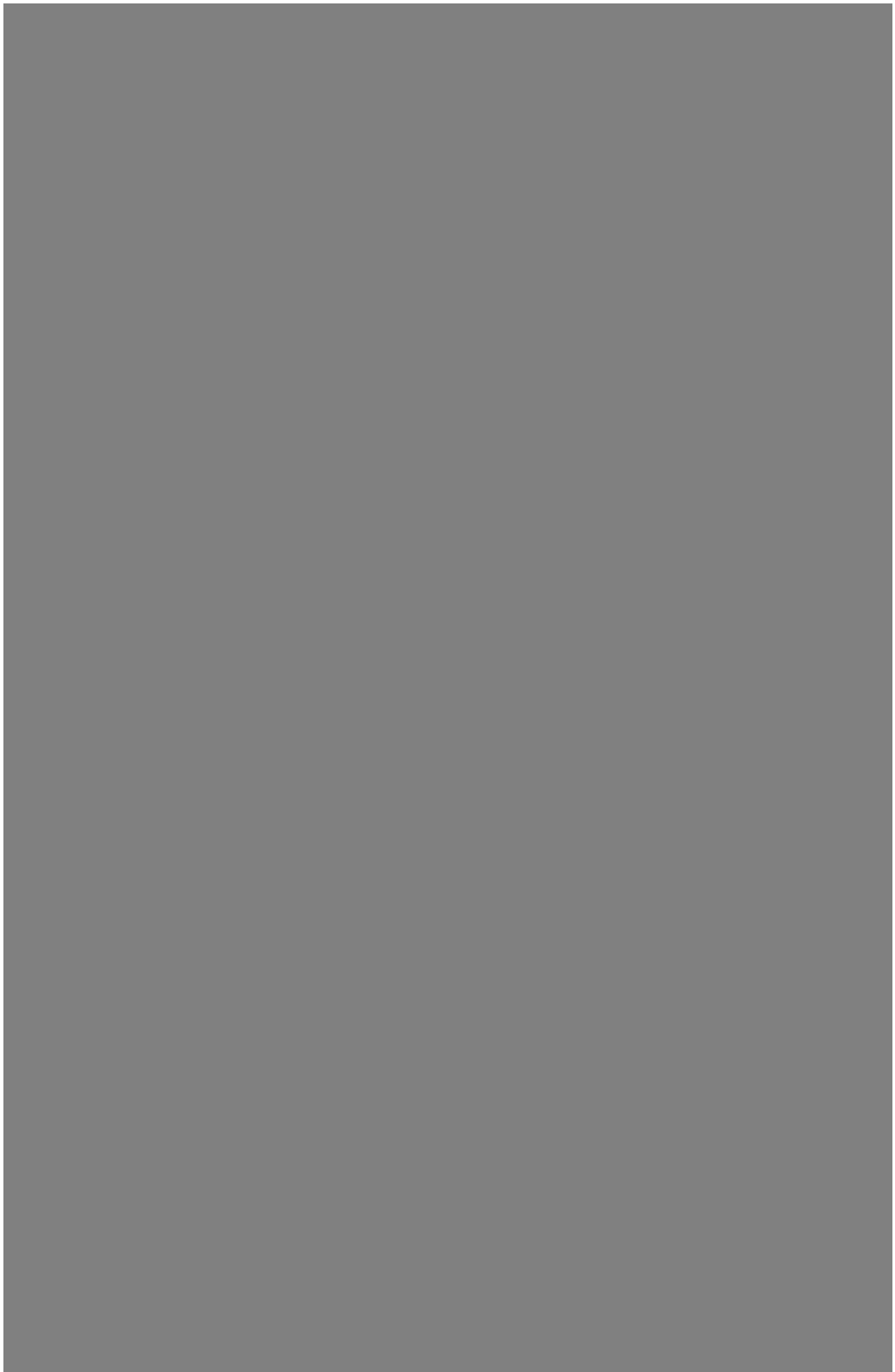
Some First Steps for Monday Morning¹

Hilary Povey

Logo has been found to be a powerful tool for prompting teachers of school mathematics to experiment with new ways of teaching and learning. This chapter is concerned with initial teacher education and looks at the ways in which the students' learning of Logo may help them to rethink their understanding of the nature of mathematics and to develop a critical, emancipatory pedagogy.







the 1990s, the number of people in the UK who are employed in the public sector has increased by 1.5 million, from 2.5 million in 1980 to 4 million in 1999. The public sector has become a major employer in the UK, and its growth has been a key factor in the overall growth of the economy.

The public sector has also become a major provider of social services, and its growth has been a key factor in the overall growth of the economy. The public sector has become a major provider of social services, and its growth has been a key factor in the overall growth of the economy.

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