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Pedagogical Discourses and Subjectivities in Primary Mathematics Initial Teacher Education

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Pedagogical Discourses and Subjectivities in Primary Mathematics Initial Teacher Education

by

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Abstract

This thesis examines students' experiences of learning to teach mathematics as they complete a primary Postgraduate Certificate in Education to gain qualified teacher status. The research data are drawn from students' accounts of learning to teach mathematics, which include email communications during their studies and interviews with eight students at the end of the course. Analysis is informed by post-structuralist feminist understandings of discourse, power and knowledge. These tools are used to explore the complexities of learning to teach, the ways in which beginning teachers are 'produced', what counts as mathematics and the effects of power relations within pedagogical encounters. I use a reflexive approach to methodology, acknowledging the ways in which my own subjectivity permeates the enquiry, and the ways in which power permeates the research process. The study found performances of gender in students' accounts of their experiences of the course, both on campus and in schools. Dominant discourses of teaching and mathematics create tensions for students and act as a form of control and categorisation as they strive to be recognised as legitimate mathematics teachers. It is argued that students' subjectivities are shaped by discursive practices and peer and pedagogical relationships in the context of the course and that students are constituted as mathematical subjects often in inequitable ways. They are both powerful and powerless in different instances as they take up competing discourses, positioning themselves and their peers in shifting locations. Some students are silenced, categorised and marginalised within discourses of mathematics. Most report complying with the established practices of the school and class teacher and focused on the struggle to achieve legitimacy as successful student teachers. They

demonstrate both compliance with and resistance to dominant discourses as they are caught between the tensions and inconsistencies of competing and conflicting discourses. A key implication of this study is that teachers, teacher educators and student teachers need opportunities to explore their own gendered subjectivities as learners and teachers and to acknowledge that learning to teach mathematics is not solely a cognitive endeavour but one deeply located in social relations and contexts. Within teacher education more spaces need to be opened up to enable student teachers to embody themselves as mathematics subjects and primary teachers differently.

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Chapter 1

Introduction

Anna: Maths is a subject that people are sometimes quite anxious about teaching. You have to be on the ball all the time and you can't show any sign of crack or weakness in front of the children. Your subject knowledge has to be sound. You have to show that you're confident with the subject itself. Whereas, I think with other subjects you have a bit more leniency. You've got a bit more space to breathe. Your subject knowledge isn't quite as important. Maths, for me anyway, is one of the subjects that you have to, you have to have it.

JA: That's interesting. Why do you think that's the case?

Anna: I don't know. I don't know whether it's because I didn't enjoy it very much at school and actually one of my most vivid, negative memories of school was in a maths lesson. So I think, for me, it was really important that I was able to project and get children to enjoy it.

This study has its origins in my desire for resolution to a practical problem of practice. I am a teacher educator, specialising in primary mathematics education, at a large university provider of initial teacher education. Prior to my current role I was a primary school teacher. Social constructivist theories of learning, based on the work of cognitive psychologists Jean Piaget (1952) and Lev Vygotsky (1962) have

provided me, for many years, with valuable ways to think about the development of mathematical conceptual understanding and the teaching of mathematics. Vygotsky's (1962) focus on the interaction between language and thought and his assertion that all learning takes place in a social context encouraged me to place talk, collaboration and shared responsibility as key pedagogical strategies and values within my practice. I began this study in order to research teacher education. I was aware that, often, students did not teach mathematics during their school placements in the ways that we hoped and proposed during our courses. I wished to explore how my practice as a teacher educator could be improved. In particular, I wanted to find out how I could teach my students to teach mathematics in enquiry-based ways, through talk, collaborative problem solving and meaningful contexts for learning. For the purpose of this study I decided to focus on students as they completed a primary Postgraduate Certificate in Education (PGCE). However, after formulating my original research proposal, I was introduced to the work of feminist post-structuralists. As I engaged with their writings, my interests and my research shifted from exploring how teacher education and my practice could be improved, to placing students' accounts of learning to teach at the centre of the study. I include the voices of my participants throughout the thesis. I weave their accounts into chapters one, four and seven, as well as chapters five and six, the two data chapters. My focus became to examine the complexities of learning to teach, the way beginning teachers are produced, what counts as mathematics and the effects of power relations within pedagogical encounters. My purpose became not to find the truth of students' understandings but to draw attention to the frameworks through which they view their experiences of teacher education. My research questions are:

What are the different discourses, subjectivities and practices at play in the context of primary mathematics initial teacher education?

In what way do these discourses, subjectivities and practices shape and/or constrain the pedagogical experiences, practices and relations in primary mathematics initial teacher education?

Where are the spaces for resistance, change and/or transformation within and between these different discourses, subjectivities and practices?

Referring back to the quotation at the beginning of the chapter, there are many different ways to analyse Anna's account of what it is like to teach mathematics in primary school. In this research the work of feminist post-structuralists, who draw on Michel Foucault's theories of power, discourse and subjectivity, provide me with conceptual tools to analyse student teachers' experiences of learning to teach across the course, at both university and in primary schools. Post-structuralists attempt to locate how individuals are situated in particular discourses and constructed in relations of power located within the social world, rather than thinking of the student teacher as an autonomous individual. This directs the ways in which they represent themselves as teachers, the pedagogical practices and strategies they employ and how they interact with their pupils. One of the main aims of my study is to carry out an exploration of the multiple discourses within mathematics teacher education. Foucault's concept of discourse is described by Walshaw (2007) as different ways of structuring areas of knowledge and social practice. In addition MacNaughton (1998) sees discourse as including the emotional

and social practices through which meaning is constituted in our lives through complex interconnections between language, meaning, the individual and the social. The concept of discourse is directly linked to subjectivity. Student teachers' subjectivities, their identities as beginning teachers, are constituted through these dominant discourses.

Anna says she feels that with mathematics, above other subjects, there is less 'leniency' and that 'you have to have it'. The discourses of school mathematics that Anna seems to draw on portray mathematics as an absolute body of knowledge that is objective, not subjective. Discourses that construct mathematics as right or wrong, a collection of facts and procedures that must be practised and memorised, and present the teaching of mathematics as the delivery of knowledge are located within the current political climate of accountability in which children's mathematical performance and the quality of teaching is measured through national, standardised written tests. What is included in these tests is restricted to those learning outcomes where performance can be measured most easily. This tends to exclude outcomes which are more difficult to judge unequivocally as right or wrong, such as application of concepts, reasoning and understanding. Mendick (2006) argues that mathematics, above other curriculum subjects, is constructed as the ultimate form of rational thought and so a proof of intelligence. She contends that in this discourse mathematics is framed as a process for discovering a body of pre-existent truths, which ties mathematics to masculinity. It is more difficult for girls and women to feel talented at and comfortable with mathematics where available identities and cultural norms are masculine (Mendick, 2005). Mendick (2006) argues that the discourse of mathematics is culturally 'ascribed' as masculine. For simplification I

go on to use the terms discourses of masculinity/femininity to denote gendered discourses ascribed as such through complex relations of power. Anna's account could be viewed as a gendered response to mathematics as she performs a culturally constructed 'femininity' in relation to a gendered binary of confident/not confident mathematician produced, perhaps in part, through her vivid memories of learning mathematics as a pupil at school and marginalisation within the discourses of her past experiences. Her account could also be seen as a description of the performance of the role of knowledgeable teacher, who must be in control of what is learnt. She says 'you can't show any sign of crack or weakness'. Britzman (1991:31) identifies persistent cultural myths within education 'that position the teacher as the expert, as self-made and as sole bearer of power'. Anna seems to work hard to position herself as legitimate within these discourses in order to be recognised as a viable teacher of mathematics.

I found that an analysis of the discourses in which Anna is produced, rather than a focus on essentialising Anna as an individual who lacks understanding, knowledge or confidence, provides the feminist post-structuralist researcher with opportunities to examine how different discourses position student teachers. In this study I aim to draw on the idea of subjectivities, constituted in discourses, to explore the multiple and often contradictory subject positions student teachers take up in their professional lives. St. Pierre (2000) argues that once a discourse becomes 'normal' and 'natural' it is difficult to think and act outside it as fictions have come to operate as truths. Conceptualising student teachers' subjectivities as a shifting 'work in progress,' in a variety of competing discourses rather than a fixed entity enables me to ask questions to destabilise taken-for-granted knowledges and

humanist assumptions about teaching, mathematics and teacher education. Davies and Gannon (2005) contend that the capacity to recognise discursive constitution and regulation of self as socially produced and thus able to be called into question, offers ways for both teacher educators and student teachers to resist dominant and inequitable discourses as they constitute their subjectivities as teachers. Britzman (1991) argues that learning to teach is always the process of becoming: a time of formation and transformation, of scrutiny into what one is doing and who one can become. Through engaging in this research I also explore my own assumptions about pedagogical relationships, knowledge and power. This research has been a process of becoming for me, as a researcher, as I pay close attention to discourses that constrain and limit achievement and position teachers, students and pupils in inequitable relationships.

Sandretto (2009) argues that in many ways, humanism, which constructs the individual as in charge of themself and their actions, who is unique and the author of their life and circumstances (Lawler, 2008) is our default setting or default discourse. Therefore, another aim of this research is to examine my own sense of subjectivity and my shifting theoretical orientation across the period to consider how the research is influenced and shaped. I therefore attempt to take up a critically reflexive approach to relations of power in the research process, to take seriously the impact on the research account of my own subjectivity, which cannot be disentangled from the writing of it. Skeggs (2002) proposes that researchers should pay attention to research practice and participants and be aware of the positions of power they inhabit, recognising that these positions may shift and are rarely easily known. While

the accounts of student teachers as they learn to teach are central to this study, I also write myself into this research account.

The context in which I work is highly pressured and increasingly uncertain. Centralisation and politicisation of teacher education has led to an inherent instability. McNamara, Webb and Brundrett (2008) argue that teacher education is now subject to the vagaries of political whim, short-termism and change of ideology, leadership or government, resulting in vulnerability of organisations and programmes. In the current political climate, teaching is positioned as a 'craft' (Gove, 2010) in which practical components of learning to teach are privileged over theory and analysis. Knowledge, skills and competences are perceived as best learnt in schools and residing within the individual practitioner. Bibby (2011) argues that highlighting the fact that so much of what happens in the formal classroom is beyond the teacher's control is tantamount to heresy in this current political climate of teaching in England. The need to control learning, measure achievement and demonstrate that students have 'met their learning objectives' is so deeply-rooted in conceptions of what effective teaching is, that it is often unquestionable.

Social constructivist theories of learning influence my teaching approaches. Teaching mathematics for understanding, investigation and using and applying mathematics through problem solving, communication and reasoning underpin the courses that I plan and teach. I promote conjecture, exploration and enquiry as important elements of knowing mathematics. I seek to disrupt dominant discourses of mathematics by emphasising the notion that there is no one right way of solving problems and by promoting mathematics as a cooperative and creative process.

Learning through peer talk is fostered explicitly as a productive pedagogical approach. I hoped that through participating in the mathematics module, students would experience a different learning environment from that in which they may have been engaged during their own schooling. Walshaw and Anthony (2007) argue that through listening respectfully to other students' ideas, through arguing and defending their own position and through receiving and providing a critique of ideas, students enhance their own knowledge and develop their mathematical identities. I envisioned that this approach would enable students to experience mathematics positively and be positioned strongly within the discourse.

I try to unite theory and practice by teaching in a style in which I hope students will teach their own pupils. My intention was that students would be able to construct conceptual understandings of mathematics, which would equip them for teaching through problem-solving and enquiry-based approaches. Initially, my goal was to empower my students, to liberate them from passivity by enabling them to experience mathematics as an exploration of mathematical relationships in the context of problem solving, rather than a set of rules and procedures to be practiced, memorised and tested. They could, in turn, empower the pupils they would teach. By stepping back and relinquishing some control over classroom interactions, I envisioned that I was sharing power with the students. However, in this study, through interrogating the accounts of students teachers' experiences of the mathematics course and drawing on feminist post-structural analytical tools I argue that these aspirations were an emancipatory quest underpinned by humanist assumptions of rational and autonomous individuals. These discursive practices construct successful learning as a personal attribute and draw on dominant

discourses which produce the notion of the effective teacher as someone who has the ability to control learning. Brown and Jones (2001) argue that the desire for control can cloud our vision against the complexities we seek to capture, trapped as we are in socially derived constructions of the world we experience. In this thesis, I contend that current authoritative discourses of accountability, school mathematics and ability fail to acknowledge how students are produced in discourses as learners and teachers of mathematics in often inequitable ways. I argue that feminist post-structural theories provide analytical tools that can be utilised to challenge taken-for-granted ways of thinking and to question authoritative discourses and assumptions.

Outline of Chapters

In this section I briefly outline the structure of the thesis and summarise the key focus of each chapter.

In chapter two I describe, in more detail, the theoretical context within which this study is located: feminist post-structuralism. I summarise key aspects of power, discourse and subjectivity in relation to education. The concepts and theories discussed are drawn on in all the subsequent chapters. I propose that feminist post-structural theories offer tools and perspectives which provide ways to explore and problematise the complexities of becoming a teacher of mathematics in the primary sector. I argue that through interrogation of authoritative discourses and discursive practices these analytical tools can be utilised to question assumptions and regimes of truth and offer insights into how teachers are produced. Possibility for change, different positions, subjectivities and performances lie within the notion of discourse and in finding spaces and mobility between multiple discourses.

Chapter three examines policy and political contexts of initial teacher education and mathematics education. I examine some of the discourses that operate in these contexts and highlight multiple and often contradictory discourses within which the identities of teachers, teacher educators and students as teachers of mathematics are constituted and negotiated. I argue that feminist post-structuralist analysis can work to question discursive practices and embedded inequalities. I identify managerialist discourses in current contexts which position teaching as a craft, privileging practical components of learning to teach and perpetuating the binary of theory and practice. I highlight how discourses of ability create norms of practice in primary classrooms within which teachers' and pupils' subjectivities are produced. I argue that focusing on rational individuals and cognitive aspects of learning operates to essentialise subjects, placing responsibility to perform successfully with individuals. This makes it difficult for teachers to conceive of mathematics being taught in any other way. I contend that dominant discourses fail to acknowledge how teachers and pupils are produced within social relations.

In chapter four I outline the methodological approach and decisions taken and explain how I conducted the research. I discuss how my research focus changed through the processes of operationalizing my initial proposal and engagement with feminist post-structural theories. I explore how I attempted to engage with power relations in the research encounter by taking a critically reflexive approach, acknowledging and interrogating how my data, data analysis methods and my subjectivities as researcher are interdependent and interconnected. I examine how my own power and subjective positions interact with my research. I identify shifting relationships of power during the research process between myself and the

participants, who were also my students, and tensions within these research relationships. Humanist notions continue to permeate my research while, at the same time, I ask questions to destabilise taken-for-granted knowledges and humanist assumptions. I acknowledge how I am a fragmented subject as I negotiate contradictory discourses. I finish the chapter by detailing the rationale for the mathematics education course which I taught to all students in the study.

In chapters five and six I present some of my data and analyses of this data. In chapter five I explore the concept of the subject as an effect of discourse in the context of student teachers' experiences of learning to teach mathematics during the campus-based module of a primary PGCE. I identify micro-relations of power between subjects which do not always allow for the full and legitimate participation of all students. I highlight shifting positions of power in different instances. I argue that gendered discourses are at play and that assumptions made about participation in pedagogical relationships are highly gendered particularly in the way that some students are silenced, categorised and marginalised within discourses of mathematics. I propose that students' identities are precarious and in process and performances of their subjectivities are dependent on immediate discursive practices and peer relationships. In this chapter, I make visible how beginning primary teachers are constituted as mathematical subjects in often inequitable ways.

In chapter six I focus on participants' experiences during school-based elements of the course as they teach children under the guidance and supervision of experienced teachers and visiting university-based tutors. I explore power relations and identify discourses and regulatory practices which act on and produce students'

subjectivities as they learn to teach mathematics in the context of the primary school. Most students reported complying with the established practices of the school and class teacher and focused on the struggle to achieve legitimacy as a successful student teacher. I argue that students' developing subjectivities as teachers become strongly constituted through authoritative discourses. However, some students demonstrated in their accounts awareness of both strategic compliance with and resistance to dominant discourses. I argue that student teachers are caught between the tensions and inconsistencies of negotiating their subjectivities within multiple and contradictory discourses. In this chapter I explore the processes of becoming a teacher as a complex activity which requires reconciliation of positionings and identities within contradictory and multiple discourses and relations of power and entails resistance, compliance and negotiation between competing and often conflicting discourses.

Finally, in chapter seven, I draw together my conclusions and focus specifically on responding to my three research questions. I explore the implications of the research for practice, and offer suggestions for future research. I argue that teachers, teacher educators and student teachers need to explore their own gendered subjectivities as learners and teachers. It is important to provide educators with opportunities to negotiate their identities as teachers of mathematics and their relationships with mathematics in order that they may identify and question authoritative discourses within the different contexts in which they are located. This may open possibilities for challenging assumptions and questioning discourses of masculinity within mathematics. Acknowledging that learning to teach mathematics

is not solely a cognitive endeavour but one deeply located in social relations and contexts may release more spaces for teachers to embody themselves as mathematics subjects and teachers differently and less oppressively.

Chapter 2

Feminist Post-structuralism

Introduction

Engaging with post-structural theories in relation to education, epistemology and ontology are at the same time compelling, demanding and disconcerting. They challenge some of my long held beliefs and taken-for-granted assumptions about identity, power, pedagogy and learning, and also my understanding of my professional practice as a mathematics teacher educator. I have come to recognise the experiences and practices I encountered when learning mathematics, becoming a primary teacher and a teacher educator, like Burke (2008), as being structural, cultural and discursive, rather than individual. This chapter provides a summary of key aspects of feminist post-structural theories in relation to education. I discuss how researchers draw on Foucault's notions of subjectivity, discourse and power to analyse identity formation and power relations within education. I focus in particular on discourses of gender and mathematics. The purpose of this chapter is to discuss the theoretical framework within which this study is located.

In this chapter I argue that post-structural theories provide analytical tools that can be utilised to challenge taken-for-granted ways of thinking about individuals, which might appear to be natural, reasoned and rational. I propose that through interrogation of authoritative discourses and discursive practices within the contexts of primary mathematics teacher education, ways to understand the complexities of becoming a primary mathematics teacher can be opened up.

Opportunities to challenge theories which tend to fix and categorise individuals and produce reality in inequitable ways can be created. I suggest that insights into what is being produced and the possibilities for finding spaces for resistance and change can be generated through analysis of the accounts of beginning teachers' experiences through examination of discourses and relations of power. The idea of subjectivity as a process which is mobile allows for movement between discourses where different positions, subjectivities and performances are available.

Post-structural theories challenge taken-for-granted ways of thinking which might appear to be natural, reasoned and rational. Weedon (1997) argues that the appeal to the natural is one of the most powerful aspects of common-sense thinking. It seems reasonable to assume that some people are naturally good at mathematics, that they have 'mathematical brains' and that therefore some people do not. Mendick (2006) maintains that throughout mathematics education and beyond, talk of natural ability is all-pervasive and all-powerful. Likewise, common sense views uphold that some people are born teachers with the seemingly innate charisma and vocation required.

Lawler (2008) argues that the self of the liberal-humanist of the enlightenment tradition has come to dominate in the West. This is the notion that to be a person is to be in charge of oneself and one's actions, to be unique and to be the author of one's life and circumstances. She observes that while people are comfortable with the idea that the social world produces part of who they are and that the idea that who they are can change, this is often accompanied by the notion of a 'true' or 'deep' self, which is seen as somehow outside the social. She suggests that

this ‘uniqueness’ is seen as something which belongs to the person in question and is not connected to the social world. Post-structuralist theorists, such as Weedon (1987) and Lather (1991), emphasise that common sense views of the individual or the subject have tended to reiterate humanist assumptions that we are unique, rational, autonomous individuals capable of full consciousness and endowed with a stable ‘self’ constituted by a set of static characteristics such as sex, class, race and sexual orientation. From this perspective it follows, therefore, that we are born with human potential which, given the right environment, we can realise through education. Education is then viewed as a means of empowerment that can be bestowed by teachers on individuals as long as they are intellectually able and willing to succeed.

Lawler (2008) argues that in wanting to see ourselves as unique, we magnify small differences until they become defining characteristics while similarities are supressed, producing differences that come to seem obvious and natural. These practices, where people are either divided within or from others, are known as ‘dividing practices’ often taking the shape of binaries. Much modernist research focuses on differences between people, for example by examining the differences between males and females. Butler (1999) is one of a number of post-structuralist feminists who have critiqued the conception of gender as tied to essential sex difference, arguing that rather than being tied to the sexed body, gender is produced discursively, through the social world. Weedon (1997) observes that patriarchy implies a fundamental organisation of power on the basis of biological sex and appeals to biological difference between women and men to argue the naturalness and inevitability of our different social status and functions. Such theories attempt to ascribe social definitions of the nature and function of femininity and masculinity to

a fixed and unchanging natural order, guaranteed by the female or male body, independent of social and cultural factors.

Research from this perspective has long been dominant in mathematics education. While it is no longer the case that boys outperform girls in mathematics, in her 1989 study, Walkerdine challenged work that saw girls' engagement in mathematics in deficit terms. She argued that the issue was thought of as the failure of sufficient numbers of girls to enter careers requiring mathematics. This explanation sought to account for the phenomenon by arguing, in a variety of ways, that there was something wrong with girls, something effectively that they lacked. Twenty years later Skelton and Francis (2009) contend that curriculum subject preference is still one of the areas reflecting persistent gender inequalities. They emphasise that gendered curriculum preferences and uptake are now more likely to be conceived as reflecting gender discourses of selfhood and appropriate behaviour rather than agentic 'choices'. However, explanations that seek to focus on differences and deficits are still common and significantly high profile. I cite two recent examples, from established academics, which received mainstream media attention.

In 2005, Harvard University President Lawrence Summers, (Summers, 2005) speculated that genetics may provide the explanation for women's inadequate representation in high-level positions in science and engineering at top US universities and research institutions. He argued that women do not have the same 'intrinsic aptitude' as men in some fields, citing findings that fewer girls than boys achieve top scores on science and mathematics tests in late high school years and

identifying this as the 'different availability of aptitude at the high end'. More recently, during an interview on the 19th January 2012 on the BBC Radio 4 morning programme, *Today*, Gijsbert Stoet of Leeds University, was invited to discuss his research findings (Stoet and Geary, 2012), which dispute a theory that highlighting negative stereotypes of women's performance in mathematics tests undermines women's performance. In the interview he states that:

> Researchers have shown that boys and girls have very specific interests from an early age on and we also know that to a certain degree that these interests are influenced by innate factors such as exposure to prenatal hormones (*Today Programme,* 2012).

Biological discourses about male superiority in mathematics were once, and arguably still are, hegemonic. St. Pierre (2000) argues that such common sense knowledge has not been scientifically discovered but produced for particular reasons from particular positions of power. Weedon (1997) suggests that biological arguments look for scientific guarantees of 'obvious' facts about women and have been used both against and in support of the emancipation of women and that social theories have looked to biological science and to psychology for proof of women's inferiority, superiority or equality in difference. She argues that these theories attempt to fix the truth of women's and men's natures. In these examples gender is understood as binary. Mendick (2006) maintains that constructing gender as oppositional and polarized, with the masculine generally more highly valued than the feminine, means we attach different labels and ascribe different motivations to what could be seen as identical behaviour. She contends that oppositional discourses about

mathematics as objective not subjective, rational not emotional, and so on, tie it to masculinity. According to Lather (1991) the essence of postmodernist argument is that the dualisms which continue to dominate western thought are inadequate for understanding a world of multiple causes and effects, which interact in complex and non-linear ways and are rooted in infinite historical and cultural specificities.

Post-structuralism allows for movement away from humanist notions of the individual. Feminist post-structuralists drawing on, amongst others, the work of Michel Foucault, reject the central humanist assumption that women or men have essential natures, an organisation which, from a post-structural perspective, is not natural or inevitable but socially produced (Weedon, 1997). Walshaw (2007) observes that Foucault's work on discourse, power and knowledge has opened up a space for us to come to grips, from a new perspective, with all aspects of education including curriculum, pedagogy, and teacher education. It also enables us to track historical events as a way of understanding the present.

Subjects and Subjectivity

Davies (2003) emphasises that post-structuralists see individuals as the complex, changing, contradictory subjects that we each experience ourselves to be, despite our best efforts at producing a unified, coherent and relatively static self. Foucault (1983) defines the subject as well as subjectivity as always produced by subjugating powers. He proposes that any form of identity always already indicates subjugation.

> This form of power applies itself to immediate everyday life which categorizes the individual, marks him by his own individuality, attaches him to his own identity, imposes a law of truth on him which he must recognize and which others have to recognize in him. It is a form of power which makes individuals subjects. There are two meanings of the word subject: subject to someone else by control and dependence, and tied to his own identity by a conscience or self-knowledge. Both meanings suggest a form of power which subjugates and makes subject to (Foucault, 1983: 212).

Weedon (1997) writes that subjectivity in post-structuralism comprises 'the conscious and unconscious thoughts and emotions of the individual, her sense of herself and her ways of understanding her relation to her world' (p. 32). This subjectivity is precarious, contradictory and in process, constantly being reconstituted in discourse each time we think or speak. Subjectivity is produced socially, through language in relations of power. It is the effect of language rather than its source and is produced in a whole range of discursive practices, economic, social, and political, the meaning of which are a constant site of struggle over power. Subjectivity is not seen as located and moulded in the individual, but as lived and enacted (Walls, 2009), therefore, as Walkerdine (1989) observes, because practices create subjectivities, no real human subject exists prior to the social practices within which she is subjected. Walls (2009) writes that the Foucauldian explanation of self regards subjectivity as the act of self upon self, rather than existing as, in or through a fixed identity. Subjectivity is then, at once, a process and a position in motion. It is this view of self as subject, whose subjectivity is something felt and lived and

continuously made and remade that I have found most useful in making sense of student teachers' accounts of learning and teaching mathematics.

Butler (1997) contends that at the heart of becoming a subject are the simultaneous acts of both mastery and submission. Drawing on the work of Louis Althusser, Butler argues that the more a practice is mastered, the more fully subjection is achieved. The binary frame of mastery/submission is forfeited. She maintains that although one might expect submission to consist of yielding to an externally imposed dominant order and to be marked by a loss of control, paradoxically submission is itself marked by mastery. St. Pierre (2000) argues that this illustrates post-structuralism's double move in the construction of subjectivity. She contends that a subject exhibits agency as it constructs itself by taking up available discourses and cultural practices and at the same time, is forced into subjectivity by those same discourses and practices. Therefore, becoming a subject requires a kind of mastery indistinguishable from submission. As Davies (2006) observes, the formation of the subject depends on powers external to itself. The subject might resist and agonise over those powers that dominate and subject it and at the same time it also depends on them for its existence. Davies writes that the mutual acts of recognition, through which subjects accord each other the status of viable subjecthood, are central to the dual process of submission and mastery in the formation of the subject. Butler (2006) explains that the acts of mastering skills for students are modes of subject formation and this formation takes place within a set of norms that confer or withdraw recognition. She continues that the subject is constituted through the anticipation or fear of having recognition conferred or denied. Davies (2006) argues that subjects work very hard to embody themselves as

appropriate and being seen to be incompetent or inappropriate can be very painful. In a study with young children, Davies (2003) developed the idea of category maintenance work. She claims that each person in a social group shares a set of 'obviousnesses' and is positioned in relation to them as perceived category membership. Individuals can deviate, but their deviation will give rise to category-maintenance work, which is partly aimed at letting the 'deviants' know they have got it wrong but, primarily, it is aimed at maintaining the category as meaningful in the face of the individual deviation that is threatening it. Davies argues that the deviants are necessary for making stronger boundaries and thus deviation does not change the category but is used as an opportunity to shore the category up. For post-structuralists, power is a pervasive factor of human social life and underlies all social relations (Walshaw, 2007).

Power

Foucault (1979) proposes that disciplinary power functions through specific techniques of bodily control as well as through forms of self-monitoring our own subjectivity. Walshaw (2007:112) observes that Foucault showed that disciplinary power affects us all and 'it impacts and regulates not just everybody but every soul'. Foucault (1979) maintains that whether individuals are actually being observed is unimportant but it is the possibility of being seen at all times, that is enough to ensure that control is maintained. The normalising gaze is turned inwards and used by individuals to observe, evaluate and regulate their own behaviour. He used Jeremy Bentham's plan for a model prison, the Panopticon, as a means of illustrating his notion of disciplinary power. The architectural structure was designed so that each cell could be observed from a central tower in a way that ensured that inmates

were not aware if they were being observed or not. They would be permanently visible but never know whether they were being looked at, at any one moment. Foucault (1979:202) writes:

> He who is subjected to a field of visibility, and who knows it, assumes responsibility for the constraints of power; … he inscribes in himself the power relation in which he simultaneously plays both roles, he becomes the principle of his own subjection.

Subjectification is a term that recognises the power of discourses not only to produce subjects but also to order, control and discipline them (Walls, 2009).

Foucault (1990) sees power, not just as constraining and repressing but as positive and productive, operating through discourses in which knowledge, meaning and truth, as well as human subjectivity, are produced and perpetuated. He writes:

> We must cease once and for all to describe the effects of power in negative terms: it 'excludes,' it 'represses,' it 'censors,' it 'abstracts,' it 'masks,' it 'conceals'. In fact power produces; it produces reality (Foucault, 1979: 194).

Youdell (2006b) explains that, from this perspective, productive power constitutes and constrains but does not determine the subjects with whom it is concerned. Walshaw (2007) emphasises that subjectification is a positive process that includes the willing development and transformation of selves and usually involves disciplinary power, and with it, surveillance and normalisation.

The concept of power as productive is something that I have begun to think about a great deal in my professional role as teacher educator and I seem to be increasingly aware of my relation of power in the pedagogic process. These concepts challenge my taken-for-granted assumptions about autonomy, empowerment and agency in learners. Davies (2006) notes that teachers can feel quite upset if their power to constitute their students becomes visible to themselves and those around them, undermining the notion that the autonomous individual is constituted as central to the educational enterprise. Recently, an incident occurred during a teaching session. Students had just returned to continue their university-based course after completing a placement in a primary classroom as part of their teacher education programme. Reflecting on her time in school, one student reported that she had planned and carried out a mathematics investigation with her pupils and, at the time, she had thought that I, as her tutor, would have been very pleased with the rich mathematical task she had chosen. Another student joined in the discussion saying that when she had given children some closed and, in her words, 'boring worksheets' to complete, she was disappointed with herself, thinking about how I would have disapproved. My initial response was quiet horror at the visibility of the power I had exerted over my students. Only in retrospect was I able to recognise the notion of pedagogical power as an idealistic conception of a process of empowering students rather than acknowledging that the teacher is always complicit in a simultaneous process of submission and mastery.

Discourse

As previously stated, Foucault (1990) locates the production of self-as-subject in discourse and argues that the self as a category does not pre-exist these discourses. Discourses refer to different ways of structuring areas of knowledge and social practice (Walshaw, 2007). According to Foucault (1990) that which is taken-for-granted as natural and normal can be seen as historically produced through discourses. Youdell (2006a) contends that the historicity of particular discursive practices means that some discourses come to dominate and bound legitimate knowledge and the idea of what is knowable, for example, biological discourses of mathematical ability, as discussed previously. Llewellyn (2010) suggests that in the field of teacher education the 'quest for understanding' is somewhat akin to the search for the holy grail. Educational research is fixated with developing student-teachers' understanding of mathematics and enticing student teachers to teach mathematics for understanding. Llewellyn emphasises that she does not wish to state that it is wrong to teach for understanding, but suggests that it should not be seen as a 'common sense' piece of truth or something which is beyond question. St. Pierre (2000) elaborates that once a discourse becomes 'normal' and 'natural' it is difficult to think and act outside it as fictions have come to operate as truths. Within the rules of a discourse, it makes sense to make only certain statements. Other statements and other ways of thinking remain unintelligible and outside the realm of possibility. Weiler and Mitchell (1992) argue that 'authoritative discourses' are insidious as they assert the unitary meanings we desire at the expense of recognising the complicated constructs that we live. Foucault (1980:131) maintains that each society:

> has its 'general politics' of truth; that is, the types of discourse which it accepts and makes function as true: the mechanisms and instances which enable one to distinguish true and false statements, the means by which each is sanctioned; the techniques and procedures accorded value in the acquisition of truth; the status of those who are charged with saying what counts as true.

He terms this a 'regime of truth'. Gore (1993:64) argues that 'regimes of truth are not necessarily negative, but, rather, necessary. Knowledge and power *are* linked, often in productive ways'. She focuses on 'regime of truth' as a tool for the analysis of radical pedagogical discourses at a microscopic level.

The concept of discourse within post-structuralism goes beyond spoken words within human conversation. MacNaughton (1998) explains that discourse has been recast to include the emotional and social practices through which meaning is constituted in our lives, through complex interconnections between language, meaning, the individual and the social. Skeggs (2004) notes that discourse is always produced in response to other discourses, and it has meaning only in its relation to complex networks of other meanings. Carson (2009) argues that 'internally persuasive discourses' originate from autobiography and are located in family histories, students' own experiences of schooling as children, gender identities, faith traditions, cultural backgrounds and political commitments. Britzman (1991:21) maintains that 'internally persuasive discourse provisions engagement with what we know and the struggle to extend, discard or keep it'.

From feminist perspectives, discourses are highly gendered, as well as raced and classed, where some men are institutionally constructed as always having legitimate knowledge and authority and many women are constructed as not having a claim to academic status and authority (Burke, 2008). Discourses offer a way of thinking, for example, discourses of effective teaching provide teachers with the identities through which they will be recognised by others and come to recognise themselves. Walshaw (2007) maintains that the ways in which we understand an effective teacher today might be quite different from an earlier period and may well be different again in years to come.

Mendick (2006:18) identifies some of the discourses of mathematics that variously frame it as:

> A route to economic and personal power within advanced capitalism.
>
> A key skill, a source of knowledge necessary for the successful negotiation of life in a scientifically and technologically sophisticated society, and thus a source of personal power.
>
> A process for discovering a body of pre-existent truths.
>
> The ultimate form of rational thought and so a proof of intelligence.
>
> Associated with forms of cultural deviance where, particularly in the media, mathematicians are depicted as 'nerds', a species apart.
>
> A skill linked to a particular portion of the human genome.

Epstein, Mendick and Moreau (2010) address the discourses about mathematics and mathematicians that prevail in popular culture which, they argue, are sometimes

contradictory. They state that they do not assume that there is a direct causal relationship between popular cultural texts and what young people do, think or become. Other factors, such as 'ability' and success at mathematics, relationships with family, friends and teachers add complexity to how students negotiate discourses and position themselves in relation to mathematics. However, they acknowledge both the influence of popular images and media texts and the importance of young people's agency in making sense of them. They write that they see these 'discourses operating within regimes of truth, not because of their power to *describe* reality but because of their power to *produce* it' (p. 46). Mendick (2005) argues that these discourses are oppositional and gendered. They inscribe mathematics as masculine, and so it is more difficult for girls and women to feel talented at and comfortable with mathematics.

Davies (2003) maintains that the discourses and practices through which we are constituted are often in tension, one with another, providing the human subject with multiple layers of contradictory meanings which are inscribed in their bodies and in their conscious and unconscious minds. For example, Walls (2009:12) explains 'a child may experience shifting or contradictory views of the self as a mathematical learner through engagement in pedagogical regimes, interactions with friends and classmates, or discussion with parents and siblings'. Walkerdine (1990) observes that different positions of power are inherent in the discursive positionings and that individuals, constituted as subjects, are produced by that process into relations of power. She argues that individuals can become powerful or powerless depending on the terms in which their subjectivity is constituted.

Davies and Harré (1990) use the concept of positioning as the discursive process whereby subjects are located in conversation as observably and subjectively coherent participants in discourses. They argue that there can be 'interactive positioning' in which what one person says positions another and there can be 'reflexive positioning' in which one positions oneself. They caution that it would be a mistake to assume that, in either case, positioning is necessarily intentional. One example is the gendered nature of positioning where gender identification and pedagogical discourses interact. Solomon, Lawson and Croft (2011) suggest that young women can only position themselves as good at mathematics by making themselves highly visible by stepping out of the available female identities due to the lack of a discursive space for women who study mathematics, since the available identities and cultural norms are masculine.

Butler (1999) argues that gender operates as an expectation that results in producing the very phenomenon it anticipates. She claims that forms of identity are often internalised by the individual who takes them on. Butler terms this process 'performativity' and argues that 'there is no gender identity behind the expressions of gender. Identity is performatively constituted by the very 'expressions' that are said to be its results' (Butler 1999:25). In addition 'performativity is not a singular act, but a repetition and a ritual, which achieves its effects through its naturalization in the context of a body, understood, in part, as a culturally sustained temporal duration' (Butler, 1999 :16). Weedon (2004) explains that feminine identity, manifest in dress, ways of walking and behaving, does not give rise to this femininity but is the product of it. She argues that it is acquired by performing discourses of femininity that constitute the individual as a feminine subject. Whereas

common sense suggests that femininity and masculinity are natural, in this mode of theorisation, they are culturally acquired through repetition. 'As individuals inserted within specific discourses, we repeatedly perform modes of subjectivity and identity until these are experienced as if they were second nature' (Weedon, 2004:7). Mendick (2006) identifies her own gendered response to becoming an undergraduate mathematician at Cambridge University where she gave the impression to her peers of not being able to cope with the work. In retrospect, she views this as a performance of femininity and an attempt to maintain her gender identity as a woman, in spite of her associations with the masculine field of mathematics.

Resistance

St. Pierre (2000) argues that though subjects are regulated and inscribed by discourse and cultural practice, they can resist those normalising inscriptions and their material effects by moving from a discourse where only certain statements can be made to another, where different statements are possible. Mendick (2006) argues that agency exists in the possibility for variation in the repetitive performances which are part of the discourses, through which 'women', 'mathematics' and other objects come to exist. She maintains that if gender and mathematics are something that we do, then they can be done differently and what matters is unpicking the ways in which our choices are formed. However, Doucet and Mauthner (2008) argue that a recurring critique is that feminist researchers who draw on post-structuralist conceptions of subjects often struggle with how to theorise resistance and agency in their research subjects. Jones (1997) warns that a humanist subject easily reappears when theorists use the terms position and positioning to denote the productive possibilities in discourses for subjects. She argues that the humanist idea of a

rational, choosing subject can be easily assumed rather than the post-structuralist notion that it is discourses which form meanings and therefore possibility for change. An example is given by Doucet and Mauthner (2008), who argue that Davies' work on children is illustrative of a 'soft' post-structural position in that subjects are positioned in discourses while also being active agents taking up discourses. This position is one where discourses are viewed not as completely determining, but rather as both enabling and constraining. The following quotation perhaps illustrates this:

> Parents and teachers who feel they have failed each time boys are aggressive or girls are 'prissy' should simply accept that the child has judged at this point in time that that is the most appropriate or comfortable way to behave (Davies, 2003: 166).

It could be viewed, that in using the word 'judged', Davies implies that the children are making a rational, agentic choice about which discourses to participate within. However, Davies (2006) argues that teachers should take responsibility for examining the discursive practices that are taken-for-granted in our schools and universities and to ask what conditions of possibility they are creating for us and for our students. Likewise Youdell (2006b) proposes that Butler's performative politics offer tools for thinking about how to intercept subjectivating processes. She argues that understanding the pupil, student or teacher as performative because she is designated as such, whereas nobody is necessarily anything, might open up subjects to radical rethinking. St. Pierre (2000) argues that what is important is to analyse relations of power in order to learn what is being produced.

Summary

This chapter examined concepts, proposed by feminist post-structuralists, drawing on Foucault's notions of power, discourse and subjectivity. These theories offer ways to challenge hegemonic discourses which categorise and position some subjects less powerfully that others. The notion of a 'true' or 'deep' self, which is seen as somehow outside the social, works to fix and essentialise individuals, for example, as possessing innate abilities based on gender and other seemingly absolute categories. I argue that post-structural theories provide analytical tools that can be utilised to challenge taken-for-granted ways of thinking about individuals, which might appear to be natural, reasoned and rational. In post-structuralist terms, individuals are conceptualised as subjects. Subjects are produced, for example, as women, as teachers and as mathematical, discursively through the social world. The post-structural notion of discourse in which subjects constituted by social interactions in relations of power and inscribed within discursive practices allows for the possibility of deconstruction of discourses which are highly gendered, raced and classed. I argue that interrogating authoritative discourses, discursive practices and notions of ascribed differences and deficits within and between subjects in the contexts of primary mathematics teacher education provides ways to understand the complexities of becoming a primary mathematics teacher. Post-structural analysis and interrogation produces powerful arguments which question assumptions and challenge theories which tend to fix and categorise individuals and produce reality in inequitable ways. The notion of subjectivity as precarious, contradictory and constantly in motion and as a performance, culturally acquired through repetition is key. The idea of subjectivity as a process which is mobile allows for movement between discourses where different positions, subjectivities and performances are

available. Mendick (2006) maintains that if gender and mathematics are something that we do, then they can be done differently. hooks (1994) asserts that teaching is a performative act: she argues that it is this idea that offers the space for change, invention and spontaneous shifts. I suggest that insights into what is being produced and the possibilities for finding spaces for resistance and change can be generated through analysis of the accounts of beginning teachers' experiences through examination of discourses and relations of power.

I draw on the theoretical framework outlined in this chapter throughout this study as I examine student teachers' accounts of their experiences of learning to teach mathematics in different contexts and within the wider political and cultural context in the United Kingdom (UK). In the next chapter I focus on the wider context of mathematics teacher education and primary education. I highlight and examine the discourses through which the 'truths' about teaching mathematics are produced and teachers' and students' subjectivities are constituted.

Chapter 3

Contextualising Initial Teacher Education and Primary School Mathematics

Introduction

In June 2010, a few weeks after the general election, the Coalition Government announced the abandonment of the implementation of the new primary curriculum, proposed by Sir Jim Rose. This was the first of many subsequent decisions, policies and proposals introduced in order to significantly reshape the whole education sector. Some of these reforms impact profoundly upon initial teacher education and school mathematics and further develop policies initiated by previous governments. These include the rise in university tuition fees, wide ranging proposals to reform teacher education (DfE, 2011d), new Teachers' Standards (DfE, 2011b), the abolition of the General Teaching Council for England, the expansion of academies, the diminishing role of local authorities and reform of the Early Years Foundation Stage Curriculum Framework (DfE, 2012a). In this chapter, I present a summary of the current political context in which mathematics teacher education is located. I discuss some of the legal requirements, official guidance, key initiatives, issues and tensions which shape the discourses in which teachers in school, student teachers and teacher educators practise.

In the education White Paper, The Importance of Teaching, (DfE, 2010) a consultation process to review and revise the National Curriculum was announced for implementation in 2014. The paper outlined mechanisms for increased

accountability. For example, it states that parents, governors and the public will have access to much more information about every school and how it performs. Performance tables will be sharpened, putting greater emphasis on the progress of every child in English and mathematics. A new minimum or 'floor' standard will be defined which schools will be expected to meet. In addition to increasing instruments of surveillance the report addresses pedagogy. It states that teachers, not bureaucrats or Ministers, know best how to teach and criticises the guidance on the current National Curriculum (DfEE, 1999b) as weighing teachers down and squeezing out room for innovation, creativity, deep learning and intellectual exploration. However, paradoxically, it goes on to state that the evidence is clear that the teaching of systematic synthetic phonics is the most effective way of teaching young children to read. To reinforce this, the Office for Standards in Education (Ofsted) will enhance its inspectors' expertise in assessing the teaching of reading. Whitehead (2011) argues that, in contrast to the rhetoric of freedom, in effect professional autonomy is being increasingly restricted. Initial teacher training will also be reformed, the white paper states, in order to ensure that trainee teachers have the confidence to teach systematic synthetic phonics. A strong emphasis on the management, surveillance and control of schools and teachers in the name of public 'accountability' is conveyed by the document. A press release on the 14th June 2012 by the Education Secretary, Michael Gove, announced plans to 'weed out' poor quality initial teacher training providers (DfE, 2012b). He stated, in a speech to the National College Annual Conference (NCAC), in June 2012 (Gove, 2012), that 'universities, and other providers, rated 'outstanding' by Ofsted will be guaranteed their existing level of places for the next two years but we will no longer guarantee places to institutions rated good or lower'. In May 2012 Ofsted announced that reductions to the notice of

inspections for initial teacher education providers will reduce from eight weeks to two working days from September 2012.

Initial Teacher Education

Gilroy (1993) argues that since the late 1980s successive UK Governments have created and then strengthened their stranglehold over initial teacher education. Legal requirements for the training of teachers have been introduced and Ofsted charged with 'policing' these requirements. Published inspection reports, grades and league tables remain a key part of the landscape of teacher education provision in England (Furlong, et al., 2006). Hagger and Mcintyre (2000) contend that it is not research that influences policy but political ideology and economic constraints. Furlong (2001 and 2005) observes that post 1992 policies, aimed at curtailing the power of those in university-based initial teacher education while increasing the role of schools, have altered the nature of teacher professionalism, establishing it as more practically based. Competency frameworks for both secondary and primary teaching were introduced which increased direct control of the curriculum and the assessment process. Murray and Maguire (2007) argue that teacher education is repositioned as a technical rational enterprise of designing and regulating pre-service programmes to ensure that teachers attain specified 'competencies' or 'standards' in a set of pre-identified 'skills' that are allegedly needed for effective teaching. Whitehead (2011) observes that turbulent times could well be the descriptor for the current state of teacher education in England. The monopoly previously enjoyed by Higher Education Institutions (HEIs), has been broken with the introduction of school-based and employment-based routes to qualification. Whitehead (2011) maintains that the Coalition Government's stated aim is to shift trainee teachers out of universities and

into the classroom. In a speech to NCAC, in June 2010, Michael Gove (2010), declared:

> Teaching is a craft and it is best learnt as an apprentice observing a master craftsman or woman. Watching others, and being rigorously observed yourself as you develop, is the best route to acquiring mastery in the classroom.

In a system where primary teachers are generalists and teach across the breadth of the curriculum, the existence of sufficient specialist primary mathematics teachers in schools who can perform this role is uncertain. According to Moore (2004) the competent craftsperson discourse locates teaching as a set of discrete skills and practical activities such as controlling awkward classes and individuals and making sure that lessons are interesting, accessible and well thought out. He argues that by prioritising skills and knowledge, which may be perceived as residing 'within' the individual, over more complex issues of educational process, the competent craftsperson discourse is able to deflect consideration of solutions for educational difficulties away from analysis and reform of social conditions towards the blaming of individual students, teachers and schools.

In a consultation document (DfE, 2011c) published in June 2011, the Government set out new proposals to further reform initial teacher education. The paper acknowledges that universities bring great strengths to the training of teachers. However, the role of universities in initial teacher education seems likely to be more

significantly decreased. The privileging of experience over theory is a common theme throughout the document. For example, it states:

> There is some evidence that university-based trainees see their training as too theoretical. One study found that 46 per cent of Bachelor of Education (BEd) students, 33 per cent of primary and 19 per cent of secondary PGCE students thought so. Students on employment-based routes were far less likely to feel this. Trainees who follow teacher training programmes that are led by schools, such as the Graduate Teacher Programme, are more likely to find their training provided relevant knowledge, skills and understanding to teach their specialist subject, and better prepared them for the classroom and behaviour management (DfE, 2011c: 14).

The document goes on to propose that over the next five to ten years, rather than Government managing much of the initial teacher training system centrally, schools should increasingly take on this responsibility.

PGCE primary students who follow a traditional university-led route to qualified teacher status currently spend 90 days in school and 90 days on campus attending taught sessions. However, from 2013 the minimum number of days that primary PGCE students spend in schools is proposed to increase to 120, drastically reducing the number of days spent studying on campus. The implication of the rhetoric and reforms of both this Government and previous Governments indicate a privileging of practical components to the detriment of theory and analysis. Terminology used reflects different positions, with government institutions referring

to initial teacher training and universities to initial teacher education. According to Murray and Maguire (2007) in managerialist discourses teaching and learning are reconstructed as straightforward, unproblematic and de-personalised processes and reducing university-based study is an implementation of these perspectives. Likewise, Hodson, Smith and Brown (2012) argue that it is likely that the reduction in time that student teachers will spend in HE institutions could result in a significant reduction in the ability of university-based routes to provide opportunities for and space assigned to theoretical or analytical aspects and that student teachers' developing practice is unlikely to be informed by research-based ideas.

Common sense assumptions that learning to teach develops directly from practical experiences and that it consists of the acquisition of a pre-determined body of knowledge, skills and attributes are hegemonic. How student teachers are engaged in actively negotiating identities through a complex array of discursive practices is seldom afforded serious consideration in government policy or the media. From a post-structuralist perspective, experience has no inherent essential meaning and identity does not follow unproblematically from experience (Weedon, 1997, Lather, 1991, Britzman, 1990). Britzman (2000) maintains that most people in teacher education are deeply invested in the idea that experience is telling, that one learns by experience, by being there, and not by theories. She argues that the notion of learning to teach through practical and relevant experiences in classrooms is based on humanistic notions of an essential self. Britzman (1990) asserts that subjects bestow experience with meanings and these meanings are determined by habits, investments, fears, social conventions, multiple discourses and relations of power. Lather (1991) contends that meanings vary even within one individual as we live in

webs of multiple representations of class, race, gender, language and social relations. We are all inventions of discourses and fragmented subjectivities. The apprenticeship model assumes that experience and rational reflection bring about professional growth towards expertise and cannot account for teachers as discursively changing and fragmented subjects.

Furlong, et al., (2006) observe that it is the concept and practice of partnership between schools and universities that is the distinguishing feature of initial teacher education in England today. However, these relationships can be problematic. Research evidence indicates that despite the high value attached to collaboration, most school-university teacher education partnerships remain HEI-led (Furlong, et al., 2000). Hagger and Mcintyre (2000) also maintain that partnerships of an integrated, collaborative kind are relatively rare and such partnerships are inevitably impoverished, without close collaboration between schools and universities. Furlong, et al., (2000) argue that, with increasing government directives, universities have, by and large, moved to models of partnership that ensure manageability in the face of the need for compliance. Contradictions between the university and its partnership schools' conceptualisations of teaching can result in inconsistency. Van Huizen, Van Oers and Wubbels (2005) observe that different and often competing notions of the process of learning to teach are frequently experienced by students between campus-based and school-based elements in teacher education programmes. As a consequence student teachers can then experience the theory-practice divide more keenly as they move between the culture of the university and the school. Brown, et al., (1999), for example, locate an incommensurability between the ways in which mathematics is presented in many

official documents and the way in which it is often depicted during college training. Van Huizen, Van Oers and Wubbels (2005) reflect that students can be immersed in a hidden curriculum of pleasing both a class teacher and a university based tutor who have different priorities and criteria for success while negotiating highly-pressured, high-stakes school-based placements.

From a post-structural perspective, as student teachers move from campus to school, they encounter and are caught up in a range of different and often competing discourses and practices. They have to work hard to be recognised as appropriate and viable subjects in both these environments, experiencing shifting and probably contradictory views of self as a teacher. Walshaw (2007) argues that what student teachers believe and what they do and think could be different from one context to another. The teaching identity that they might construct within the university course may well be fought over and resisted within the context of the school placement. She continues that the student teacher's sense of self within the placement school depends on the opportunity to construct and reflect on new self-understandings. Likewise, an ideological construction of a teacher is advanced within the university course and student teachers are shaped to fit the mould. Both institutions act as a disciplinary technology. Learning to teach from this perspective is viewed as bound up within relations of power. In addition to the discourses of the teacher education course and the placement schools, Carson (2009) identifies the internally persuasive discourses which originate from autobiography and are located in family histories, students' own experiences of schooling as children, gender identities, faith traditions, cultural backgrounds and political commitments. He argues that, while internally persuasive discourses can take the form of explicit investments, more usually they

are not explicit but are provoked into consciousness through encounters with authoritative discourses that circulate the programme. He argues that learning to teach becomes a struggle for personal voice in which student teachers are trying to sort out where their own experiences and deeply held personal investments fit in relation to the authoritative discourses they encounter. In Britzman's words 'learning to teach is a time that is taken up with negotiating, constructing and consenting to their identity as a teacher' (1991: 221). It is much more than simply acquiring new skills from a master craftsman.

This section identified managerialist discourses which position teaching as a craft. These discourses privilege practical components of learning to teach over theory and analysis and perceive knowledge, skills and competences as best learnt in schools and residing within the individual practitioner. Post-structuralists critique this position offering the notion of student teachers as engaged in actively negotiating their identities with a complex array of often competing discourses and discursive practices.

Mathematics Education

I now address mathematics education, focusing on the impact of the National Numeracy Strategy (NNS) (DfEE, 1999a) on school practices and pedagogy and the tensions arising from this. Social practices, discourses of accountability and ability and the way they act to shape school mathematics and pedagogy are considered.

Brown (2010) observes that there has never been a time when those who speak for the nation have been satisfied with the level achieved by primary children

in what is now generally known as ‘numeracy’. Over the years, the pendulum has swung back and forth between two positions emphasising the accurate use of calculating procedures or the possession of a number sense which underlies the ability to apply such procedures sensibly. She argues that in prosperous times progressive and conceptual approaches have the edge, whereas high unemployment and internationally uncompetitive industries have tended to fix the state’s attention on public education and the uniform teaching of procedural number skills.

Concern about low standards of number skills surfaced in the late 1990s. According to Brown, et al., (1999) this concern was a result of apparent declining mathematical performance of English pupils viewed in a comparative international context and as part of the incoming Labour Government’s emphasis on basic skills. In 1999, a major initiative, the National Numeracy Strategy (DfEE, 1999a) was launched. The NNS specified the curriculum by year group and included the introduction of a daily mathematics lesson, increased emphasis on mental strategies for calculation and non-statutory prescription, not only of the content and scheduling of teaching but also of pedagogy and lesson-structure. Guidance stipulated that teachers should teach the whole class simultaneously about a single idea and differentiate work to three different levels. Specific timings and content of a three-part mathematics lesson were prescribed. As Pratt (2006) observes, for the first time, teachers were given instruction regarding not just what to teach but how to teach it. While the NNS was not statutory, Webb and Vulliamy (2006) note that pressure to comply with the Strategy was exerted through Ofsted and Local Education Authority inspections. Lerman (2006) points out that it was a rare school that risked not following the Strategy.

Criticisms of the NNS were many. Brown, Askew and Millet (2003) contend that areas of mathematics, such as pupils' approaches to real life problem solving and strategic thinking, have suffered. Kyriacou and Goulding (2004) found that much teaching was characterised by briskly paced, brief interactions between teachers and pupils. They conclude that this emphasis on pace, rather than reflection, has a negative effect on pupils who think and work more slowly. Pratt (2006) argues that the highly structured approach tends to create a systemic tension for teachers. This tension revolves around the extent to which teachers should provide the freedom for children to make sense of their mathematics through discussion and reflection, whilst controlling what is learned and being accountable for it. Brown, et al., (1998) argue that the NNS does not fully acknowledge the tensions between the requirement to plan using assessment information, which may reveal a wide range of attainment, and the expectation that teachers will keep the whole class together in following the framework with its week by week objectives. Brown (2011) argues that some children continually face new content without having had time to consolidate the underlying skills, concepts and structures from previous years. Since the introduction of the NNS, ability grouping and setting have become increasingly prevalent in primary school classrooms. Askew (2012) observes that current practices establish norms about different abilities in mathematics and enact these through practices such as sorting pupils into high, medium and low groups and labelling individuals. Boaler (2009) notes that:

> when we look at the grouping systems that are used in maths classrooms around the world, we see that England is very unusual as we have more

> ability grouping, with more divisions, applied at a much younger age than anywhere in the world (p. 96).

Askew, et al., (2010) contend that all too often it seems that mathematics is bracketed off from the rest of the curriculum, afforded a distinct status that allows particular practices that would not be countenanced in other subjects. They argue that it is common practice in UK primary schools to play 'maths champion' games – head to head challenges – that establish who is 'best' in class at mathematics, while the same teachers would not publicly establish the 'pecking order' in literacy. Mendick, Moreau and Epstein (2009) observe that the use of competition and grouping by ability within mathematics teaching practices support discourses of specialness. They argue that the notion of specialness is not innocent, as discursively it relies on the idea that not everyone can do mathematics, which excludes many people from mathematics and disproportionally excludes particular groups.

Current practices within discourses of ability have significant consequences for inequality in education. Gillborn and Youdell (2000) maintain that understandings of 'ability' as a fixed, generalised and measurable potential are completely incompatible with critical notions of equal opportunities. A report published by the Organisation for Economic Co-operation and Development (OECD) concludes that early tracking and streaming very often pose risks to equity (Field, Kuczera and Point 2007). A recent Ofsted publication (2012) reports that less experienced, temporary and non-specialist teachers were more likely to teach lower sets. Walls (2009) argues that practices of grouping and setting by ability naturalise a structure that first establishes and then perpetuates inequality. Marks (2012)

highlights another example as she examines evidence of the existence of educational triage in primary schools in England. This specific practice, enacted through ability-grouping, involves the direction and redirection of educational resources towards those pupils most likely to benefit, whilst taking support away from those deemed as 'hopeless cases'.

The NNS was revised and became the Primary National Strategy in 2006 (DfES, 2006). While the PNS is no longer officially endorsed by the Coalition Government, the practices promoted by the NNS in 1999, such as whole class teaching of mathematics from Year One and differentiation and ability grouping have become normalised. It is often difficult for student teachers to envisage any other ways of teaching mathematics and to question current practices.

Assessment of Mathematics

It has been argued that English children are the most tested in the world (Brown, 2003). The 1988 Education Reform Act (DES, 1988) introduced the publication of league tables of examination results for schools with the results of national tests (Standard Assessment Tests, SATs) used for evaluation and accountability of teachers and schools. Harlen (2007) argues that, as a consequence, schools focus on teaching the content of what is being assessed. What is included in the test is restricted to those learning outcomes where performance can be marked most easily. This tends to exclude outcomes that are more difficult to judge unequivocally as right or wrong, such as application of concepts, reasoning and understanding as opposed to factual knowledge. There is a strong sentiment amongst the teaching profession and professional associations that Key Stage 2 (KS2) SATs

in mathematics in England should be abolished (Royal Society, 2010). The Royal Society (2010) reiterates that by allowing 'teaching to the test' to persist, the tests militate against more innovative approaches to teaching. 'They also reduce the breadth of the curriculum and, consequently, put pupils off the subjects before they enter secondary school education' (3.8 p. 26). The Cambridge Primary Review (Alexander, 2010), an independent, wide ranging review of English primary education, recommends that current KS2 literacy and numeracy SATs are replaced by a system which assesses and reports on children's achievement in all areas of their learning, with a minimum of disruption. They argue that the current testing regime produces results which are less reliable and valid than is generally assumed. A recent Ofsted publication (2012) identifies as a problem that too much teaching is concentrated on the acquisition of disparate skills to enable pupils to pass tests and examinations but does not equip them for the next stage of education, work and life. However, the report focuses on developing staff expertise and does not analyse wider reasons for these teaching practices. The Advisory Committee on Mathematics Education (ACME, 2011), supports the development of a robust teacher assessment at the end of KS2 in place of testing, which better reflects the investigative and problem solving aspects of the subject. ACME strongly believes that change is important to allow for more investigative teaching and learning of mathematics. The DfE, under the Coalition Government, tasked Lord Bew with reviewing KS2 testing. The panel published its final report in June 2011. The report states:

> We have not received any evidence to suggest that there are significant issues with an externally-marked mathematics test. We recognise that it is relatively

> straightforward to create a valid and reliable test of mathematics, and we feel that the current mathematics tests achieve this (Bew, 2011: 63).

Bew's recommendations to retain the tests were subsequently approved in a government response (DfE, 2011a). Ironically, two months later in August 2011, The Vorderman Report (Vorderman, et al., 2011), commissioned by the Conservative party, recommended that the KS2 National Test (SAT) in its current form should end, arguing that research has suggested that most schools focus their mathematics education for a minimum of two terms on teaching to the test due to league table pressures. The report concludes that SATs can actually depress mathematical standards. With SATs supplying data for performance tables, this assessment acts as a technology of surveillance and control under the guise of public accountability.

With KS2 SATs for mathematics still in place and the common practice of schools to implement end of year voluntary SATs across the other KS1 and KS2 year groups, it seems unlikely that the pendulum will swing back to a prioritising of number sense away from practices focused on developing procedural mathematical knowledge assessed by high-stakes tests. These social practices act to shape mathematics in the school context. Askew, et al., (2010) argue that the polarising of procedural and conceptual is not helpful. In England, procedural fluency and conceptual understanding in mathematics are largely seen as mutually exclusive aims. They observe that teaching in Pacific Rim countries is largely dominated by procedures and hence supportive of procedural fluency, but the procedures used tend to be explicitly grounded in mathematical principles, and hence more mathematically coherent and meaningful than those most commonly used in the United Kingdom.

Brown and McNamara (2011) argue that mathematics is generally a function of the social agendas relating to the circumstances of its practice, mediated through dominant discourses. Conceptions of mathematics in the primary classroom are substantially shaped by norms of primary classroom practice rather than by mathematics defined in a more abstract sense. Government policy regulates and normalises these practices, for example through explicit enforcement of pedagogy via initiatives such as the NNS and through the impact of SATs and performance tables upon pedagogy. As pupils, student teachers and teachers enfold themselves within these discursive practices, their subjectivities and mathematical identities are actively constituted.

Knowledge for Teaching Mathematics

The mathematical subject knowledge of generalist primary teachers has come under significant scrutiny recently. The teaching of mathematics has stayed at the forefront of concern and in recent years a number of prominent reviews and reports have been produced. In 2007, Sir Peter Williams was commissioned by the Labour Government to carry out a review of mathematics teaching in early years settings and primary schools (Williams, 2008). The findings of the review focused on the subject knowledge of teachers. It argued that confidence and dexterity in the classroom are essential prerequisites for the successful teacher of mathematics and that this confidence stems from deep mathematical subject and pedagogical knowledge. The principal recommendation of the review was the presence of a Mathematics Specialist in every primary school to champion the subject and act as the nucleus for achieving best pedagogical practice. In response, the Mathematics

Specialist Teacher (MaST) programme, a national two-year Masters-level course was launched, led by selected HEIs across England. The first cohort of over 1600 primary teachers began the programme in January 2010. However, in 2011, changes to funding arrangements were implemented with the transition to a market model, in which the costs of training specialist teachers are now borne by schools and individual teachers. Numbers of teachers registering on the programme are reducing. The Vorderman Report (Vorderman, et al., 2011) also identifies an urgent need to improve the mathematical subject knowledge of primary school teachers and new trainees. Brown and McNamara (2011) observe that the response of successive British Governments to the ostensibly poor performance of English pupils has been to blame the mathematics subject knowledge of its teacher workforce.

The mathematics education research community also widely highlights the importance of subject knowledge for primary teachers. For example, Ma (2010) observes that elementary mathematics is not superficial at all, and anyone who teaches it has to study it hard in order to understand it in a comprehensive way. She argues that teachers who do not acquire mathematical competence during schooling are unlikely to have another opportunity to acquire it. Heavily influenced by Shulman's (1986) categories of knowledge for teachers, Rowland, et al., (2009) identify 'the knowledge quartet', four 'big categories' of content knowledge for primary mathematics teachers. The first, 'foundation knowledge' refers to a teacher's theoretical background and beliefs. It includes subject matter knowledge which comprises 'substantive' and 'syntactic' knowledge. Substantive knowledge includes the facts, concepts and processes of mathematics and the links between them. Syntactic knowledge concerns the process of doing mathematics rather than

the product of such activity and, for example, includes knowing how to prove an idea through deductive reasoning. Rowland, et al., (2009) argue that this knowledge is possessed, irrespective of whether it is being put to purposeful use. The other three dimensions of the knowledge quartet all rest on foundation knowledge and include transformation (e.g. choice of examples and representation), connection (e.g. making connections between concepts) and contingency (e.g. responding to children's ideas).

> We take the view that the possession of such knowledge has the potential to inform pedagogical choices and strategies in a fundamental way. By 'fundamental' we mean a rational, reasoned approach to making decisions about teaching based on something other than imitation or habit (Rowland, et al., 2009: 30).

Clearly, it is critical that teachers must make good sense of the mathematics involved or they will not be able to help pupils work with ideas and knowledge. Anthony and Walshaw (2007) argue that sound teacher knowledge is a prerequisite for reflecting on the spot and dealing with contested and contesting mathematical thinking. However, singling out deficits in teachers' knowledge does not address issues of teacher subjectivities and by this omission can imply that acquiring this knowledge is a solely cognitive endeavour which can be constructed by the individual through rational, autonomous engagement with the subject material. Klein (2009) suggests that a post-structural view of learning adds complexity, for it does not take for granted a rational and cognate being capable of translating constructed knowledge directly into practice. She contends that to facilitate students using the

powerful ideas within mathematics more supportive pedagogical relationships are needed.

Hardy (2009:188) observes that in some research an essentialising shift can be noticed from 'What is the problem with mathematics teaching?' to 'What is the problem with primary students' mathematics?' She argues that some literature produced within the mathematics education community portrays a problem with the students' personal mathematics knowledge. This produces a teacher whose mathematics knowledge is deficit or flawed in some way. She gives an example from a popular text book aimed at student teachers; 'Mathematical Knowledge for Primary Teachers' by Suggate, Davis and Goulding (2006). The introduction reads: 'One of the problems to be overcome by many seeking to teach mathematics to young children is that they have the wrong kind of understanding of their subject' (ibid, preface). In response to government regulation most university teacher education courses focus on externally defined measures of the students' mathematical abilities, for example, the use of subject knowledge audits and the requirement for students to evidence improvement in their subject knowledge before the completion of the course. The aforementioned text book and the practices of auditing are all components of the mathematics education courses at my own institution. These interactions manage to categorise and classify students into marginal or authoritative positions within the discourse of teacher education and potentially jeopardise pedagogical relationships between students and between students and tutors.

There is a large literature on emotions within mathematics education (Brown and McNamara, 2011). Hamilton (2004), for example, observes that emotions seem central to the learning to teach process. She maintains that emotion imposes on the understandings that people bring to their experiences in the classroom and in their lives. Hodgen and Askew (2007) suggest that, for many primary teachers in the UK, their relationship with mathematics is fraught with anxiety and emotion, much of it relating to their negative experiences of school mathematics. A post-structural perspective views emotion as a component of identity formation which is dependent on power relations and recognises how student teachers' emotions can become sites of resistance. In a longitudinal, ethnographic case study of children's lived experiences of learning mathematics, Walls (2007) notes that taken-for-granted customary practices of teaching and learning mathematics formed a significant part of the everyday worlds of the children in her study. She concludes that for most of the children the isolation, tedium, and inaccessibility of written mathematics tasks, experienced on a daily basis over a long period of time, were sufficiently off-putting to produce profound feelings of alienation and inadequacy. Klein (2006) speculates that it may be that teachers' emotions and unconscious minds draw them away from participation in a discourse within which they feel powerless. Bibby (2002a) maintains that mathematical anxiety is the single most reported negative response. She suggests that absolutist conceptions of mathematics as quick, efficient, rule based, and full of procedures to remember, provide ideal opportunities for experiencing shame. Critically, she argues that primary school teachers seeking to change their relationship to mathematics and their practice are not likely to find the process easy. There are many external factors likely to militate against changing practice. Developing personally motivated change is a risky business and the current

climate is not supportive of teachers taking risks in the classroom. Likewise, Klein (2008b) suggests that student teachers who were not able to establish themselves as numerate subjects during their own schooling, find themselves marginal to the operation of the discourse and the discursive practices during teacher education courses. They have come to know themselves as 'poor' at mathematics. She contends that it is unlikely that a programme of study at university could successfully overwrite already constituted discursive alienation.

In this section I argued that a tendency to pathologise primary teachers as lacking in mathematical knowledge and ability promotes an uncritical view of the current educational climate and the dominant discourses that constitute teachers' identities. A focus on rational individuals and cognitive aspects of learning fails to acknowledge how teachers are produced in discourses as mathematics learners and teachers, to address embedded inequalities and to question authoritative discourses.

Pedagogy for Teaching Mathematics

I now briefly discuss theories of learning and the implications for teaching mathematics. There are a range of different perspectives within the mathematics education research community on how mathematics is learnt. The most prominent theories which underpin guidance for teaching mathematics are social constructivist theories of learning. These theories explicitly inform pedagogy in the mathematics teacher education modules at my own institution and the content of the sessions. Students are expected to develop an understanding of different aspects of social constructivist theories of learning in relation to mathematics education. I consider

how feminist post-structural arguments critique some of these priorities and recommendations for practice.

According to Brown and McNamara (2011), constructivist theory has dominated mathematics education research for the last 20 years. In social constructivist notions of learning, mathematics students should be allowed to construct their own mathematical knowledge through problem solving, exploration and conjecture and through working in groups, learning to communicate mathematically as free and autonomous individuals collaborating together. Brown (2003) contends that teachers teach mathematics most effectively when they engage children's intellectual capabilities, not when they teach facts and measure what has been memorised. He argues that the most effective way to teach mathematics is as a problem-posing-problem-solving cycle of activity, with the teacher introducing new knowledge and techniques to help children ask increasingly challenging questions and use increasingly complex processes to solve problems. Lerman (2006) argues that mathematics in this view is characterised by activities such as engaging in interesting problems, making imaginative conjectures, testing, reflecting, examining results informally, formalising and testing results formally and publishing ideas for criticism and development by the mathematical community. In a study focusing on low attaining pupils over two years, Watson and De Geest (2005) found that improved learning is not dependent on specific teaching methods or tasks but based on common principles, the most universal of these being the creation of space and time for learning through extended thinking time and extended tasks, giving pupils more choice, freedom, challenge and responsibility.

The work of Jean Piaget (1952, 1973) and particularly Lev Vygotsky dominates much current ideology within mathematics education. Vygotsky (1962) acknowledged the influence of Piaget's work in revolutionising the study of child language but he proposed significant differences. He reversed the direction of the process of communication by contesting Piaget's premise of the sequence of maturation of thought from nonverbal autistic to egocentric thought and speech to socialised speech and logical thinking. He proposed a contrasting schema of development: 'In our conception the true direction of the development of thinking is not from the individual to the socialized, but from the social to the individual' (Vygotsky, 1962, p. 20). A key feature of the Vygotskian theory of human development is that higher order functions develop out of social interaction and that all learning takes place in a social context. 'Thus we may say that we become ourselves through others and that this rule applies not only to the personality as a whole, but also to the history of every individual function' (Vygotsky, 1966, p. 39). Bruner (1996) identifies co-constructivism as an extension of constructivism, which he describes as learning being part of a knowledge generating community as opposed to learning by being shown, learning by being told, or learning by constructing meaning. Carnell and Lodge (2002) argue that co-constructivist learning is effective for building a community of learners which encourages all participants to be involved, invites complex learning where there are no right and wrong answers and where boundaries between learners are broken down. These interactions require interdependence rather than autonomy or competition. The focus is not on the teacher's responsibility but learning is seen as a shared responsibility. Drawing on Vygotsky's ideas, Mercer and Wegerif (Mercer, 1995 and Wegerif and Mercer, 1997) identify a type of peer talk which they term exploratory talk. They define

exploratory talk as brought about through participants, who engage critically but constructively with each other's ideas, offering justifications and alternative hypotheses. Knowledge is made publicly accountable, reasoning is more visible in the talk and progress results from the agreements reached.

Walshaw (2007) argues that despite the focus on social interaction, the reality is that, within theories of social constructivism, the construction of knowledge never strays too far away from the individual mind. The 'social' functions as a 'shaper' rather than a 'constitutor' of learning. Learning through social interactions is seen to support and develop the construction of knowledge by the individual. From a post-structural perspective meanings are constituted through discursive practices and knowledge construction cannot be reduced to the autonomous maker of meaning. The result is that the social constructivist position on learning as 'influenced' by the social does not effectively change classic definitions of the cognitive learner. This means that, for the mathematics teacher or teacher educator, their primary interest is in students developing internal representation or cognitive understanding of mathematics and the way mathematics is learnt and taught. While this knowledge is important, knowledge of the discourses which are available to students and pupils is also significant. From a Piagetian perspective, common sense assumptions about learners and learning imply that engagement in enquiry based processes leads to depth of understanding. Brown and McNamara (2011) reiterate that whilst enquiry methods permit greater learner autonomy the overarching conception of individuals acquiring or producing mathematical knowledge has been maintained. According to Klein (1998), if we accept knowledge as a cognitive construction alone, we take for granted that student teachers will be empowered to adopt new approaches to teaching

merely from being told about them and their advantages. Klein (2002) goes on to argue that from a post-structural perspective, enquiring habits of mind are constituted through classroom and other socio-cultural discursive practices; they are not personal attributes or attitudes, as understood to be the case in humanist understandings of the individual. Focusing on personal attributes and understanding essentialises subjects and failure to learn is considered the responsibility either of the individual teacher in not providing the requisite skills, or of the individual student's incapacity to grasp conceptual knowledge (Walshaw, 2007) rather than possible inequalities in relations of power within dominant discourses. Providing a supportive environment where subjects co-construct knowledge through productive, exploratory talk in an empathetic learning environment is viewed with suspicion by post-structuralists. Burke (2002) warns of the danger of critical pedagogues believing themselves to be 'liberators' and 'givers of power'. She claims that differential positions of power occupied by students are ignored. Klein (2002) argues that, from a post-structural perspective, the priority is to focus on the qualitative nature of interactions and relationships for all learners, to ensure they are as positively productive as possible.

In an influential study of primary teachers, Askew, et al., (1997) argue that the style of organisation for teaching mathematics, whether whole class, group or individual, makes little difference. In the study classes that made the highest gains were those of teachers who had a connected view of what they were teaching and knowledge of different ways of teaching it, of how pupils learn and of their own pupils' attainment. They describe a connectionist orientation as one that emphasises the links between different aspects of the mathematics curriculum and that places a strong emphasis on developing reasoning and justification, leading to the children

developing early ideas of proof and to the importance of children drawing on their mathematical understandings to solve realistic problems. Askew (2010) argues that within a connectionist orientation is a fundamental belief that teaching mathematics is based on dialogue between teacher and children. Brown and McNamara (2011) suggest that in coining the notion of 'connectionism' Askew, et al., (1997) appear to have reconciled two apparently dichotomous perspectives of mathematics teaching: that is a learner perspective-prioritised style of teaching, which they associate with discovery or a Piagetian type of constructivism, with a transmission style of teaching, which they associate with an official perspective and characterised by emphasis on the ability of pupils to reproduce set methods and routines. The teacher draws links between alternative perspectives as offered by children and discusses how these 'connect' with the curriculum topics being addressed. Through sharing personal insights or understandings during lessons, with children and teacher working together, meanings are socially constructed. From a post-structural perspective disrupting the binary of traditional/progressive teaching methods offers a more productive approach to understanding the power relations implicated in oppositional discourses and highlights the mutual dependence of both sides of the binary. However, it could be argued that the notion of connectionism is still committed to objectivity by prioritising the belief that learning comes about through rational reflection.

Lather (1991:16) maintains that the key question of postmodernism is, 'How do our very efforts to liberate perpetuate relations of dominance?' Klein (2004) poses the question of whether pedagogic practices in teacher education unintentionally and invisibly reproduce old epistemologies and ontologies which

support knowledge transmission and teacher authority over student authored engagement and construction of ideas. Britzman (1991) points to the lack of opportunity for negotiating identities in conventional teacher education programmes during a time when authoritative discourses of subjects and teaching come into contact with student teachers' internally persuasive discourses. According to Klein (2004) teacher educators need to create a discursive space that operates to unsettle or subvert the taken-for-granted metanarratives of the learner as a rational and autonomous agent. This may draw mathematics teacher education closer to the empowering experience that Lather (1991) conceptualises: this she re-defines as analysing ideas about the causes of powerlessness, recognising systemic oppressive forces and acting individually and collectively to change the conditions of our lives.

In this chapter I identified some of the dominant discourses and regimes of truth within which primary education, mathematics education and initial teacher education are located. I described multiple and often contradictory discourses within which teachers', teacher educators' and students' identities as teachers of mathematics are constituted and negotiated.

Chapter 4

Methodology

This chapter describes the methodological approach, decisions and activities taken in the study. I start by providing a description of the conceptual lenses and methodological perspectives that I employ and I briefly outline some of my personal experiences of learning mathematics and my relationship to mathematics that have led to my research. I draw on Miller's (1997) work on the autobiography of the question to illustrate how my final research questions were shaped. I am continually concerned with ethics in the research relationship. I implement conventional strategies such as anonymity for research participants but I also attempt to take up and explore a critically reflexive approach to power relations in the research relationship.

Over the period of the study I have been exposed to a range of different theoretical positions, some of which I have been drawn to as they seemed to resonate with my existing values, beliefs and emotions. Skeggs (1995:95) argues that the 'social location of the researcher and access to theories is central to the motivations and framing of the research'. My research questions and methodological approaches have developed and changed as I have become influenced by different people and ideas. Burke (2002) suggests that researchers make sense of their work according to a complex web of factors including subjectivity, current socio-economic conditions, and geographical, political and historical contexts. My own sense of subjectivity and my shifting theoretical orientation across the period I was engaged in the study have significantly influenced and shaped my research.

Denzin and Lincoln (2005) maintain that objective reality can never be captured. They claim that post-structuralists have contributed to the understanding that there is no clear window into the inner life of an individual.

> Any gaze is always filtered through the lenses of language, gender, social class, race, and ethnicity. There are no objective observations, only observations socially situated in the worlds of – and between - the observer and the observed (p. 21).

The research process means that the researcher can never hope to be fully detached, that the self intrudes in every aspect of my research endeavours.

Brown and Jones (2001) propose that changes in both researcher and the world need to be documented within the writing process as they are mutually constitutive. They argue that as a practitioner-researcher, in describing my classroom, I 'affect the way I see it, thus the way I act in it, the way I am and hence the way I subsequently describe it' (p. 8). Lather (1991) argues that the value-ladenness of enquiry necessitates self-reflexivity, therefore, in this study I attempt to demonstrate how my subjectivity permeates my enquiry. I remain cautious about what I can achieve as through offering an account of myself as researcher, Youdell (2006a:65) warns that I risk assuming 'a disembodied authorial authority'. However, she argues that not offering such an account seems a much greater risk than slipping into an inadvertent essentialism. She cautions that the notion of the reflexive researcher infers a knowing subject, who can assess rationally the actions, words,

thoughts and meanings of both her/himself and the researched 'and if the researcher is such a subject, then so is the researched' (Youdell, 2006a:61). She argues that rejecting the neutral researcher and homogenous respondent does not resolve the dilemmas raised by constituted and located subjects doing research on or with other subjects who are also constituted and located. However, I attempt to use a reflexive approach in my values-based enquiry in order to ask the question, 'Who am I in relation to this research?' and to interrogate and explore how my own power and subjective positions interact with my research, while recognising, as Walshaw (2010a) argues that subjectivity is the cornerstone of the research encounter.

Initially I intended to fully centre myself in the research. I proposed to explore how I could improve my practice as a primary mathematics teacher educator as an exercise in self-formation. I was interested primarily in interrogating the contradictions between my beliefs and assumptions about how learning comes about and my practice as a teacher educator. However, as Sandretto (2009) observes, underlying these ambitions is the humanist assumption that there is a 'self' that the researcher can gain access to through reflection on information gathered about one's professional practices. Here the self is understood as coherent, fixed and rational, able to see the world as it really is. This implies the existence of stable beliefs and values emanating from a core self that drive professional practices.

Initially, like Skeggs (1994), I believed if I spent enough time talking to and observing my students and asking them the right questions, I was sure they would eventually reveal themselves to me. Using collaborative talk as a key pedagogical practice I hoped to create a dialogic community of learners so that knowledge could

be socially constructed, all voices heard, personal responsibility encouraged and assumptions challenged (LaBoskey, 2004). My aim was to investigate pedagogical practices which gave students opportunities to engage in productive, collaborative talk to analyse, evaluate, reconsider and reconceptualise their values, beliefs and attitudes about themselves as learners of mathematics and about the teaching and learning of mathematics. Underlying my research plan was a desire to learn how to convince my students that alternative pedagogy, as described and modelled in my course, was the way to do things better, positioning myself as Lather (1991) articulates as master of truth and justice. Davies (2006) describes this stance as 'teaching-as-usual', a dominant discourse in which the teacher has an habituated sense that she is the one who unquestionably knows and who has the authority to assert the correctness of that view. My initial research questions focused on finding out what participants were thinking and learning about mathematics and teaching mathematics. I proposed research questions such as, 'How can I develop my pedagogy for enquiry-based teaching of primary mathematics?' and 'How can I help PGCE student teachers become critically reflective teachers of primary mathematics?'

As I became increasingly interested in and engaged with feminist post-structuralist theories my focus changed towards examining the effects of power on educational processes and interactions. My attention shifted away from self-directed research to shape my practice and more towards the research process itself. Skeggs (2002) proposes that researchers should pay attention to research practice and research participants, to be aware of the positions of power we inhabit as researchers and recognise that these positions may shift and are rarely easily known. She calls

for accountability and responsibility in research, not for self-formation and self-promotion. She argues that the centring of the self is a particular technique of eclipsing and de-authorising the articulations of others, which relies on accruing the stories of others in order to make them into property for oneself. The risk is that the researcher's reflexivity, mobility, and self-narration become based on the participants remaining in place. Mauthner and Doucet (2003) argue that there is a danger that the voices of research respondents are viewed as transparent passageways into their experiences and selves that can be captured and that direct access to their subjectivities can be gained. My focus changed to acknowledging the impact I have on all aspects of the research as the product of my academic and personal biography. Walkerdine, Lucey, and Melody (2002) assert that we need to check our own story and be aware of its place as what we tune into in our own histories may be a projection onto the research subjects.

From the very beginning of my compulsory education my relationship with maths has swung back and forth from positive to negative.

During primary school and most of secondary school I enjoyed maths and was good at it. I received the approval of my parents and teachers with positive reports and good grades. I was consistently placed in a top group, set or class. I elected to take maths at A level and it was at this point things started to change. I was not allowed to take double maths A level as I had only achieved a B for O level. My only option was the

single maths class. I was the only girl in the class. Even though the teachers were two young women, I felt isolated and did not enjoy maths lessons anymore. The maths seemed to have changed. I felt it had become about remembering methods and procedures and reproducing them when before it seemed that it was a subject where I could always work things out and did not have to rely on memory. I no longer felt I understood the maths that I was studying.

I achieved at best an adequate grade for A level and despite negative feelings I chose to study for a maths degree at a Polytechnic. However, things continued to deteriorate and I became even more disengaged and passive. I began to quietly hate maths. During tutorials we were required to work individually, without talking, however, in our own time, we always completed set course work collaboratively. I relished this way of working even more as I felt that it was not how the tutors intended us to work. I stayed on the course and scraped by.

Five years after graduating I decided to become a teacher, a primary teacher rather than a secondary maths teacher as I wanted to teach across the curriculum areas. However, my relationship with maths changed again. Maths was high on the national agenda and education was awash with funding for new initiatives for

teaching maths. Significant time was spent on staff training for the new National Numeracy Strategy. I regained my enthusiasm and confidence and found myself really enjoying teaching maths to children. I completed a Masters in maths education before becoming a maths teacher educator. I am excited by maths still but in particular the complexities of teaching the teaching and learning of mathematics. I currently view learning, as Stentoft and Valero (2010:89) observe as a 'fragile, intermittent and discontinuous process vulnerable to the interrelated and continuous constructions and alterations of discourse and identity'.

The above story could be told in many different ways and this version is only a representation, not an account of reality, recorded at this specific point in time. If I had written this account at a different time in the past or if I write it again in the future it would be different. It is infused with my current situation, perspective and social context. Lawler (2002) argues that the 'truths' people produce through stories are not 'truths' as conventionally understood in positivist social science. She maintains, nevertheless, that they do speak certain 'truths' about people's socially located lives and identities. Weedon (2004:155) argues that 'identity is never complete, it is always in process, and constituted within representation' and from this post-structuralist perspective, identity becomes an effect of culture.

My beliefs about and understanding of learning mathematics were influenced, initially, by mathematics education research which, according to Bibby, et al., (2007:17), 'has traditionally assumed a notion of learning as ultimately individual, cognitive, curriculum-definable; the measurable by-product of teaching'. My Masters thesis focused on the cognitive challenge that specific mathematical terminology poses to six and seven year olds as they learn about shape and space. My research was, as Walkerdine, Lucey and Melody (2002:84) contend, 'infused with realism, with claims to an authenticity which purports to 'tell life how it really is'. I was interested in accounts that provided insights into pupils' knowledge, conceptual understanding and thoughts, as though they have a coherent personality which can be studied (Francis, 1999) or as Brown and Jones (2001) explain, I believed that by hearing what children say I can know what they are thinking.

I am motivated by notions of empowerment and inclusion for learners of mathematics. My own biography taught me powerful lessons about what it is to be categorised and positioned as a learner and to struggle to achieve legitimacy as a woman and as a mathematician. Initially, my goal became to empower my students, to liberate them from passivity by enabling them to experience mathematics as an exploration of mathematical relationships in the context of problem solving rather than a set of rules and procedures to be practiced, memorised and tested so they could, in turn, empower the pupils they would teach. Brown and Jones (2001) caution researchers against an emancipatory quest which presupposes values that cannot be agreed upon universally or permanently. Fighting for something means always working against someone else's interests and they argue difficulties arise in creating a robustly moral perspective that will be seen as better by everyone.

My research focus changed, due in part to the difficulties of trying to operationalise my original research proposal and an increasing interest and engagement in feminist post-structuralist theories. The study became an attempt to engage with and incorporate post-structuralism into my practitioner research. Like Brown and Jones (2001) I have not abandoned my aspirations for emancipation and the foregrounding of gender within a feminist analysis. I examine these goals as they become the basis for self-critique in this study. I have been influenced by Butler's (Butler, 1999:16) notion of performativity. She suggests that 'the performativity of gender revolves around the way in which the anticipation of a gendered essence produces that which it posits as outside itself'. My focus shifted away from an interest in the epistemological dimensions of pedagogy and the constructions of mathematical ideas. Instead I focus on the contribution of ontology to the ways in which learners themselves and what counts as mathematics are produced in teaching and learning interactions (Klein, 2008a). Skeggs (1995) describes the ontological question as one which deals with the assumptions one is willing to make about the nature of reality. As I sought to examine the effects of power relations rather than explanations for its existence my new research questions were constructed, influenced by post-structural perspectives on what is knowable.

My research questions are:

> What are the different discourses, subjectivities and practices at play in the context of primary mathematics initial teacher education?

In what way do these discourses, subjectivities and practices shape and/or constrain the pedagogical experiences, practices and relations in primary mathematics initial teacher education?

Where are the spaces for resistance, change and/or transformation within and between these different discourses, subjectivities and practices?

Participants

For the study I focused on students enrolled on a ten month PGCE. Across the 2009/2010 academic year I taught two groups of 24 students who had all chosen to focus on the KS2 age phase (7 to 11 year olds). The mathematics course was taught weekly over a period of 15 weeks between September and April with sessions of between two and three hours duration. The PGCE is a very short and intensive programme leading to qualified teacher status (QTS). Students spend half of the 36 week course off campus in placement schools. While on campus they are timetabled to attend lectures and workshop sessions, morning and afternoon, five days a week. They have directed tasks, essays and Teacher Development Agency (TDA) skills tests in English, mathematics and ICT to complete outside of taught sessions. In addition to numerous group presentations to prepare and subject knowledge audits and independent study to complete, they are also required to submit two 5000 word essays at Masters level. How much I impinged on students' time was a major constraining and ethical factor in my choice of research methods.

At the time of the study I had been employed for eight years at the University in which the study took place. I was intensely involved in teacher education and the

PGCE programme in particular. I taught on two substantial courses on the Programme, Mathematics and Teaching and Learning, and had pastoral responsibilities for one of my two mathematics groups. For four years I had been part of the management team of the programme and acted as external examiner for a similar PGCE programme at another university. I identified closely with the students in the study as my own route to achieving qualified teacher status was through a similar PGCE programme at another London University. Burke and Kirton (2006) argue that the teacher-researcher is in a strong position to shed light on the pedagogical processes of the particular educational setting under investigation. They maintain that 'methodologies that support knowledge production from an insider perspective and at the localised level are of great value in developing more nuanced and complex understandings of educational experiences, identities, processes, practices and relations' (p. 2). I was an insider in the research context in that there were experiences shared by participants that I could relate to on a personal level. I too had experienced the intensity of this route to teaching. I could have approached students from the other, parallel groups which I did not teach to be participants in the study. However, I chose to invite students to participate from my own two groups with whom I had already developed a pedagogical and professional relationship. I hoped that the relationship of trust and support was reciprocal and would contribute to the richness of the data generated. Unquestionably, ethical difficulties are increased when the researcher is also responsible for teaching the students she is researching.

While I have extensive knowledge of the PGCE Programme and the wider context of teacher education, at the same time I was also an outsider seeking to

become familiar with the lived experiences of the subjects who inhabited the setting of the research. My role as tutor, positioned powerfully as a mathematics educator, removed me from the local context of the student teachers. Thomson and Gunter (2011) contend that the very act of creating the terminology of inside and outside researcher identities is a sociological practice of fixing and naming, an act of sense-making that promotes an illusion of stability. Youdell (2006a:66) reminds us, from a post-structural frame, of the impossibility of ever 'knowing' the context and its subjects and 'so of pinning down the meanings of it/their practices once and for all'. In their own research, Thomson and Gunter (2011) concluded that they were neither insiders nor outsiders, but rather were engaged in messy, continuously shifting relationships. This reflects my own position of being simultaneously both inside and outside of the research context. My relationship changed with students as both the course and the research progressed. I was teacher, tutor, assessor, support and advice giver, interviewer and fellow professional.

Corbin Dwyer and Buckle (2009) argue that the core ingredient is not insider or outsider status, but an ability to be open, authentic, honest, deeply interested in the experience of one's research participants and committed to accurately and adequately representing their experience. However, accurately representing the experience of the participants is not a claim I can make. I can only offer partial and positioned accounts of the data. As Youdell (2006a) observes, researchers are absolutely entangled in the research data and the data are inevitably their own construction. My recourse is to strive to write a reflexive account by acknowledging and interrogating how my data, data analysis methods and my subjectivities as researcher are interdependent and interconnected. Mauthner and Doucet (2003)

argue that without emotional and intellectual distance from research projects, reflexivity may be limited. It may be more useful to think in terms of degrees of reflexivity. Including my own students as participants in my study increases my interest in their experiences and my commitment to accountability. My aim was to conduct research that was empowering for both my subjects and for me.

Data Generation

My data generation methods included weekly emails from students, interviews and a research diary containing field notes made throughout the academic year recording my observations and responses to interactions with my students during both teaching and research activities. Just prior to the first school placement and just under half way through the taught mathematics course I invited all 48 students to be participants in my study. I discussed my research, explaining that I was interested in their experiences, views, opinions and feelings on being a student on the mathematics course. I suggested that they email me or communicate with me any way they preferred, preferably each week after the session or as frequently as they liked. My invitation to students to regularly email me their thoughts was left open so they might set the agenda for topics and themes. In total 22 students communicated with me, some every week for the remainder of the taught course and some just once. Just over half chose not to participate. At the end of the 36 week course I asked nine of these students to consider allowing me to interview them to discuss their emails and their experiences further.

Walkerdine, Lucey and Melody (2002:194) contend that researchers are confronted with the inevitability of the place of power within the account and the

way in which our own inscription as researchers produces a deeply uncomfortable gulf between ourselves and our participants. Asymmetrical relationships of power clearly existed between myself and my participants. I was their tutor, responsible for assessing their satisfactory engagement in the mathematics course. While there were no credit bearing assignments that students were required to submit, I was responsible for confirming that they had satisfactorily demonstrated their mathematical subject knowledge through a subject audit and portfolio of supporting evidence of engagement with mathematics. Klein (2008b) argues that it is unlikely that students reliant on a pass in a subject would complain too bitterly about the content or delivery. Power relations will always pertain. I found this often to be the case in my study. The emails I received predominantly related positive feelings and experiences. Klein (2008b) suggests that one reason why students might not express critical comments may be 'their previously constituted notion that when you fail or find things difficult in mathematics it is your own fault, in that you are just not 'good' at it' (p. 320). In a number of emails students focused on other students, who they felt had impacted negatively on their own learning in some way.

Dissatisfaction with the course, when voiced, was often expressed indirectly, or only after first relaying positive feedback. Students were often constructive in suggesting how they felt their experiences could be improved and ended with concern that I was not offended.

Included below is an example of an email received. Alex emailed me once only, straight after my initial invitation to become involved in my study in January. He wrote:

> In terms of some feedback, I hope you find the following useful:
>
> Maths lessons have been probably the most useful because it is in these (and T&L) that we have actually covered topics relevant to our placements - i.e. mathematical concepts (and misconceptions), lesson plans, etc. I think it's very hard to comment on your specific teaching methods and strategies because I don't have anything or anyone else to compare them to but I do feel that sometimes they are too theoretical and do not have enough practical content. I don't know if comments like that help you at all but from my personal viewpoint, yes discussions and theoretical underpinnings are necessary (after all we are doing a post grad course!) but maybe they could be interspersed with more investigative work?

He then expressed his opinion that he felt there was too much paperwork in the course as a whole and finished with:

> As I say, I hope that this feedback is useful and is by no means taken the wrong way.
>
> Best wishes,
>
> Alex

On receiving this email I initially focused on the way that Alex privileges the practical knowledge and activity over theory and values the mathematics covered in

the course only if it is directly relevant to his experience of teaching during his first placement in school. I interpreted Alex as resisting the theoretical elements of the course wanting practical examples that are readily applied in the classroom. After more readings I see an alternative interpretation of Alex, not only resisting the perpetuation of the binary pair of theory and practice but also the traditional power relation between student and teacher, with my position of teacher as the ultimate arbiter of authoritative knowledge, expecting students to construct knowledge that I deemed appropriate.

Power relations and resistance also infuse the following email from Jason who emailed me only once, a few days after the end of the taught course in March.

> Hi,
>
> Just thought I'd give you some feedback on the PGCE Maths lessons.
>
> I have found the lessons interesting at times. Your lessons involve students partaking in lots of practical activities, which is great because we can then take some of those activities into school. The discussion on these activities is helpful at times, but I can't escape the feeling that the underlying emphasis of maths work is about right or wrong answers...not the effort put in. Saying 'not quite right', as the Drews paper suggests, does not make wrong answers any easier to take. Perhaps I am not vocal enough when I am struggling with maths concepts?

> I would say that I think I have grasped the most from the group activities with my peers where we worked together to solve a problem. Great!
>
> The main thing that I have found a lot less positive is the marking of work. You only seem to make a note of the things that are wrong on the audit. The absence of ticks or some sort of acknowledgement places more emphasis on incorrect answers.
>
> Jason

One reading of this email would suggest that the mathematical activities during sessions and the administration of the mathematics audit have suppressed Jason's engagement with mathematics. It seems he has experienced mathematics in teacher education predominantly as an endeavour to arrive at the correct answer. He has not been able to embody himself as a legitimate mathematics subject, however, rather than perceiving this as a deficit within himself, he focuses on the dichotomous encounter with right or wrong answers which positions students as unknowing subjects (Nolan, 2009). He perceives the coercive, constitutive nature of the context and the ways in which the discourses of the mathematics course operate. He resists this positioning, making himself heard in a powerful way. He is skilful in drawing on theory, citing a paper he has read, to use the legitimacy of theory within the dominant academic discourse to gain authority.

Davies and Robyn (1994) observe that power and powerlessness are in one sense transitory; the result of being positioned or positioning oneself in terms of one category or another. As both Alex and Jason are positioned as both powerless and powerful at the same time, so too am I as researcher-practitioner. We are all in the process of 'becoming'. I hold an authoritative position over my students as a teacher as they endeavour to 'become' primary teachers but as a doctoral student I am also struggling for legitimacy, to become recognised within the academic community. Seeing myself as an outsider, enables me to see more clearly how my students might see themselves as outsiders in the discourse of mathematics education.

I carried out interviews at the end of the PGCE Programme. Out of the 22 students who had emailed me during the mathematics course I selected and invited nine to be interviewed. The students appeared interested and pleased to be invited. The interviews took place in July after the Programme board and recommendations for awards were finalised when I was technically no longer their tutor and they were in the transition from student teacher to newly qualified teacher. All students had successfully passed all aspects of the Programme without being required to resubmit any elements or require additional support during their final placement. It would have been possible for the students who I selected to invite to be interviewed to decline, as early July was a transition period when students were leaving their accommodation and going on holidays before taking up teaching posts in September or were still looking for positions. One student responded that she would be happy to be interviewed but a later date would be more convenient. However, I chose not to take up this offer. Two students offered to come to the campus expressly to be interviewed at my convenience. Another three arranged times when they were on

campus for other commitments. These five interviews were carried out in my office. The remaining three students were not intending to visit the campus again and were unwilling to come in specially. I interviewed two of them by telephone and the third I offered to meet in a café near to where she lived but she preferred that I came to her flat to carry out the interview. I made every effort to reduce the power-distance between myself and the participant by paying careful attention to timing, privacy and location.

The interviews were semi-structured. I prepared a question guide for myself for each participant. Each guide was different as many of the questions focused specifically on discussing topics students raised in their emails, although there were also common questions relating to key themes that I wished to discuss. (See appendix one). My questions focused on details of the context of the mathematics course and of teaching mathematics during school placement. I made an audio recording of each interview.

Barbour and Schostak (2005) argue that interviewing is an impositional strategy which reinforces the power of the interviewer over that of the interviewee and creates the suspicion that the other is 'hiding something' that must be found out. During the interviews I controlled the agenda of the conversation: however, the questions were based upon a mixture of themes that students had initiated themselves in their emails and themes I introduced. Most answers were long.

I chose the eight students to interview for a number of different reasons. Gerson and Horowitz (2002) observe that in choosing a sample, the goal is to select a

group of respondents who are strategically located to shed light on the larger forces and processes under investigation. All students had emailed me regularly during the period of the study. I chose Chloe, Helen and Nicola because they were three students who seemed not to participate as much as others during the mathematics sessions and yet all had emailed me on a number of occasions and mentioned in their emails feelings of frustration and vulnerability during taught sessions. I was very interested in some of the statements they had made about their emotional responses and their feelings about learning mathematics, themselves as learners and their peers. Mike was chosen for similar reasons. Pippa and Amy were chosen because both were women who were well qualified mathematically and in their emails appeared confident in their own mathematical subject knowledge. I wanted to include students who were positioned differently within the discourse of mathematics education. I chose Anna and Tom because they were very consistent in their communication and they seemed to be interested and willing to be part of the study. From their email responses both seemed to be positioned positively as learners of mathematics. I wanted a mixture of men and women. The women outnumbered the men by three to one in the two groups that I taught and this is reflected in the sample. Below is a table presenting some information about the prior mathematics achievements of the students and previous employment before embarking on the route to qualified teacher status. The inclusion of this information adds context to the study but it is not my intention that it should be used to make assumptions or judgments about students' attitudes or attainment in mathematics.

Name	Gender	Age	Mathematics qualification	Degree subject and classification	Previous employment
Amy	F	24	GCSE grade A A level grade B	Psychology 2:1 (14% Statistics) (also qualifications in Counselling Skills and Health and Social Care)	Worked with disabled children at a respite centre- part time for 4 years.
Anna	F	25	GCSE grade B	Education and History 2:1	Worked as a Teaching Assistant before studying for her degree
Chloe	F	23	GCSE grade C	Sociology 2:2	1 year as a teaching assistant in a secondary school
Helen	F	29	GCSE grade C	English Language and Linguistics 2:2	4 years as a teaching assistant in both primary and secondary schools
Mike	M	46	CSE grade 1	Economic History 2:2	24 years in publishing and marketing
Nicola	F	25	GCSE grade C	Psychology 2:1 (Statistics module)	1 year as an administrative assistant and 1 year as a teaching assistant in a primary school
Pippa	F	29	GCSE grade A* A level grade A Further maths A level grade D	Natural Sciences 1st (28% mathematics 44% physics)	6 years as an investment banker
Tom	M	31	GCSE grade A A level grade B	Sociology 2:1	5 years in human resources

My aim was to examine closely and deeply, rather than broadly, the intersection between different discourses and practices at play in mathematics teacher education and how they shape pedagogical experiences. I wanted to gain a better understanding of the informants' individual perspectives and constructions of their lived experience and social realities. My goal was not to uncover universal truths about mathematics education. Instead my focus was on the discourses and subjectivities within the local context. Walkerdine, Lucey, and Melody (2002:179) argue that:

> there is a level at which the practice of data collection suggests that we are seeking a truth about our research participants and that further, the deeper and more delving our questioning, the more profound that truth of the subject will be.

This approach can be related to the metaphor Kvale (1996) uses of 'interviewer as miner' where knowledge is understood as buried metal unearthed by the interviewer. Kvale (1996) also offers the 'interviewer as traveller' metaphor, which represents a different concept of knowledge formation, associated with a postmodern constructive understanding, in which the interview is a conversation aimed at leading the researcher to new understandings about other people's experiences. The interviewer is understood as a traveller on a journey that leads to a tale to be told upon returning home. What the travelling reporter hears and sees is interpreted and reconstructed. Mason (2002:227) argues that treating the interview as a site of knowledge construction and the interviewee and interviewer as co-participants in the process is 'based on a more sophisticated, and more satisfactory,

ontology and epistemology'. Stentoft and Valero (2010) maintain that interview materials are constructed especially for the event of the study and in discursive practices and participant identities far removed from the actual events of the mathematics classroom. Ritchie and Rigano (2011) observe that meaning is co-constructed and co-authored by the participants through interacting subjectivities as well as desires, motives, and emotions.

The persistence of humanism

Sandretto (2009) argues that in many ways humanism, and the various discourses that draw upon themes of humanism, is our default setting or default discourse(s). Humanist discourses are pervasive in teaching and underpin the institution in which I work and the programmes on which I teach. Authoritative discourses of reflective practice, social constructivism, the autonomous learner, self-development, the valuing of mathematical reasoning and understanding and the binaries that result are inescapable. At the same time as asking questions to destabilise taken-for-granted knowledges and humanist assumptions, humanist views still permeate my research. Like Youdell (2006a), I am concerned with how knowledges are constituted and how they constitute subjects and I try to set aside the notion of accounts that provide insight into participants' knowledge of phenomena and participants' perspectives. She argues that as we live this model of the world and our place in it so wholly, it is difficult to give up. A desire to 'know' my students psychologically rather than an understanding of the way in which they are produced as subjects (Walkerdine, Lucey, and Melody, 2002) at times seeped into my interview questions. Scheurich (1997) contends that the complex play of

conscious and unconscious thoughts, feelings, fears, power, desires and needs on the part of both the interviewer and interviewee cannot be captured and categorised.

Attempting to be a detached observer, listening to the students' accounts was at times an awkward experience. I attempted to create boundaries rather than have a reciprocal conversation where I also shared my beliefs and experiences with the students. At the time I rationalised this decision as wanting to ensure that the interviewees talked much more than I did. However, I now recognise that my approach sustained an unequal exchange between the researcher and the participant. Reynolds (2002) describes this scenario, where the participant is actively encouraged to disclose personal details of their lives only to have these accounts objectified and scrutinized by the researcher. In contrast researchers reveal little personal information about their own lives. Walkerdine, Lucey, and Melody (2002) argue that creating boundaries is quite different from being a detached observer. Boundaries serve to defend against intrusive feelings about the research process, the subjects and the relationship between the two. However, power is not one-directional and I found that it flowed in more complex and multiple ways during the course of the interviews.

I started the interviews with an open question, asking students to tell me about their experiences of learning to teach mathematics and the mathematics course over the previous ten months. It was uncomfortable at times listening to my students discuss aspects of the course, recounting their feelings of both success and achievement and frustrations and disappointments. I had heavily invested, both emotionally and professionally in the planning and teaching of the course. Criticisms

are hard to hear. At times I was unable to keep the boundaries in place and responded to their questions or suggestions. The participants were primarily my students rather than interviewees. They knew quite a lot about me. Across the course I had told them, both unsolicited and in response to their questions, about my experiences, particularly my mistakes as a beginning primary teacher and had shared my own beliefs about learning and teaching. I offer the following extract as an example of the above. In my interview guide I planned to ask a question about a comment that Tom had made quite early in the course during a presentation he was giving to the group which I had recorded in my research diary. I wanted to ask him about this incident.

JA: In semester one you were doing a presentation of an individual maths plan. At one point, you were obviously leading that bit of the presentation, and you said you had decided to group the children by ability but that you knew you were not supposed to do that.

Tom: Yeah, I did! How did you have that down? If I'd known you were going to quote things at me that I said in semester 1 I wouldn't have come (laughing).

JA: I found it very interesting. The implication was that it was something we would perhaps frown on.

Tom: Yes. And it was half-jokingly that I said it but it was half-jokingly. It wasn't full jokingly. It's like what I said at the beginning, I don't feel like I've been told how to teach, which is good, because, you've made it quite clear that this is our class, we have to decide which way it works and actually some things might work better in some classes than others anyway. Yes, I had the feeling, certainly in the first term, that there were certain ways which we were sort of.... well, which you were trying to sort of head us towards without being pushy.

JA: The thing for me is a fine line. It's not about indoctrinating you.

Tom: No, but it is something you believe in isn't it?

JA: Yes, but you have to be informed and be able to make your own decision but that makes me feel I'm imposing.

Tom: No, no. I like to get a laugh when I'm up front, that's part of it. When we [with other students] were having conversations during that time, when we'd make a joke out of that, that we couldn't put groups together because there'd be questions that probably came from you saying "Why have you put these groups together?" "What about if you could use them in mixed ability groups?" But, again, it depends on what the task is. I don't feel like I've been indoctrinated but yes, there was an emphasis, I think, on

this particular way of teaching. But no, I don't feel like I've been pushed or told what we need to do. What else have I said? (laughing).

I felt extremely uncomfortable during the above exchange. I became aware of my surveillant research gaze and the power differential in Tom's surprised response to the fact that I had made a note of and raised a comment he had made many months earlier. Walkerdine, Lucey and Melody (2002) highlight that the desire to reveal counterpointed by the desire to conceal on both the part of the researcher and the researched is, in many ways, the classic aspect of research as surveillance. Tom asks me a question about my beliefs about grouping children by ability to which I respond. When he then asks, 'what else have I said?' I change the subject and go on to ask him about his mathematics subject knowledge, which, as I already knew from his emails and other conversations, was an area of the curriculum in which he was well qualified and in which he felt very confident. Walkerdine, Lucey and Melody (2002) suggest that within psychoanalytic theory, identification or its absence can signal a defence against its opposite. I introduce the notion of indoctrination, which Tom picks up on. My desire to identify myself, in humanist ways as a teacher who empowers her students, giving them the ability to think critically and make autonomous, informed pedagogical decisions contrasts with my fears that rather it is indoctrination that characterises my pedagogy. Gore (1993) argues that in the well intentioned focus on empowering others lies a paradoxical danger of overlooking reflexivity. Walkerdine, Lucey, and Melody (2002) contend that defence mechanisms sometimes mean that the researcher changes the subject or pushes the interviewee into another direction when faced with responses too uncomfortable to deal with.

The only student, other than Tom, to ask me questions directly during the interview was Mike. He asked me about 20 questions across the interview. Some were to clarify questions or ask me factual information, for example the name of some specific equipment but he asked a number of questions of the type; Does that make sense? Are we talking about the right thing here? Does that help? Mike was possibly trying to initiate conversation, resisting his positioning as the less powerful research participant. Mike's interview was conducted over the telephone. Maybe this was a factor. Another factor that I was aware of was that Mike, at 46, was a few years older than me. The other students ranged from between 12 and 20 years younger than me. Archer (2002) argues that talk does not occur 'in a vacuum' but is contextually produced and negotiated in relation to different audiences, through gendered, racialised relationships between researchers and participants. She contends that race and gender interact between researchers and participants in highly complex and unpredictable ways to produce particular accounts. In addition to race and gender, other power differentials, including class and age are present in all research encounters. Reynolds (2002) suggests that a reflexive understanding of power relations between the researcher and research participant is inextricably linked to wider race, class and gender divisions in society. Race and class were not explicitly confronted as issues of power relations in this research but nevertheless they inevitably infuse the research relationship.

Discourse Analysis

Discourse analysis within a feminist post-structuralist framework is the research approach used to analyse the email and interview texts for this study. Like

all methodologies, discourse analysis directs the researcher's attention to particular questions and phenomena. It has the capacity to trace the way in which different discourses create different effects with regard to the way in which people's subjectivities are made up (Walshaw, 2007:45). As Britzman (2000) contends, feminist post-structural theories argue that by assuming people to be effects of language, knowledge, power, and history, rather than their essential authors, a more provisional, historical, and ethical understanding of agency is possible. Francis (1999) maintains that by analysing discourses we can open up texts to different readings in which discursive constructions can be identified. As the self is not recognised in post-structuralist theory as coherent, spoken and written texts are studied instead of the 'thoughts' of a person. If discourses construct the subject and produce contradictory subjectivities, then analysing discourses can be employed to produce an analysis of who benefits and how from the articulation and practice of a particular discourse. MacNaughton (1998:169) identifies six inter-related processes to analyse discourse:

- Identifying how we categorise people, including ourselves. These categories will be formed and expressed via our language.
- Identifying the social practices through which meanings are given to the categories we learn.
- Identifying the patterns of emotional meanings and investment we have in particular categories.
- Naming the discourses that are formed by our categories, practices and emotional investments.

- Identifying the institutional basis for different discourses that construct and are constructed in our teaching.
- Identifying the social power relations and effects of the different discourses that construct and are constructed in our teaching.

I attempt to address all six of MacNaughton's processes in different ways and in different chapters within this study. Scheurich (1997:73) argues that the researcher brings considerable conscious and unconscious baggage into the interpretive moment and the final interpretations of the interview interactions are overloaded with the researcher's baggage and is largely a mirror image of the researcher. I therefore try to highlight the subjectivities that I bring to the research although this will inevitably be incomplete. Stentoft and Valero (2010) argue that what appears in the analysis is inevitably the result of the researcher's prioritising and own interpretations.

As I read the transcripts of the interviews multiple times I interpreted the students' responses in different ways. I did not use conventional practices of coding data and sorting into categories, however, themes did emerge. I recognised students' resistance to the disciplinary power they experienced during their school placements which regulated their choices and also some of the students' resistance to being positioned and silenced by other students during group work in mathematics sessions. It was only on later readings that I acknowledged widespread and significant resistance to the pedagogy and theories of learning introduced in the PGCE programme and the mathematics course. This can be demonstrated by my initial interpretation of Tom's interview. In my field notes at the time I recorded that I felt he was particularly insightful due to the way he was tentative about claiming

full understanding of important concepts of social constructivist theory. I felt that this showed he had grasped how complex and interesting these theories were. Identifying Tom as insightful implies a humanist view of Tom constructed as having individual strengths in binary opposition to a less thoughtful student.

Tom: Near the beginning of the course the term social constructivism was coming up quite a lot. I didn't really understand what it was. I could argue that I don't entirely understand it.

Tom: I could go on about scaffolding. I'm still not absolutely certain I could totally explain how that works or if it works. I think it does work but I haven't seen it that much in school.

Often as I wrote my analysis changed and I thought of different ideas and connections.

Walshaw (2010a) describes research as a performance which is about fictions and fantasies and the complicity of these in relation to others. Walkerdine, Lucey, and Melody (2002) argue that understanding subjectivity demands an understanding of emotions because the fictions of subject positions are not linked by rational connections but by fantasy, by defences which prevent one position from spilling into another. The three authors consider how their own histories affect how they both read the data, their emotional response to the participants they interview and the way they conduct the interview. Walkerdine's working class background made her feel she was connected to the working class subjects she interviewed. In another study

the authors became aware of how their envy of the freedom of choice which middle-class families enjoyed led to feelings of contempt for their participants. They surmise that these feelings must be a common place feature of the research encounter and produce fantasies on both sides. They argue that both researcher and researched can then use these fantasies to position each other within discourse. In their analysis they attempted to understand the relation between the fiction of positioning and the fantasy. They interrogated their own fantasies by asking questions such as, to which part or parts of me is the subject speaking? Which part of me is responding? In other words, who do I represent for the subject, and who do they represent for me? Walkerdine, Lucey, and Melody (2002:194) maintain that they understand their work as dealing with the impossibility of detachment through methodological guarantees and they try to 'find some way to take seriously a subjectivity that always intrudes, no matter what one's best intentions'.

I was able to see alternative interpretations of Tom's responses and the discourses within which he is positioned after acknowledging my own fantasies of being the kind of teacher who bestows agency and criticality on her students, creating students who are insightful and reflective practitioners. Britzman (2000) argues that for post-structuralists 'being there' does not guarantee access to truth. She maintains that subjects may well be the tellers of experience; but every telling is constrained, partial and determined by the discourses and histories. Britzman (2000:37) identifies the messy problem of whether the participants, in her own study of secondary student teachers, if asked, would see themselves as inventions of discourses and as fragmented subjectivities. I do not know if Tom would recognise himself as constituted within coercive practices and relationships of power that

maintain teacher/student and knowledgeable/lacking knowledge binaries. Like Britzman (2000), I try to hold tightly to the ethic of not producing these subjects, my students, as persons to blame or as heroes of resistance. Instead, my concern must be one of questioning how the categories of blame and resistance became discursively produced and lived.

In this chapter I have outlined how I implemented my research plan and how I conducted the research. Two key aspects of the methodological approach discussed is firstly, the acknowledgement that data, data analysis methods and researcher subjectivities are interdependent and interconnected and secondly, an attempt to take seriously subjectivity as the cornerstone of the research encounter. By taking a feminist post-structural approach and examining the notion of reflexivity, I explore how power relations and subjective positions interact within my research. I follow this chapter by detailing the rationale for the mathematics education course which I taught to all students in the study. It is hoped that this contextual background, in which the participants are located, provides appropriate information as a pre-curser to the following two chapters in which I present and analyse some of the students' accounts of their experiences of learning to teach.

4b The Mathematics Education Course

The cohort of 220 PGCE students was divided into nine groups of approximately 25 students. I planned and led the module with a colleague in the mathematics education team and taught two of the nine groups, focusing on teaching in KS2. The mathematics course consisted of 15 sessions, taught between September and March, each of which lasted two hours. Half way through the taught course, students completed their first full-time, eight week teaching placement in a primary school, returning to university in late January to continue with the course, before undertaking the final eight week placement in a different school during May and June.

A key objective across all aspects of the programme was to facilitate students' journeys towards becoming critically reflective practitioners. They carried out some mathematics in each session and also reflected on and discussed the teaching of mathematics. Specific learning objectives included that students should develop their own knowledge and positive attitudes to mathematics and explore developments in teaching and progression in children's learning from ages 3 to 11. We emphasised teaching mathematics for understanding, investigative approaches and using and applying mathematics through problem solving, communication and reasoning across the curriculum. Activities were carefully chosen to give students opportunities to experience conjecture, exploration and enquiry as important elements of knowing mathematics and to challenge, stimulate and extend their own mathematical thinking. The aim was that students would be able to construct conceptual understandings of mathematics, which would equip them for later teaching through problem-solving and enquiry-based approaches (Klein, 2001).

Social constructivist theories of learning influenced the teaching approaches taken in the course underpinned by the rationale that constructing mathematical ideas is not only a cognitive activity but also a social one (Twomey Fosnot, 2005). Creating a community of learners engaged in mathematical activity and reflecting on how children learn was encouraged. Social constructivism, as a theory of learning, was explicitly addressed in the mathematics course and in other subject courses across the programme. During weekly sessions as much time as possible was allowed for small group work and discussion and students chose who they sat next to and worked with. Learning through peer talk was addressed explicitly as a pedagogical approach through preparation reading about learning through talk and asking students to analyse dialogue observed in video clips of classroom teaching. They also analysed their own peer talk when carrying out group tasks and considered pedagogical strategies to bring about productive talk. The objective was that exploratory talk (Mercer, 1995) as a vehicle of learning could be both practiced and analysed. Segall (2001) contends that practice in teacher education should include more than teaching about teaching as an abstract entity, separate and separated from student teachers' learning. I tried to unite theory and practice by teaching in a style in which I hoped students would teach their pupils. Giroux (1994) argues that if educators make a distinction between teaching theory as a body of knowledge that informs students' understanding and the practice of theorising as a pedagogical activity in which students actually participate, it becomes possible to assert the mutual importance of both practices. I aimed to teach through a social constructivist pedagogy of enquiry learning to encourage students to make personal and professional transitions from traditional, didactic teaching to enquiry-based

approaches (Nolan, 2010). However, I also encouraged students to be self-conscious about the theories that guided their learning and future teaching. By relinquishing some control over classroom interactions, I envisioned that I was sharing power with the students. Preparation reading was carefully chosen to introduce theories of learning mathematics, to encourage critical reflection on government policy and dominant classroom practices as well as to support students' mathematical subject knowledge. Video was used in the majority of sessions to offer examples of a variety of different teaching approaches, which students were asked to analyse, compare and discuss and relate to their own understanding and experiences of teaching. Twomey Fosnot (2005: 286) argues that:

> as learners share perceptions with each other and with the teacher, and their ideas become modified, selected or deselected, as common meanings develop. This enables learners to become clearer and more confident about what they know and understand.

I sought to challenge narrow, procedural, exam driven pedagogy based upon fixed ability by encouraging students to think through pervasive ability-predicated practices and the implications for pupils. I encouraged students to consider other ways of grouping children for learning mathematics and to develop strategies for differentiation that included open-ended activities accessible for all and that could offer challenge for all learners. I sought to disrupt dominant discourses of mathematics by emphasising the notion that there is no one right way of solving problems and presenting mathematics as a cooperative and creative process.

The assessment of the course was carried out by means of an audit of students' mathematical subject knowledge. I encouraged students to work on the audit in study groups but to write up their own solutions and explanations and identify the areas of mathematics they felt they needed to address further, through self-study. This additional study was handed in to evidence engagement with mathematical knowledge and understanding. However, I was aware that the requirement to submit completed audits and evidence of further study for checking, could foster dividing practices which categorised performances and thereby students into appropriate and inappropriate mathematicians. For some this may replicate experiences of previous schooling as acts of teacher authority which position students as in some way deficient or lacking if they cannot produce authoritative truths (Klein, 2001).

Walshaw and Anthony (2007) argue that through listening respectfully to other students' ideas, through arguing and defending their own position and through receiving and providing a critique of ideas, students enhance their own knowledge and develop their mathematical identities. I hoped that through participating in the course, students would experience a different learning environment from that in which they may have been engaged during their own schooling. I envisioned that this would enable them to be positioned positively in classroom interactions in mathematics.

In chapters five and six I focus on the concept of the subject as an effect of discourse through analysis of my data. In chapter five I focus on the context of student teachers' experiences of learning to teach mathematics during the campus-

based mathematics module described above. In chapter six I go on to focus on students experiences during school-based elements of the course.

Chapter 5

Subjectivities and Discourses - Accounts of learning to teach mathematics on campus

Introduction

This chapter explores accounts of students' experiences during the campus-based mathematics course. I include extracts from students' accounts which I analyse to identify multiple discourses, power relations and performances of subjectivities as learners and teachers of mathematics. I identify micro-relations of power between subjects and suggest that the qualitative nature of interactions and relationships, rather than being neutral, are informed by overlapping and contradictory discourses within relations of power. The full and legitimate participation of all students is not realised. I contend that assumptions made about participation in pedagogical relationships are highly gendered and that gendered discourses are at play, particularly in the way that some students are silenced, categorised and marginalised within discourses of mathematics. I argue that students' identities are precarious and in process and performances of their subjectivities are dependent on immediate discursive practices and peer relationships. In this chapter I make visible how beginning primary teachers are often constituted as mathematical subjects in inequitable and unpredictable ways through multiple discourses and discursive practices and learning environments infused with domination and permeated with relations of power.

Gendered Peer Relationships

Not all students appeared to experience the mathematics sessions as supportive and empowering. Helen, Chloe and Nicola emailed me expressing discomfort with the learning environment. In particular, they focused on frustrations they felt about the nature of the interactions with their peers during small group collaborative activities. Helen wrote the following:

> I find maths quite tough... It's tough because there are quite a lot of people in the class who are quite confident and comfortable with maths and it doesn't feel like you can always ask for clarification.
>
> (Helen, email, 29 January 2010)

> I found it hard to learn anything, partly due to the people I was sitting with. It was difficult to let them know that I didn't understand, even with their lengthy explanations. (Helen, email 28 Feb 2010)

During the interview in July, I asked her to tell me more about the group discussions she was involved in.

Helen: When you're slightly less confident, you need a bit more time to sort of think about it, to work it out, then it's a bit harder and in some of the discussions you do just let other people talk, not because you can't be bothered but just because sometimes you feel like your opinion is not valid as much as theirs because they've done their maths. They've got a

lot of maths background or whatever. So I think that is sometimes an issue for me, personally.

JA: How did that make you feel?

Helen: I'd kind of just switch off a little bit, maybe and just think about other things. I do try to comment sort of here and there but it's harder when people have much more of a secure grasp of what they're saying and their ideas and they can formulate them and explain them like the mathematical way to explain it. And when you're not so mathematical, then it's harder for you to get your point across without feeling maybe stupid or patronised sometimes by some of the people.

Chloe also expressed similar feelings about her experiences. Reflecting back on the first half of the course she wrote:

> The sessions have allowed me to build my confidence over the time of the course. However, sometimes, I find peer talking difficult when there are people a lot more confident in maths on my table. For example, last session, I was working with someone particularly confident and I never really got a chance to work out the problem solving task for myself before she had worked it out and told us what the solution was!
>
> (Chloe, email, 29 Jan 2010)

In July, at the end of the course, Chloe returned to the subject of collaborating with her fellow students.

> I did enjoy the discussions but I don't know if I wrote or put it down in the email but sometimes I did find them slightly um. . . .I wanted to say annoying but I don't want to use that word, irritating, yeah, frustrating. If there were certain people in the group who have a really, really, good subject knowledge of maths and whereas mine maybe wasn't as good, that the conversation would kind of just lead off in a direction and I'd just kind of be sitting there. Maybe I just didn't understand what they were saying, or felt maybe intimidated by how much they knew and maybe, just not having the confidence in myself to participate fully in the discussion.

Later in the interview she said:

> There were often times when I did feel a little bit like a lost sheep in the group, so to speak. I think it was just a confidence thing in myself that I felt like other people were very confident and I maybe didn't want to speak out as much, or I didn't want to say something in fear of them kind of saying 'no that's not'. Overall, I get on with everybody.

Nicola also expressed feeling intimidated by other more 'knowledgeable' students in the group.

Nicola: I felt a bit intimidated, not that I was made to. I think it was my personal hang up maybe but I did often worry that what I was talking about might not make sense, or that I was talking a load of rubbish. But there again, I think that was to do with my confidence, really.

JA: So, what was intimidating about it?

Nicola: Feeling as if there were other people in our group who were like maths gurus, especially those who said 'I got an A* at GCSE' or whatever. I'm like – 'that's nice but do we really need to know that?'

JA: So, you felt put on the spot at bit?

Nicola: Yes, by other members of the group. I don't know, I think it was all subconscious as well.

Helen, Chloe and Nicola describe instances when they have not been able to construct a sense of self, as a legitimate participant within the university mathematics sessions and in their words describe feeling stupid, patronised, irritated and intimidated. Chloe feels that she does not want to say anything in case she is told that she is wrong. Helen lets others talk as she feels she is not able to communicate in a 'mathematical way'. Mathematics is often experienced as an intensely emotional subject and Bibby (2002a) argues a lack of connectedness with mathematics is an issue for generalist primary teachers. Davies (2006) claims that being seen to be

incompetent or inappropriate can be very painful and not contributing could be a less distressing alternative, a defensive mechanism. Helen, Chloe and Nicola are positioned as 'not knowing' and position others as 'real knowers' of mathematics. They focus on their own perceived culpability, all three citing 'personal hang-ups' and lack of confidence in comparison with their peers who are attributed with being superior and more confident mathematicians, as if these are essential characteristics or inner states. They reflexively position themselves and are also positioned interactively by their peers as less powerful in relation to other students (Davies and Harré, 1990). Hardy (2009) argues that confidence is caught up with principles of essentialism, as problems within the mathematics student. Binaries of being a mathematical person/non-mathematical person and being confident/not confident presuppose an essence at the heart of the individual which is fixed and coherent. The position of a non-mathematical, unconfident person is taken. For Helen, Chloe and Nicola being non-mathematical seems to be the only identity available to them.

Walshaw (2007) suggests that a problem with constructivism is that failure to learn is considered the responsibility of either the individual teacher, in not providing the requisite skills, or of the individual student's incapacity to grasp conceptual knowledge. It does not offer an explanation of how we make sense of ideas, given our history and positioned as we are within our cultural and social environments. Humanist assumptions of a rational and autonomous being puts the onus on the learner to be positive, satisfied and to enjoy mathematics. Inability to make sense of/in mathematics confidently is perceived as an inherent deficit within the individual, rather than as connected to complex classed and gendered constructions and subjectivities which operate to privilege particular forms of knowledge and

particular bodies (Burke, 2008). It is a function of the learner's subjectivity and the dynamics of the learning context. Klein (2009) argues that although students may attribute their lack of disciplinary knowledge and a dislike of mathematics to personal characteristics, this could be reinterpreted as the inability of past discourses to ensure their full and legitimate participation as numerate individuals.

Hardy (2008) suggests that to be able to take up the position as confident in mathematics, students must act in particular ways. Visible participation and performance in front of others is necessary, such as speaking out and offering answers. She maintains that for some learners performing mathematics in front of others is discomforting and this strengthens an identification that they are not and never have been any good at mathematics. Helen, Chloe and Nicola categorise themselves in comparison with their peers, as does Tom, who describes himself as very strong at mathematics. He is clear who his unconfident peers are.

Tom: I mean some people aren't very interested in talking, so that's a slight problem in itself if you've got a few people who don't want to talk.

JA: Do you think it's because they don't want to talk?

Tom: Well, it could be because they're not confident in what they're saying. I mean certainly I'm more confident in maths than some of the people in the class. In fact, we had a fair few in our class who would say, either they're not good at maths, or they don't like maths. So I think some

people in the class did naturally switch off because they were coming into a maths lecture.

Walls (2009) argues that these categorisations are indicators of the mathematics sessions as socialised, culturally defined and culturally defining political spaces, productive of the students as mathematical subjects. Tom attributes the lack of participation, the 'switching off' of some students, as a personal choice.

Amy, like Tom, had also studied mathematics successfully at A level. She also seemed unaware of the relationships of power and domination in circulation.

JA: Can you tell me a bit about some of the small group discussions you had?

Amy: I'm trying to think. They varied, I guess with who you sit next to, so it was useful to sit with different people each time. You get different things from different people. I can't really remember very many of them.

JA: Did you feel you contributed and were listened to?

Amy: Yes, I think our group was quite good in that way. Everyone was quite equal. Generally everyone got a say and was listened to.

Discourses, through which students are constituted, act in tension with one another. Helen, Chloe and Nicola's embodiment as mathematics subjects, who

sometimes participate in a limited way in group discussions, who do not compete with their peers and who identify themselves as lacking in confidence and knowledge, could be seen as a gendered response, a performance of femininity (Butler, 1999). Mendick (2006) argues that often mathematics is viewed, among those who think of themselves as experts and those who see themselves as failures, as a body of external truths that are discovered by mathematicians. According to Ernest (1998) these absolutist philosophies of mathematics are still the dominant view. Absolutists believe that mathematical truths are universal, independent of humankind and that mathematics is discovered, not invented, and culture- and value-free. Mendick (2006) suggests that oppositional discourses about mathematics as objective not subjective, rational not emotional, tie mathematics to masculinity. Her argument is not an attempt to essentialise gender or attribute masculine behaviours solely to men and feminine behaviours to women. Aspects of culturally constructed 'masculinity' and 'femininity' as necessarily 'tied' to, and performed by, particular sexed bodies are not assumed (Read, 2008).

Constructed Identities

Britzman (1990) argues that experience, in and of itself, does not telegraph essential meanings and language does not automatically reflect experience: rather, we bestow experience with meanings and these meanings are determined by habits, investments, fears, social conventions, dominant and private discourses and relations of power. As Stentoft and Valero (2010) maintain, the identities constructed in and through discursive practices are not random, but are products of past experiences and imaginaries about the future, as well as the present. Student teachers bring with them their first over-familiar contexts, constructed through their own educational

biography and through common sense ideas about the roles and functions of teachers in school (Walshaw, 2007). Helen, Chloe, and Nicola had all identified mathematical subject knowledge, above all other subject areas, as their main target for development at the beginning of the course. Before starting the course they had already taken up less powerful positions as mathematicians. Their previous experiences in the discourses of classroom, school, home and work have shaped their behaviour and the way they engage in mathematics. Their subjectivity, defined by Weedon (1997: 32) as 'their conscious and unconscious thoughts and emotions, sense of themselves and ways of understanding themselves in relation to the world', is an effect of the discursive practices of many years' experiences of learning and doing mathematics. Their subjectivities seem to have been further unified and solidified as 'non-mathematical' within the discourses of the mathematics teacher education course.

Similar threads weave through the three students' telling of their educational biographies; of being subjected to being classified and 'set' for mathematics, feelings of fear and dislike and of achieving a grade C at GCSE, the lowest grade in mathematics that allows entry to teacher education. In their stories aspects of their positioning and subjectivities change across their childhoods and into adulthood as they are located in different contexts and discourses.

Chloe states that she really enjoyed doing mathematics at primary school but on starting secondary school she was 'put down' to set 4, the second from bottom set. She worked her way up to set 3 for GCSE and was awarded a grade C. She gave

up mathematics after GCSE, aged 16. She described herself as ‘middle of the road’ at mathematics and says:

> I did struggle a lot and I think once that was all over, I thought right I’m going to put mathematics to the back of my mind now because I didn’t like it. (Chloe)

At the beginning of the course Helen states that mathematics filled her with fear. She describes at first getting really scared when she has to do mathematics but when she thinks it through she can see the different steps. She said that she had nice mathematics teachers at school and was not too bad at mathematics. She achieved Grade C GCSE at school and gave up mathematics, aged 16.

Similarly Nicola remembers enjoying mathematics at school up to the age of 9 or 10 because she had a ‘really good teacher’. At secondary school, initially, she was in the top set but was moved down. The school did not allow her to sit the higher paper for GCSE as she was in a lower set. She was awarded a grade C at GCSE and gave up mathematics. She describes herself in the interview as not very mathematical in the way she views things and as having had a fear of mathematics because it was not something she was ‘great at, at school’.

Negotiating Power Relations

Anna also expressed anxiety about mathematics. She said she was afraid of teaching mathematics when she started the course because of her lack of confidence. She was concerned that if pupils asked her questions ‘outside the box’ she would not be able to answer. She expressed several times, both in emails to me during semester

two of the course and the interview at the end, that she now feels more confident in her knowledge of mathematics and teaching mathematics. She explains how recognition from her peers about her ability in mathematics has made her realise that she is better than she thought she was.

JA: You said in one of your emails that you realised that you are better than you thought you were. Can you tell me what you mean by that, maybe give me an example?

Anna: I just mean, I think the algebra one really sticks in my mind when we were doing the equations and finding it out and then we were speaking about it afterwards and the people in my group were like, 'well of course you're going to get it Anna you're really good at maths', and I felt like, ok, actually I thought I was really bad at maths but I felt like when I was in the lessons I was always talking and yes, so I realised that, actually, maybe I'm better at it than I thought I was but I felt like it allowed me to, kind of, make sense of my thoughts on it because I mean maybe I started out wrong or something and eventually I, kind of, got there but yes sometimes I really didn't understand it, but by the end of the lesson I always felt like I'd learnt something. I felt like I contributed quite a lot in the lessons. Yes, I felt like I was really involved in the topic.

Anna accounts for her confidence through her embodied actions during group work. She states: 'I was always talking'; 'I contributed quite a lot'; 'I was really

involved' and she describes taking risks; 'maybe I started out wrong'. Hardy (2008) suggests that the attribution of confidence as an inner characteristic of personhood seems to follow from predominately performance based elements, for example, specific forms of visible participation and risk taking. The immediate interaction with her peers and the particular pedagogic modes of collaborative learning, legitimated by the course, have enabled Anna to gain authority. It appears that Anna has repositioned herself in relation to others and to mathematics subject knowledge.

Within the groups during mathematics sessions it seems that differential positions of power are occupied by students. Helen, Chloe and Nicola appear to be marginalised, unable to draw on discourses available to Anna. However, these relationships are not static and power does not operate in a simplistic dualism of powerful/powerless. Burke (2002) argues that we need to move away from binaries such as silence/voice to address the micro-power relations that shape the intricate dynamics in classrooms. These dynamics are complex and connected to, as Walls (2009) explains, the multitude of competing and overlapping discourses that student teachers are exposed to. Weedon (1997) asserts that post-structuralism proposes a subjectivity which is precarious, contradictory and in process, constantly being reconstituted in discourse each time we think or speak.

In different, immediate contexts within mathematics sessions, Anna's fragile identity is revealed as she describes how she felt overwhelmed during one session when she worked with a group of male students.

Anna: Sometimes it was harder sitting with all the boys if I was like with Ben or Ed or Mike then I felt like… Ben and Mike argued quite a lot, actually, in their discussions because they both wanted to be right but then when I worked with other people I felt like it was a lot more teamwork, kind of helping each other and everyone had a chance to speak.

Anna: I think there was a time I was with all the boys like Steve, Jason, Ben, Ed and Mike and me and I felt so over overwhelmed by them. I was really overwhelmed by them I was like, 'I'm not sitting with the boys again'. So yeah, I think, there must've been 6 of us in that group but I don't know maybe if it was too many or if it was just that it was just all the boys and me and I felt really like dominated by them but I didn't really want to say anything.

From Anna's account, it appears that the collaborative pedagogy, authorised by the course, is resisted by this group of five men and an alternative discourse of mathematics is performed; one that is often taught and learned in school as a competitive race to the one right answer. If, as Llewellyn (2010) suggests, getting the right answer is seen as an indicator of natural ability, the performance of this group may be about taking up a discourse of being naturally able, in an acceptable and masculine way, which is crucial in maintaining a position in the male hierarchy. They seem to be positioning themselves by drawing on the discourses of masculinity available to them. However, Anna's ways of relating to her peers, characterised by mutual support, ensuring everyone has a chance to speak and admitting to not

understanding break the ‘ground rules’ in this discourse and so her claim to be seen as mathematically able amongst this group of peers is not recognised. Anna is not able to use power relations in a positive way to support her construction of knowledge and a sense of self as a legitimate participant and she is forced into subordination and compliance. Stentoft and Valero (2010) argue that learning is tied to fluid identities of individuals contingent on immediate discursive practices.

Mike, whom Anna describes above as arguing with Ben in a contest to be right, also participated in my study. The highest formal qualification Mike had achieved in mathematics was a grade 1 at CSE. He had not been entered by his school for the higher O level examination that was current during his schooling in the 1970s. In the interview, talking about the course, he said:

> I just don’t have the kind of brain that allows me to move very quickly with mathematical things. Some of the things we were doing were a mystery. (Mike)

His subjectivity in the episode above, as Anna describes it, seems to be inscribed by a performance of gender. He is performing his masculinity through his combative style of communication. I asked Mike to tell me about the discussions he had and the work he did during the mathematics sessions. His response exemplifies, like Anna’s, how he too is caught up in and constantly negotiates relations of power. He recalled a specific incident.

Mike: I arrived just at the start and I think I was sitting in the wrong group, if you see what I mean. I wasn't sitting in what I call my usual group and I think they were all sort of quite able in the subject and I think they were more interested in the answers rather than the methodology, really.

JA: You didn't feel able to slow them down?

Mike: Gosh, I think you say 'hang on a second. I don't understand that' but sometimes there's this kind of air of competitiveness, depending on the task. I don't know which one it was but in any one task, they kind of want to get the end result or they see it. Sometimes it's difficult, I think, with people you don't have the same affinity with. I think with people you've got affinity with, you're far more relaxed and they are saying I don't get that and then you're able to question them back and that's part of the learning process for me.

Later he added:

> I think it's uncertainty. It's uncertainty, I think. It's being in a situation where you feel you can actually say you don't understand and people will listen and respond and scaffold and that kind of stuff. (Mike)

Here Mike talks about how important peer support and collaboration is to him. He describes episodes when he was marginalised and silenced, not being able to

say that he does not understand, by those students who he describes as ‘more interested in the answer rather than the methodology’. Sometimes he seems to use silence to avoid the risk of being identified as not understanding mathematics. A few minutes later in the interview the contradictory subjectivities that Mike embodies are highlighted by the following summary of his experiences of working collaboratively with peers. Mike expresses a resistance to the discourse of collaborative learning that the course promoted. He adopts a bold and competitive style of communication, reflecting culturally ascribed notions of ‘masculinity’, possibly to avoid the subject position of not being mathematical and effectively silencing others such as Anna.

> I found that generally throughout the course, it makes me sound like a non-team player, that if you are quite quick to see a way of doing something then obviously you have to be able to explain that to people who aren’t as quick and can’t see it. I remember finding it frustrating that I had to repeatedly try to explain things to people who then still didn’t get it. (Mike)

Mike’s subjectivity is fluid as he switches between embodying and expressing culturally ascribed performances of masculinity and of femininity. Through his accounts of how he experienced the course and the sometimes contradictory nature of these accounts, he presents his position as precarious and unpredictable as he is rendered powerful in one moment and powerless in another (Francis, 1999). Ellsworth (1992) argues that what we say, to whom, in what context and depending on the energy we have for the struggle on a particular day, is the

result of conscious and unconscious assessments of the power relations and safety of the situation.

Silence in Pedagogical Relationships

Nicola had, comparatively, considerable classroom experience prior to starting the course, having worked full-time as a teaching assistant in a primary school for a year. On discussing this role she explains how valuable she found it.

> There were a lot of things I found this year that certain people panicked about because they didn't know; silly things like what does LSA mean and stuff, all things like that, that I already knew like APP. I would recommend to anyone before they do a PGCE that they work in a school for a year because I just think it's a great experience. (Nicola)

Nicola's experience gave her specific knowledge of classroom practices and terminology that other students had not yet acquired. However, she seldom contributed to whole group discussions during sessions. She presented herself as unconfident and inexperienced. She did not appear to use her previous experience of teaching mathematics in primary classrooms to establish herself authoritatively in the eyes of her peers. She discusses this as if it were a conscious decision.

> I, personally, believe it's a quiet confidence. Personally, I just thought; well, I'd like to start sharing this [her experiences of working in

> classrooms] but I actually can't be bothered for it to escalate into something that….I didn't want to be a bragger, basically. (Nicola)

One analysis of this statement is that Nicola is not able to reflexively position herself strongly, as she feels that her knowledge is not valued in the university setting where theory is inherently privileged over practice and the authoritative discourses of the university course are privileged over knowledge of classrooms. Burke (2008) argues that 'other' bodies of knowledge that the student might bring to their work are often invalidated. Students must often frame their understanding in terms, not of practical or professional knowledge but in relation to academic knowledge, the literature or 'the field'. The complex processes that might constitute 'the field' are silenced. From another perspective Nicola's silence does not signify a loss of voice or a lacking of confidence. She states that she has a quiet confidence but is declining to talk. Nicola is suggesting that it is possible to be confident and not be prepared to speak out, that is she has chosen not to join the competition to have a voice. Like Anna, Nicola withdraws. She says that she does not want to be a bragger. She challenges commonly recognised performances of confidence as a certain type of social participation but also highlights that knowing within the mathematics course exists in a hierarchical way. hooks (1994) argues that where the prevailing pedagogical model is authoritarian in a coercive and often dominating way, 'competition for voice' is an integral part of pedagogic practice. As Klein (2004) speculates, could it be that, while speaking new truths of what mathematics education might be and engaging students in investigating mathematical and pedagogic ideas and problems, the form and operation of the discourse and interaction actually reproduce old epistemological and ontological assumptions?

Despite explicitly valuing cooperation and collaboration, exploratory talk, mathematical enquiry and investigation, a competitive dynamic remains. Klein (1994) argues that the power of the authoritative voice is all the greater when on first glance it appears muted.

Tom identified himself as very confident in his own mathematical subject knowledge. He had studied mathematics successfully at A level. He said that, when he started the course, it was how to teach mathematics that he did not know about.

> Yes, my knowledge is very good of maths but, of course I couldn't have taught it well at the beginning of the course. (Tom)

The way he describes how he interacted with his peers in group mathematics activities is interesting. He too does not seem to explicitly embody confidence.

> If I've got other strong people [in my group] because I consider myself a fairly strong person in a discussion but if there are other strong people, I tend to take a back seat. Then actually I don't tend to involve myself so much. I don't think that's a problem necessarily. (Tom)

Tom, like Nicola, seems to portray his silence, not as a loss of voice but as declining to talk. He performs his confidence and position of power through sometimes not feeling the need to engage. He seems to be drawing on discourses of masculinity of 'effortless' achievement, which, according to Jackson and Dempster (2009), is an idealised form of masculinity constructed as the 'pinnacle of success',

because achievement without hard work signals 'natural' ability. Aspects of Tom's behaviour are similar to that of other students. He appears to disengage outwardly, embodying behaviour much like that of Helen, Chloe and Nicola. However, unlike them his strong position and mathematical ability is recognised and acknowledged by himself, his fellow students and by me. He seems to be able to maintain an authoritative position as a 'strong person' through his silence and does not need to compete, as Mike does, to maintain this status. His lack of engagement and contribution seems to be an expression of power itself and a resistance to the collaborative participation endorsed by the course. This contrasts with Nicola, where her withdrawal is understood by her peers and myself as an act of powerlessness. Attaching different labels and ascribing different motivations to what could be seen as identical behaviour maintains an oppositional and polarized construction of gender (Mendick, 2006). Ellsworth (1992) challenges the assumption that silence in pedagogical relationships indicates 'lost voice' arguing that this betrays deep and unacceptable gender, race, and class biases.

Interactive Pedagogy

Burke (2002) argues that reflexivity in interactive pedagogy is a crucial tool for addressing the complexity of localised power relations. I had expected that during university based teaching sessions, through using a collaborative pedagogy, we would be able to ensure all participants a safe place and equal opportunity to speak. I had assumed that a neutral context for learning was possible and that students would feel safe to speak and respect each other's right to speak. However, this appears simplistic, failing to acknowledge the constitutive nature of multiple

discourses. Burke (2002) observes that the interactive approach to teaching has its problems and has the potential to reproduce unequal power relations. I had failed to confront dynamics of subordination and competition in the form of multiple and contradictory subject positions held by myself and the students

Ellsworth (1992) writes about an attempt to put into practice pedagogical practices such as 'empowerment', 'student voice' and 'dialogue', partially in response to increased racism at the university where she was a professor. However, she found that the results were not only unhelpful but exacerbated the very conditions they were trying to work against. Instead of students sharing their experiences and understandings of oppression with other students, fundamental challenges to and rejection of the voices of some classmates occurred. She concludes that the goals of critical pedagogues, in particular empowerment, are repressive myths that led her and her students to reproduce relations of domination. She argues that conventional dialogue is impossible because social agents are not capable of being fully rational and disinterested. They are subjects split between the conscious and unconscious and among multiple social positionings.

Ellsworth (1992) argues that fear of being misunderstood, being too vulnerable and memories of bad experiences and the often contradictory intersection of voices constituted by gender, race, class, ability, ethnicity, sexual orientation, or ideology renders each expression of student voice as predicated on the absence and marginalisation of alternative voices. Like the students in Ellsworth's class, Helen, Chloe, Nicola, Anna and Mike at times expressed much pain, confusion and difficulty in speaking. They were engaged in what Ellsworth terms 'teeth gritting' in

their attempts to constitute themselves as legitimate mathematicians within the multiple discourses that they were subjected to. Some were at the mercy of pedagogical strategies and practices which suppressed a realisation of self as numerate (Klein, 2008a).

Coalitions

As already discussed, some students were not able to establish themselves as legitimate by performing with agency through collaborative learning with their peers in the ways I initially recognised. However, some of these students describe participating in other ways. The class in Ellsworth's study formed informal affinity groups within the larger group. These provided some participants with safer home bases from which they gained support, important understandings and a language for entering the larger classroom interactions each week. Helen, in particular, describes how she reflexively re-positioned herself by finding alternative ways to participate.

Helen: On some occasions there were certain people in the group who were very good at maths but also knew other people weren't very good at maths so they would say, 'wait a minute, let's explain it', or you could say, 'oh I don't actually, I don't actually get that' and you knew that a couple of people like Catherine and Will and Alex, they would take time to explain it to you and make sure you were, understanding it, as well as carrying on. Whereas some other people were, sort of, more like, well that's just the way it is, let's do the next part.

Helen: I'd quite like it when Catherine particularly, helped me a lot, like just breaking down the ideas and explaining them, then if I didn't get it she'd know and she'd try and explain it to me in a different way and so that was really useful to me because I knew I could ask her a question and she wouldn't think it was a stupid question and could build on it and develop my confidence that way.

Helen formed a 'coalition', in particular with Catherine, developing a support mechanism which extended outside the teaching room. It seems it is more than just a clear explanation of the mathematics within which Helen found safety but in the relationship she established with Catherine. Helen explained how she worked on the mathematics audit outside of sessions.

Helen: Catherine again, she helped me and, she would explain things to me that I didn't quite get. And she'd say to me, 'oh you got this one wrong, why did you get it wrong?' She would help explain it. And then through her explaining she would sort of treat me like the child and she would say, 'explain it back to me then if you do understand it' and so, I think through that it has developed my subject knowledge.

This could be analysed as Helen remaining in a passive position, dependent on other more powerful students who are willing to help. The talk would seem to be dominated by Catherine in a rather unequal dynamic that mirrors a more traditional teacher-pupil relationship with knowledge transmitted by the knower to the learner,

as Helen explains ‘she would sort of treat me like the child’. It is not the kind of communication, in my humanistic understanding of empowerment that I was hoping to foster as it is hierarchical and reinforces differential positions. However, Helen is participating. She is asking questions and explaining mathematics concepts back to Catherine. Helen has found a way to avoid being identified as illegitimate which enables her to develop her understanding of mathematics subject knowledge. Llewellyn (2010) speculates that the quest for understanding mathematics is a mask for the taking up of a subject-position, and belonging to an identity. She argues that understandings are tied up with notions such as gender, confidence, and emotion. Helen has renegotiated herself into a relatively more powerful position in terms of her increased participation but also in a more explicit understanding of her own mathematical knowledge. However, the position secured by Catherine, of legitimate knower who is authorised to teach her peers, is not available to Helen. Catherine did not study A level mathematics; like Helen her highest mathematics qualification is GCSE. Despite this, she has been able to embody her subjectivity within the discourse of mathematics very differently from Helen. She has drawn on discourses of femininity of the primary school teacher rather than discourses of masculinity of mathematics to establish her legitimacy, a position which perhaps carries more authority in the eyes of many of her peers, than that of ‘mathematics expert’. However, Catherine and Helen are co-dependent. They have formed a coalition as they enable each other to draw on discourses through which they can establish themselves differently.

Relations of domination

Another participant, Pippa, often embodied her subjectivity as a confident knower of mathematics. She studied mathematics as part of her degree and felt she already had sufficient subject knowledge.

Pippa: I suppose basically what I got from the course was pedagogical knowledge because I don't really need the subject knowledge.

She positions herself strongly in discourses of masculinity of mathematics which is embodied in how she describes her participation and experiences of the mathematics sessions.

Pippa: I'd kind of have my own ideas of how to do it and then if someone else had another opinion, then we'd have to have another discussion about that. But, mostly I had an idea within 10 seconds and everyone else was thinking or hadn't even got their pens out or something or didn't get the maths, they were slower on the maths.

Pippa: I remember going 'oh, I know how to do this' because I remembered that I'd learnt how to do it and then I'd say 'oh forget that and I'd just invent my own system which was just as quick'.

Pippa: I like being a know-it-all and I like getting all the right answers and I like being really quick.

She describes herself as having her own ideas and being faster than her peers. She likes getting the right answers and inventing her own systems. She classifies other students as slower or not 'getting' the mathematics, positioning herself as authoritative and others as marginal in the discourse. Pippa takes up masculine identities and cultural norms, earning herself legitimacy as a successful woman. Pippa has a privileged academic background. She attended a private school and achieved A* at GCSE and studied mathematics and further mathematics A levels, achieving grades A and D respectively. She was awarded a first class degree in natural sciences at university. Her degree comprised one third mathematics.

Pippa resisted the university discourse of collaboration. Following the unwritten rules of co-operative learning with peers was not something that Pippa found easy. She recalls that she usually tackled the mathematics problems individually.

Pippa: I'm very verbose, so I don't think I really get what other people are saying or what I'm saying, even. So, I was happy to do the maths thingy and then explain what I'd done and then maybe have a bit of a chat about how you'd found your own maths experience or your own experience in school or something.

Pippa: I don't really have the thing when you talk to people and you wait for their opinion and then you talk.

She talks about reciprocal communication involved when working collaboratively as if it is an innate ability that she does not possess. She constructs herself firmly within discourses of masculinity of mathematics where individual work, speed and correct answers are valued, rejecting the role that Catherine embodied of the supportive, sympathetic sub-teacher. She explicitly challenges the status quo of the collaborative pedagogy promoted through the course, positioning herself authoritatively within a traditional, discourses of masculinity of mathematics. Solomon, Lawson and Croft (2011) argue that women can only position themselves as good at mathematics by making themselves highly visible and stepping out of the available female identities. This may have been a performance that Pippa had enacted in the past which enabled her to be recognised as a very strong female mathematician. Within the current context of initial teacher education, in which both government organisations and the mathematics education research community portray a problem with primary teachers' personal mathematics knowledge, Pippa has much to gain by establishing herself as strongly mathematical. Externally defined measures of the students' mathematical abilities, such as the use of subject knowledge audits, during the mathematics course and the requirement for students to evidence improvement in their subject knowledge before completion, contradict the softer image of mathematics the course also proffers, one of mathematics as enquiry and collaboration. Pippa uses discursive practices such as working individually and racing her peers to correct answers to maintain her position rather than relinquish the security and privilege of being the 'knower'. However, these practices can be seen to be experienced as potentially oppressive by some of her peers. Ellsworth (1992) argues that social agents are not capable of being fully rational and disinterested.

Pippa is not necessarily acting consciously. She is a subject split between the conscious and unconscious and among multiple and social positionings.

Fragile Identities

I asked Pippa if she felt confident**.**

Pippa: Not really. I think that's almost my own insecurity in maths. I got a D in Further maths A level, which was kind of unexpected because….. I just learn maths through practice. I don't know it. I can just do it because I'm practising it at the time.

JA: What do you mean you don't know it?

Pippa: Well…I forget it.

Pippa: I mean I do remember at primary school we had a little refresher at the beginning of topics and I always used to go and ask to sit at the front when everyone was doing their work and join in the refresher and the teacher would be like, "no, I know you know it" and I'd be like, "no". Like that was what I was saying right at the beginning, I don't know it, because I haven't learnt it. I've just been able to pick it up and do it at the time, so unless I practice maths, I'd forget it completely.

She responds by denying that she has a deep understanding of mathematics and asserting that her success comes from rote learning and practice. Her identity as 'good at mathematics' appears fragile in this conversation. Moreau, Mendick and Epstein (2010) argue that claiming 'normality' for a woman doing mathematics is particularly difficult. Likewise, Solomon, Lawson and Croft (2011) contend that while many learners may be successful in mathematics they nevertheless see themselves as existing only on the margins of the practice. One interpretation could be that she is experiencing multiple tensions within the discourses of being good at mathematics and being female and there is no discursive space in which she can belong, since the available identities and cultural norms are masculine. 'Being good at mathematics, or more accurately being seen to be good at mathematics, continues to conflict with femininity' (Solomon, Lawson and Croft, 2011:5). Pippa does not draw on discourses of masculinity of effortless achievement, instead positioning herself within the discourses of femininity of achievement through hard work. Jackson and Dempster (2009) argue that the valorisation of 'masculine' learning styles means that the best achievements are seen as those that are effortless, because then they are authentic and (feminine) hard work is in fact evidence of a lack of 'natural' mental superiority. Drawing on Mendick's (2006) arguments, Pippa's is a gendered response. In this instance her response to my question about her confidence could be a performance of femininity in an attempt to maintain her gender identity as a woman in spite of her associations with the masculine field of mathematics.

Amy had also studied mathematics to A level, achieving a good grade and had taken a module on statistics as part of her degree in psychology. I asked her how she felt about mathematics.

> I always thought that I needed everything broken down for me because I guess my family have always got maths a lot quicker than I have, so I always thought I struggled, in a way, with maths and I had to break it down. (Amy)

Amy's view of herself as someone who struggles at mathematics could also be seen, like Pippa's, as a performance of femininity, her lack of access to discourses of masculinity of natural ability and an attempt to maintain her gender identity as a woman in spite of her associations with the masculine field of mathematics (Mendick, 2006). Her family relationships also add to the complexity. In a study of girls and mathematics from pre-school to secondary school, Walkerdine (1998) found that the majority of the middle-class girls were very anxious that their performance was not good enough. She argued that in the middle-class schools they consistently used terms such as 'natural ability' to describe top pupils, but rarely to describe girls, even girls who were doing very well indeed. It was far more common for high-ranking girls to be call 'hard-working'. Amy wrote in her Starting Profile, completed at the beginning of the course, that she had always enjoyed mathematics but that her understanding of mathematics did not come naturally to her.

Regulating Deviance

As previously discussed Pippa did not always abide by the norms of practice within the university session room. She did not collaborate easily with other students, she worked individually and quickly and she sometimes shouted out

answers as soon as she had calculated them rather than focusing on sharing and comparing methods. She made her impressive qualifications in mathematics known to others. She performed her subjectivity in mathematics in a highly visible way which impacted upon other students. It seems other students on occasion told Pippa to be quiet.

Pippa: I got told a few times to be quiet because I was trying to tell them the answer.

Pippa's behaviour was open to scrutiny by her peers and they performed a normalising function as they attempted to regulate Pippa's behaviour to be more acceptable, perhaps more feminine. By breaking the 'rules' and deviating from acceptable norms of behaviour some of her peers resorted to category-maintenance work (Davies, 2003), letting Pippa, the 'deviant', know she had got it wrong. On another occasion students were sitting around five small tables working on different activities based on explorations of properties of 2D and 3D shapes. Pippa describes how she finished her own table's activity very quickly and attempted to circulate the room in order to find out about and do the other four activities as well. She was rebuffed.

Pippa: I did it in 2 minutes and I wanted to do all 5 of them and the other table groups said 'no go away'.

Her peers excluded her overtly, not allowing her to join their groups or break the 'rules' of the teaching session. Pippa talks about her often unsuccessful efforts to

try to conform to the norms of acceptable behaviour. She describes how she tries to keep herself in check, to self-discipline herself to behave in appropriate ways.

Pippa: I talk a lot and I'd be careful not to jump in with the answer and also adapt to people who are at different levels.

Walshaw (2007) maintains that truths about gendered subjectivity are produced in all classrooms. Students operate within its particular regimes of truth, legitimising and sanctioning gendered practice. Those students who refuse or cannot identify with the patterns of 'normal' studentship will be marginalised to some extent.

Summary

Through the analyses offered in this chapter I have drawn on feminist post-structuralist ideas to explore the concept of the subject as an effect of discourse in the context of student teachers' experiences of learning to teach mathematics during the campus based module of a PGCE. These discourses are interlinked, overlapping and also contradictory, encompassing gender, ability, internally persuasive discourses, managerialist and humanist discourses and discourses of mathematics.

I prioritised an interactive pedagogical approach to promote collaborative learning, with a focus on small group productive talk. I now perceive this approach as an act of resistance against currently dominant transmission based approaches and absolutist discourses of mathematics dominant in the context of school mathematics and the discursive practices of ability grouping, SATs and league tables. I imagined

that by relinquishing some control over dialogue and interactions during seminars that I was sharing power with students, making the assumption that they would be left free to act according to reason and choice. However, the fantasy of a neutral, supportive pedagogy is fractured. I argue that the learning environment is infused with domination and permeated with relations of power, which I demonstrate in this chapter through analysis of students' accounts of learning to teach.

Students started the course already subjects within discourses of mathematics constructed through past experiences. I identify dividing practices and oppositional discourses of the mathematical/non mathematical subject in the way that students described their own mathematical histories and identities. During mathematics sessions differential positions of power were occupied by students who categorised and classified themselves and each other by perceived mathematical ability, drawing on fixed notions and performances of ability. I demonstrate how some students were positioned as 'not knowing' and others were positioned as 'real knowers' of mathematics. I identify the micro-relations of power, which seemed to circulate, not allowing for the full and legitimate participation of all students. Rather than a liberating, empowering experience which produced students able to engage authoritatively with mathematics, relations of power through multiple discourses reproduced some students' subjectivities as still marginalised. Despite explicitly valuing cooperation and collaboration, exploratory talk, mathematical enquiry and investigation, dynamics of subordination and competition were also fostered. The mathematics course can be read as a socialised, culturally defined and culturally defining political space productive of the students as subjects (Walls, 2009).

I did not start this research with the explicit intention of examining gendered discourses and therefore did not communicate to the participants an interest in gender. However, as I analysed the data, I drew increasingly on the work of Judith Butler (1999), Heather Mendick (2006) and Penny Jane Burke (2002). I identify gendered discourses at play in the ways Helen, Chloe and Nicola were silenced and marginalised as non-mathematical within the university course. I argue that gendered performances of confidence and capability established unequal power relations. Students worked hard to establish their legitimacy. Helen and Catherine, drew on discourses of femininity of collaborative learning and primary school teaching or found security in coalitions with other students. Some students, such as Mike and Pippa, were able to enhance their legitimacy as mathematical subjects by drawing on discourses of masculinity of mathematics as competitive, performing a mathematics that is defined as an end result of an intellectual process rather than the process of getting there (Brown and McNamara, 2011). However, discourses were not available in equitable ways to all. Pippa, though a very high achieving female mathematics student, positioned herself within the discourses of femininity of achievement through hard work rather than natural ability. I argue that assumptions about participation in pedagogical relationships are highly gendered. Both Tom and Nicola described interacting in similar ways during mathematics sessions. They engaged in limited participation and interaction with peers when undertaking mathematics tasks and discussion, however, they were categorised differently by themselves, their peers and myself. I suggest that this attachment of different labels and motivations to what can be seen as identical behaviour maintains an oppositional construction of gender.

Some students were able to draw on discourses to position themselves more positively as mathematical subjects. Anna gained authority through the nature of her immediate interaction with her peers and the particular pedagogic modes of collaborative learning legitimised by the course. However, such performances may be only fleeting, producing students who are in one moment powerful and another powerless as their subjectivity is something felt and lived and continuously made and remade. In another session Anna reported feeling dominated by her peers, revealing a more fragile, fluid identity. I argue that students' identities are precarious and in process and performances of their subjectivities during sessions can be contradictory and dependent on immediate discursive practices and peer relationships. Students are both oppressed and oppressors as they defend their positions and perform category maintenance work to re-establish acceptable norms of behaviour, positioning themselves and their peers in shifting locations. I argue that the qualitative nature of interactions and relationships, rather than being neutral, are informed by overlapping and contradictory discourses within relations of power. In this chapter I have made visible some ways that power relations and discursive practices constitute learning and learners of mathematics in unequal, unconscious and unpredictable ways in the context of the mathematics education course.

Chapter 6

Subjectivities and Discourses - Accounts of learning to teach mathematics in school

Introduction

This chapter focuses on the context of learning to teach in primary classrooms. I analyse students' accounts of their experiences of teaching mathematics under the supervision of their class teachers and supervising tutors, focusing on their shifting subjectivities within the discourses and relationships of power in which they are positioned and position themselves as beginning teachers.

I build on the arguments presented in the previous chapter which identify ways in which power relations and discursive practices constitute learning and learners. I identify discourses and regulatory practices that produce students' subjectivities as they learn to teach mathematics. I argue that discourses of school mathematics, mathematical ability and accountability are compelling for student teachers and shape their accounts and practices. Students' developing subjectivities as teachers become strongly constituted through these authoritative discourses. Many of the students individualise and essentialise the difficulties they encounter when trying to manage learning in school, blaming either themselves or their pupils for their lack of knowledge. Power relations feature prominently in the students' accounts. They demonstrate that they are explicitly aware of their compliance within the discursive practices of their settings and for most it is a struggle to take up and perform those practices which are deemed appropriate. Most of the students comply

with the established practices of the school and class teacher, however, many resist and criticise these practices during interviews, demonstrating that they are caught between the tensions and inconsistencies of negotiating their subjectivities within multiple discourses. However, one student does find spaces and draw on discourses which enable her to challenge authoritative discourses of teaching-as-usual.

In this chapter I argue that the process of becoming a teacher is one that requires reconciliation of positioning and identities within contradictory and multiple discourses and relations of power which entails resistance, compliance and negotiation.

Regulatory and Normalising Practices

All eight participants carried out their placements in schools in which the children were set across classes in year groups and grouped within sets by ability. Organising mathematics lessons by ability sets across parallel classes, with ability groups within these sets, is widespread in KS2 classrooms in the UK. Despite seating children in groups, research into mathematics teaching has found that most academic work within groups is undertaken by individuals (Askew, 2001). Bibby (2011) argues that these groupings are more collections of individuals than groups.

A prominent feature in the way the students talked about the children they taught during their placements was in terms of National Curriculum levels and ability. They were very aware of 'levels' that teachers had attributed to children and did not question the practice of setting such levels or the appropriateness of the

assigned levels. These levels seemed to be unchallengeable, for example, describing her final placement school Pippa said:

> I had four children in the class who were like level 4 in year 3, so I knew they would just do their maths straight off. (Pippa)

Jackson and Dempster (2009) argue that in the current neo-liberal climate, the product, not the process, of teaching and learning is emphasised and rewarded. Children are expected to achieve level 4 by the end of year 6. This is highly significant as league tables for primary schools measure and publish the percentage of children who achieve level 4 in the mathematics and English SATs tests. Schools are then ranked and judged on this achievement. Marks (2011) found that it was not uncommon to hear pupils referring to themselves by National Curriculum level. Amy noticed that the children in her placement class, as well as the teaching staff, were also very aware of their current level in mathematics.

> My school valued their IQs very highly because it was a very middle class school and they had to do entrance exams for private schools. So, they [pupils] were very aware of their levels and that they needed high levels. I think it would be different in other schools. (Amy)

Amy also seems to be conscious of higher expectations held for children in her placement school in an affluent area of London, than in schools in less prosperous communities. Mike was conscious of the significance of SATs results and the

importance of work the school needed to do to maintain their performance and achieve competitive results. Talking about his final placement school he said:

> They had SATs that they were going to do. I was made aware of all the different levels and who had and hadn't progressed and all that kind of stuff. You know, it was obviously the big deal. The big deal was numeracy and that really, really reinforced in my mind it is a big deal to me. I still feel that numeracy is a big deal. (Mike)

The impact that preparation for high-stakes national tests and performance tables has on working practices in English primary schools is widely recognised (Harlen, 2007, Kelly, 2006 and Lerman, 2006) and becomes part of the discursive frame of the schools in which student teachers are located and constituted.

Students in the study used labels such as high ability, middle ability, low ability, the top, the bottom, the highers, the lowers and even the whizzes to describe the children they taught. Ability is seemingly regarded as an immutable part of the child's personal makeup (Walls, 2009) as the children are recognised in the language of normalisation/abnormalisation and compared and ranked. Gillborn and Youdell (2000) argue that a belief in the distinct abilities of individual pupils is a fundamental assumption at the heart of contemporary education reform and the notion of ability as inborn intelligence has come to be seen as a natural way of talking about children that summarises their perceived differences (Hart et al., 2004). This reflects how some of the students regarded each other. Pippa suggested that I should group students by mathematical ability to work together during university sessions.

Pippa: I think it might be an idea to put people of different maths ability in different groups.

Hart et al., (2004) observe that national policies promote these assumptions, making it essential for teachers to compare, categorise and group their pupils by ability in order to provide appropriate and challenging teaching for all. The Teachers' Standards (DfE, 2011b) states that teachers must:

> have a clear understanding of the needs of all pupils, including those with special educational needs; those of high ability; those with English as an additional language; those with disabilities; and be able to use and evaluate distinctive teaching approaches to engage and support them (p. 6).

Practices of 'differentiation by task', that is to provide different mathematical tasks for the identified groups in the class, thereby become essential to cater for and challenge children across the range of levels. As Walls (2009) notes, in measuring, classifying and ordering children according to frameworks of normalisation, it becomes possible to differentiate. When the National Numeracy Strategy (DfEE, 1999a) was introduced in 1999 teachers were required to differentiate mathematics lessons to three levels. Pratt (2006) argues that tensions were created for teachers in controlling what is learnt and being accountable for it. As Twomey Fosnot (2005) explains, all children are expected to understand the same mathematics in the same way at the end of the lesson. They are assumed to move along the same path. If there are individual differences it is viewed that some children naturally move along the

path more slowly and hence need remediation. However, Brown and McNamara, (2011) contend that we cannot assume consistency between children as to their apparent readiness to occupy new understandings and that this readiness is not straightforwardly associated with broader mathematical ability.

Walls (2009) argues that children's subjectivities are made in this authoritative discourse, through assessment, grouping and differentiation practices in the way in which they perceive their work being evaluated. Schools act as disciplinary institutions in which the child is subjected to a normalising gaze according to the classification systems schools create. Walshaw (2010b) suggests that these 'dividing practices' are instrumental in shaping the way that teachers think about particular pupils and how pupils come to think of themselves in ways that have been shaped for them. Both teacher and pupil begin to act accordingly, assuming that in every class there will be some children who naturally 'understand' numbers and are able to think and reason logically and others who cannot. This regime of truth is brought about by social practices.

Compliance

Most of the students in the study described their attempts to implement the school practices of differentiation in terms of the difficulty of appropriately mastering the task, which required a substantial effort and exertion of energy. They struggled to be recognised as viable in their ability to carry out practices of differentiation and some students judged themselves negatively, due to their perceived failure to act legitimately within these discursive practices. For example Anna describes the challenges she faced.

> It's hard when there are lots of different children with lots of different misconceptions about something. I think that's why I found that one of the most difficult things with teaching was just there are so many of them and they've got so many different needs that you've kind of got to try and cater for all of them and it's so hard when you feel like you're really helping a few children and then there are some children that are obviously just not getting it and being in many places at once and sometimes at the end of the lesson someone has done really well but sometimes you feel like maybe you've let someone else down and I think that's one of the hardest things. (Anna)

Britzman (1991) describes three seemingly inescapable myths that all student teachers are summoned by, which she identifies as: everything depends upon the teacher, the teacher as expert and the teacher is self-made. The first myth represents the requirement to control learning, which means that knowledge is reduced to packages that can only be effectively transmitted to a well-behaved class and consequently pedagogy becomes a means for delivering the subject matter. The cultural demand that everything depends on the teacher means that teachers often internalise issues that arise with behaviour and learning, blaming themselves rather than reflecting on the power relationships that shape classroom life. National policies work to make the teacher individually responsible, for example, the Teachers' Standards (DfE, 2011b) state that teachers must: 'be accountable for pupils' attainment, progress and outcomes' (p. 5). In this discourse Anna has little option

other than to view herself as being responsible for all the needs of all the children she teaches and where she recognises that this is not possible to achieve, she feels it is her fault. Likewise Mike also focuses on his responsibility to control the learning for all pupils.

> I had quite a number of differing abilities in the second placement. The first placement there were 6 forms and so they were quite well streamed whereas in the second placement there were only 2 and within my slightly lower ability maths group they were differentiated 4 ways at times and I found that initially quite tricky because the more able children were grasping the concepts and I found it hard to get through to the least able. I just couldn't pitch it low enough. I had to keep going lower and lower and lower. (Mike)

Mike talks about the 'more able' grasping concepts and his difficulty in 'getting through' to the 'least able', focusing on simplifying tasks and his attempts to deliver knowledge. Bibby (2011) argues that the 'it' that has not been 'got' suggests knowledge that can be considered in discrete packages, split off and separate from the knower. She maintains that discrete knowledge is one of education's sustaining fantasies. 'If 'it' exists then a good teacher could/should give 'it' to me' (p. 108). Amy relates similar pressures and stresses.

> I remember teaching a child fractions and they had no concept of what even a half was and I tried everything to try and explain it to him. I didn't

> even know where his misconceptions would lie with it because I had a cake and I was cutting it in half and there were two halves. I couldn't think any more simply than that. You start to say it slower and more loudly because you can't think of any other way to explain it to them. (Amy)

Bibby (2011) argues that teachers are required to tolerate their own states of not knowing as they attempt the task of helping children to face the difficult work of learning. She contends that not engaging with their not knowing is an ethical issue. Amy used the word 'struggle' thirty six times across her 40 minute interview as she described both her struggles to teach and explain mathematics and the children's struggles to learn.

Another extract from the interview with Amy shows how she took on the dominant classroom pedagogies in her school and the assumptions about learners and learning.

> In all my schools I've ever been in they were set. But the lower groups, I found were so diverse; the ability levels were just phenomenal, especially in my last group. I had children who couldn't understand the bare essentials of maths, kind of thing, even, you know, they had difficulties knowing what the inverse operations were; just even doing a simple sum, they would struggle with. Whereas I had the highers who would fly away and finish their work within seconds all be stood next to me waiting for an extension sheet. I had one lesson where I had 5 different extension sheets

because I was so used to the children coming up asking for extensions whilst I was trying to explain the very first question to the lowers. You would keep giving them sheet after sheet, kind of thing and it's very difficult because your concentration seems to be taken up on the lowers and also we found in the class, the lowers, they weren't even listening to the introduction. When you were introducing the idea and everything because they almost knew that they would then be explained it afterwards. (Amy)

Amy is entangled within school practices of keeping children busy by making sure they always have another sheet to do, promoting a version of mathematics that values speed. In these excerpts Mike and Amy seem to lay the responsibility with some children for not having the appropriate motivation or ability to learn mathematics. They do not recognise how children are constituted and maintained as low achieving by institutional practices.

Pippa explains that whilst she predominantly employed ability grouping within mathematics lessons she occasionally incorporated mixed pair work.

Pippa: I didn't specifically do it [mixed ability] apart from when I wanted them to sit with someone for checking over their work. I sometimes moved them to sit next to a child with a higher ability. But then I thought it was a little bit unfair to the high ability child because they'd have to be a nice child to

work with a low ability child and just tell them what they're doing. I think it's slightly unfair to the high ability children.

JA: In what way?

Pippa: OK, they're explaining something and reinforcing their own learning but they should be doing far more bits of learning. They shouldn't be learning the same thing twice over.

That mathematics ability is innate and immutable frames Pippa's reflections as she categorises pupils. She seems to empathise with the children designated as 'high ability' and their frustrations at being required to work with peers of 'lower ability' as if this is a natural response. Pippa also seems to be drawing on internally persuasive discourses which originate from her autobiography in her interpretation of the children's emotions during pair work. Pippa is highly educated in mathematics and, as discussed in the previous chapter, had not found collaborating with her peers during university based mathematics sessions beneficial.

Within hegemonic discourses of accountability either the individual teacher or the pupil are constructed as responsible for the failure of a pupil to demonstrate 'normal' progress. Klein (2008a) argues that humanist readings of learners assume a rational individual so when learning outcomes are not met, attention turns to the individual learner rather than the regulatory and constraining teaching practices. Bibby (2011) maintains that coming to know is an active process of tolerating anxieties and enabling links to be formed; so refusing to know is an active process of

breaking links and defending the self against seemingly impossible difficulties. She contends that neither process is passive. Brown and McNamara (2011) suggest that pupils may choose not to comply with officially sanctioned modes of mathematics education and resist these approaches in many ways, such as dulling senses or mere non-engagement.

Survival

Hardy (2009) argues that prevalent themes and difficulties with mathematics teaching are repeatedly reported in government publications, media stories and research findings. She claims that such accounts perform an essentialising shift where the question 'what is the problem with primary students' mathematics teaching?' can become 'what is the problem with primary students' mathematics?' (p. 188/9). These discourses interact with other stories, which frame mathematics as the ultimate form of rational thought and so a proof of intelligence (Mendick, 2006). They overlap with Britzman's (1991) second myth of 'the teacher as expert'. Britzman argues that supervisors, class teachers and pupils expect student teachers to know everything about their subjects and this can become a principle source of anxiety. She suggests that they may see their teaching practice as an opportunity to expand their 'bag of tricks' so their survival in the classroom in guaranteed. By bag of tricks Britzman is referring to classroom experience and 'tricks of the trade' such as providing suitably differentiated worksheets and appropriate explanations. The problem arises when students focus in on such practices rather than engaging in problems of how we know, how we learn and how we are taught. The highly regulated context of primary education works to constitute appropriate professional practice as the effective management and organisation of learning rather than an

engagement with an exploration of mathematical relationships, the nature of mathematics and how children learn mathematics.

Pippa describes her efforts to establish herself by performing the routines and pedagogies of differentiation and ability grouping.

> I was finding it difficult to teach for starters in the style of teacher, let alone to try out new things. I think it's 'how realistic is even mixed ability groupings?' (Pippa)

Pippa found it difficult to operationalise the institutionalised practices of her class teacher in the school in which she was placed. She was concerned about her efforts to manage behaviour and she quickly identified the imperative to focus on gaining legitimacy within the discursive practices of the placement school rather than resisting their practices. Walshaw (2010b) argues that for student teachers to be recognised as legitimate requires working out what is open and what is not open for negotiation and then determining the remaining options and their likely costs. Pippa seems to exemplify this process.

> Coming to be on placement, it's more a case of assessing what the school is like and how much leeway you've got with the teacher and then, obviously, build a relationship with the children. Then something else to think about, for example, is if the school seems okay with you just doing it as the school has been doing, even if you aren't particularly happy with that teaching method. (Pippa)

Britzman's (1991) third myth is represented by the notion that 'teachers are self-made'. She argues that teacher education is seen as a 'tortuous moment that tests the inner strength of the novice' (p. 230) and student teachers are often forced to find the most direct route to survival in a system of rigid and high expectations with little margin for and willingness to forgive errors**.**

MacNaughton (2005) argues that officially produced and sanctioned truths resonate more powerfully in and through us and form regimes that govern what are held to be normal and desirable ways to think, act and feel. The students' developing subjectivities as teachers seem to be becoming strongly constituted through these authoritative discourses. Within the classroom the class teacher authorises practices that regulate minute details of space and time which normalise observable practices (Walshaw, 2010b). The arrangement of the furniture, though seemingly a small detail, acted as a technology of normalisation for Chloe.

> Actually reflecting back on it now I feel like there are times when, maybe when I should've used the opportunity to try mixed achieving groupings but I think, just in terms of supporting groups it was just maybe easier at the time to say, well I'll work with those target children, those, those, those. And also, I know it sounds really silly but the layout of the classroom didn't help the groupings because our tables were literally, like, two, two, two, two, two, two, two, two. So obviously sometimes we pushed the tables together and worked in a group but predominantly it was just pair work. (Chloe)

Talking with me during the interview seemed to have opened up a space for Chloe to reflect on the overlapping and conflicting discourses through which she was operating, as she explained how the children were grouped and how she might have grouped them differently. She also discussed other practices stemming from discourses of accountability, such as the requirement in most primary schools for teachers to ensure children record work in books and copy down the learning objectives for each lesson. She was very aware of the potential scrutiny of her pupils' exercise books by the head teacher and the class teacher. She described a series of open ended mathematics lessons which she planned and taught across a week where the children followed through the data handling cycle of gathering, representing and interpreting data. She explains why she did not repeat similar activities across her placement.

> I know it sounds really silly but I was really conscious of the fact that they hadn't written down a date and a learning objective in their exercise books and that the teacher or the head teacher or anyone coming in could look at that and say well what did they do from that date to that date? There's nothing in their books. What did they do? (Chloe)

Time and pace was another issue that arose for a number of students. Helen describes trying to manage these expectations.

> When you're in school, I think it's particularly because you're on placement, your class teacher expects you to get through these maths lessons in this order. You don't always have time. The next day you've marked all their books from one day, you know you've made a right pig's ear of whatever you were saying, or you haven't explained it well enough to them, for them to understand and you can't go back on it, because there's not enough time for what your class teacher is expecting you to get through. But I think when it's your class, you can make the time, if you know what I mean. (Helen)

Bibby (2011) argues that the accountability culture has come to shape education at all levels. She found in interviews of KS2 teachers that they 'generally indicated the pressure they felt under to 'shove', 'hammer', 'push', 'cram' and 'force' knowledge into children so that they would make at least the expected progress' (p. 50/51). This pressure is inevitably passed on to student teachers.

Power operated on the student teachers both at the macro and micro levels within the relationship between the student and the class teacher. Nicola explicitly identified the regulating gaze of her teacher.

> I felt as if there was always someone watching over me at the back of the classroom like the class teacher and it really just put me off. There were times when I thought, 'I'm just going to stick with her way'. (Nicola)

Walshaw (2007) observes that there is little that goes on in relation to the student teacher's classroom practice that the class teacher will not find out about. She suggests it goes some way to explaining why student teachers prefer to copy and adapt ideas for planning and teaching that have been suggested by their class teachers, rather than drawing on their own knowledge. She argues that pedagogical relations between student teacher and class teacher are fused within networks of power and that, with this assumption, teaching practice is a strategic political activity. She contends that it is impossible for student teachers to practise disinterestedly in schools because their practice always works through vested interests, both their own and the rhetoric of others.

Self-worth Protection

Tom is also consciously aware that he complied with the practices and operated within the discourses of his placement schools. Like Helen, he suggests that when he has his own class next year, he will have more agency to implement practices based on his own beliefs, though he is not yet sure what these will be.

> I probably wasn't very, what's the word? Well, I didn't change much. I think I made a subconscious decision, looking back, that on the placements I wouldn't actually change much. I don't think teachers like you to change much. That's not necessarily a very good reason not to but because I think of myself as an inexperienced person, that I would try it their way. And then, you know, I've got my own class next year, so I can do it as I think. (Tom)

Brown and McNamara (2011) found similarly optimistic student teachers in their own study. They argue that it seems impossible for new teachers to appreciate fully and then reconcile all of the alternative discourses acted through them. They contend that professional development needs to include further intellectual and emotional work to reconcile the contradictory messages encountered. For Tom, his own experiences of learning mathematics and the classrooms in which he was placed as a student teacher shared very similar pedagogies and assumptions about learners.

Tom: A lot of the teaching I saw in schools is much like the teaching I had at school. I don't know whether that's a bad thing or not because I haven't seen much teaching yet, actually. It worked for me, the way I was taught but I'm not sure. I knew how to pass exams. I knew how to answer questions. I knew how to use certain methods to find things out but no, I didn't know what I was doing when I was doing something. If I was multiplying two numbers, I didn't have a clue what I was doing. I was putting a nought there, I was putting the next number next to it and it came to an answer and that was all that really mattered because you got a tick. I'd say most of the teaching I saw and the planning that was going on for when I was teaching and a lot of the planning I was doing myself was a lot like when I was at school. I'd say from my own point of view of my planning, because there was so much to do this year, yes, I probably took a maybe simpler way of doing some lessons because, actually, I feel I need to think more about things if I'm going to try and do it in the way that I'd

really like to do it. It would actually take a lot more time at the moment. I think that will develop over time.

JA: What do you mean by the way you'd really like to do it?

Tom: Well, I really very much value what social constructivism stands for.

JA: Which is?

Tom: Well, children creating their own learning. Okay, that's like the sort of the tag line for it, I suppose; where children are actually investigating their own things and coming up with things themselves, instead of being told this is how to do something.

JA: And why do you think that's what you want; that's what you like?

Tom: Because I can see the skills it develops in children and when I've done investigations and problem solving, there is something..... I haven't probably reflected upon it as much as I might have done with more time. But there is something about children working things out for themselves and what they get out of that as well, partly in terms of, you know the sort of eureka moment thing that people talk about where they actually realise they've understood something which they didn't really think they could do.

Tom seems to be trying to reconcile the discourses of the primary school classrooms in which he was placed, his own internally persuasive discourses and past experiences and competing discourses about teaching and learning from the university mathematics sessions. He talks about 'social constructivism'; a theory of learning often discussed during university sessions and discusses discourses of understanding and investigation. Walshaw (2010b) argues that dividing practices that are at odds with each other are most keenly felt by student teachers as they move from one disciplinary institutional site to another. Both sites, the primary school and the university, attempt to regulate the student teacher's behaviour and pedagogical practice.

Tom is explicitly aware that he did not enact the pedagogy promoted by the university during his school placements and he is aware that he did not think about how the children were learning.

Tom: I think part of that is me taking the easy way out during this year, as well i.e. perhaps not trying to be as imaginative or perhaps creative as perhaps I can be because it's sort of getting through the year thing. I knew it was going to be hard work but it's been a long nine months. So, by the end I really enjoyed the second placement but I don't really think I've stretched myself, not work wise but stretched myself thinkingwise about how the children are learning this year because I figure out I'm going to get more experienced and it will develop. I suppose there's a touch of laziness in that.

JA: Do you think you've been given space to reflect on things?

Tom: Not really but then, as I said to you before, I needed, and I have done over the year, to do better with my time management.

Tom draws on discourses of masculinity to explain his compliance during his teaching practice. This parallels how he portrays his participation during the university based mathematics sessions, discussed in the previous chapter, where he describes performing a more passive role if he identified another 'strong' student in his group. Burke's (2007) study of the accounts of men participating in access and foundation programmes found that a key theme in the men's talk is a natural tendency towards laziness and disorganisation which are discursively constructed as essential male characteristics. Tom draws on these gendered responses to explain why he complied so fully with the classroom discourse during both his placements. He says that he did not 'stretch himself thinkingwise' and identifies two reasons; laziness and poor time management skills. These responses enable him to reclaim an identity as someone who can think deeply and act accordingly despite his 'laziness' or given more time. Jackson (2003:585) argues that constructions of natural male laziness operate as a 'self-worth protection strategy'.

Resistance

Hart et al., (2004) argue that there is little scope for teachers who reject the fixed view of measurable ability to hold on to their principles. Many of the students

in the study did express their discomfort with ability grouping and differentiation by task. Nicola is critical of the pedagogy that her class teacher employed.

Nicola: I'm always a bit sceptical with differentiation because you don't want to underestimate what children can do by giving them work that's too easy for them.

JA: I think what you're saying is; you feel those who have been identified as lower achievers often benefit less. Is that what you're saying?

Nicola: Yes, definitely, particularly for maths because they know that they're not in the top group. They know and I just think that the effect that that has on their self-esteem and therefore their view of the subject is kind of; you're starting on a negative before you've even moved on, in my opinion.

Nicola seems to highlight how categorising learners exerts an impact on their relationships with mathematics and their developing subjectivities. Nicola taught the highest set during her final placement and felt required to maintain the practice, already established, of ability grouping.

Nicola: I had to do what was done already, unfortunately. If I'd had my choice, I wouldn't have done that.

JA: What do you think has made you come to those views that you hold?

Nicola: From experience.

JA: What experience is that?

Nicola: The teacher, I don't think, meant to say it. She has even said; 'oh come on, kids in my top set maths group, you should be able to do this' and like it's you know; kids go off and you know that they've gone to the low class group and you know that they're the middle. The kids in my class know that they're the top and they think they're amazing. And some of the kids in that class were over confident, if you ask me, because they are still children, at the end of the day. To see that amount of over confidence in a child is quite, in my opinion, worrying to them, because one day they might fail at something and then it makes me wonder how they would be able to cope with that, to be quite honest.

Nicola, like most of the students, complied with the established practices of the class teacher, however she resists these practices, criticising the teacher for the way she explicitly categorises children and positions the 'top set' children more powerfully within the classroom discourse. This sensitivity could have arisen due to how her own educational biography has constituted her subjectivity. Nicola was in the top set herself for mathematics when she was at school but was moved down to a lower set. She uses the term 'over-confident', perhaps to signify the unequal power relations that she perceives between the children, produced by the practice of setting

and ability grouping. Perhaps she is thinking of the emotions she experienced herself on being relegated to a lower set.

Amy, like Nicola, also complied with school practices of ability grouping. However, she too seems to be reflecting on her subjectivity as a teacher during the interview, caught between the tensions and inconsistencies of multiple discourses.

JA: So, what's your view on setting?

Amy: I still think it's..... Well, I don't know. I do kind of think it's good because of the diversity in maths ability, especially. But, at the same time, we had a lot of parents coming in all the time wanting their kids to be moved up a set and it really meant a lot to them. It was really quite…. it kind of determined who their children were to them, kind of thing and which I don't think is good and often we were doing the same work that the higher set were doing anyway and we'd plan it together but the highers in my class would be doing exactly the same as the higher set were doing whereas some of the lowers in my class would be given kind of additional help and support with kind of simplified questions.

JA: Sorry, can you clarify? What do you think isn't good?

Amy: I don't know. I'm split with thinking about setting the children. I kind of do think it was good but I kind of don't, at the same time.

JA: Tell me why you don't.

Amy: Because the children get their identity from it quite often. And the parents; we had so many parents coming in and being quite blunt that they didn't want their children put in the lower set and it was very….. it kind of defined their personalities in a way. So I don't know.

JA: What's your view on mixed ability grouping?

Amy: I think it is good and in general I would try to do mixed ability grouping for my classes but you do then have the problem that some children dominate and you would have lessons where the highers would do all of the work and the lowers would sit there and twiddle with their thumbs. So, you have to kind of monitor them really and make sure that the tasks mean that every child needs to be doing something and is involved. Yes, I would say that some children would make other children feel less adequate and they would make comments about their intelligence and things like that.

In Amy's analysis of how mathematics is taught at her placement school and the merits of their grouping strategies she seems to be caught up within a number of discursive practices. She shifts her subject positions frequently, switching between recognition of, for example, how grouping practices constitute children's

subjectivities, creating hierarchies which position children more or less powerfully and at other times, pathologising the behaviour of the pupils categorised by the school as the lowest of the low group, as passive, 'twiddling their thumbs'. At the same time she recognises the fallibility of so called ability groups as an arbitrary way to divide children up. She seems to embody the notion that Jackson (2001: 386) presents of 'the self as a site of disunity and conflict that is always in process and constructed within power relations'. Perhaps, as well as drawing on school and university discourses, she also draws on internally persuasive discourses from her own family experiences. She had a long standing interest in working with children with special educational needs and had previously gained qualifications in counselling and social care. In her personal life she was the main carer for her brother who was diagnosed with a mental illness.

Walshaw (2007) distinguishes 'three moments of identity' within teacher education and the importance of experiences within three contexts which present a different set of assumptions and demands. These are firstly students' own educational biography, secondly their personal experiences during their teacher education programme and thirdly their involvement in teaching practice. She argues that different discursive practices are made available through these different contexts and each represents different and competing relations of power.

Helen also describes her own practice in relation to her educational biography and her personal experiences during the university based part of the programme. She describes how she taught mathematics to her pupils during her placement. She explained that she often grouped children within the top set that she

had been allocated into mixed ability groups, encouraging children to explain the mathematics to their peers.

> I found that was one of the best ways to stretch my higher achievers. It was a lot more, beneficial for them, I think, to know why they were trying to explain something and know what they were doing and the process behind it. For them to explain it and say to me what their [the lower achieving children's] problem was or what they found difficult about explaining it and then that sometimes picked up on what they might not have understood securely in the way that they explained it back to me. (Helen)

It is noticeable that Helen uses the terms 'higher and lower achiever' rather than 'ability' which denotes perhaps the concept of mathematical performance as fluid and changing rather than a fixed, innate ability, avoiding implied predictions relating to future performance. Helen implements talk as a key pedagogical strategy, encouraging children to ask questions and explain their strategies to each other and to reflect on and talk about what they found difficult. She seems to reject a traditional version of mathematics which promotes unreflective performances of mathematical procedures.

> I struggled a little bit because my class teacher is very different to me in her style and it was a very test orientated school. It was quite difficult because they would say, 'I found it really hard', but not be able to explain

> why they found it hard. They were working really fast because they thought they had to get through everything. And I would say I'd rather that you did a couple of questions and I knew that you understood how you were doing them and you tell me if you were having a problem, rather than you rush through them and I spend all my time marking them incorrectly and then we have to have another discussion another time. I think some of them thought I was joking at first when I said that to them because they were like, 'what you don't mind if we get them wrong?' and I'm like, 'no I'd rather you get them wrong, then we can talk about them and then we can find out why, what's wrong, what you're not particularly understanding. (Helen)

She felt the school focused on teaching children to perform well in their SATs tests and describes the school as 'test orientated'. She tried to challenge the authoritative discourse of classroom mathematics where individual work, speed and correct answers are valued, instead trying to focus on methods, strategies and understanding and to change the norms regulating how mathematics was learnt in the classroom. She is conscious that this style of learning reflects her own preferences. Indeed the pedagogy she describes implementing in her placement school directly parallels the way she studied with her peer, Catherine, as her sub teacher, discussed in the previous chapter.

> I try, when I'm in the classroom, to say there's no stupid question, to try and get the higher achieving children to explain it to the lower children.

Which is how I liked to work sometimes when I was in the group. I'd quite like it when Catherine, helped me a lot, like just breaking down the ideas and explaining them, then if I didn't get it she'd know and she'd try and explain it to me in a different way and so that was like really useful to me because I knew I could ask her a question and she wouldn't think it was a stupid question and could like build on it and develop my confidence that way. (Helen)

Negotiation - becoming teachers of mathematics

I wanted to know how the students viewed themselves as mathematics teachers. In their answers they tell stories about themselves. Their identities are constructed through these accounts, rather than being revealed or exposed. For some of the participants a shift is evident in their developing sense of selves as prospective teachers. This seemed to be the case for Helen and Chloe who started the course feeling very anxious about mathematics and teaching mathematics and had felt marginalised by some of their peers during the taught university sessions. Helen's and Chloe's responses were very positive. They both seemed to link confidence to competence and survival (Hardy, 2009).

Helen: A lot more confident than when I started. There are still areas that I'd like to work on, but I think that's the same with all of the subjects, but, for maths in particular I do feel a lot more confident in teaching it, a lot more, competent when I'm teaching it.

Chloe: I feel confident now when I'm teaching maths. I feel that tomorrow I could go into school and they say we're doing this unit of work. I can go away and find the resources and come back and teach, I think, a good maths lesson. So yeah, I feel quite positive.

For Chloe and Helen the productive nature of interactions and relationships during their school placements seems to have constituted identities as legitimate mathematics teachers, enabling them to recognise themselves as generative and successful beginning teachers. Chloe was supervised on her first placement by one of my colleagues in the mathematics team. I recall my colleague telling me, with pleasure, about a mathematics lesson she had just observed Chloe teach. Chloe explained.

> I think maybe responses from my supervisor and my teacher, especially in the first placement, because I went out of my way to focus on my maths. They were really supportive and, you know they recognised that I have worked quite hard to try and be as creative with maths as possible. So I think that has all boosted my confidence. (Chloe)

Helen spoke about three different individuals with whom she had positive relationships, her supervisor, the parallel class teacher who was also the mathematics co-ordinator for the school and a parent.

> My supervisor picked up on, in one of my first observations, needing to use more technical, mathematical language in explaining and extending the range of questioning skills and the way I get children to answer and explain their responses. On my last observation, she observed maths and she said that I'd worked, really worked on the questioning skills and getting them to explain their answers in a more mathematical way. (Helen)

> The other class teacher who was in charge of maths was a bit more free on what I did, and I would show her my plans and she would say, 'oh yeah that's good or you could change it here or, I think they'll really enjoy that'. (Helen)

> A parent came up to me and said, 'oh, Tommy had the most fun maths lesson yesterday' and we hadn't even really been doing anything particularly exciting, but like, I think it was just the way that I allowed them to have a discussion in maths. (Helen)

Helen and Chloe seemed to have established a relatively secure identity of themselves as teachers of mathematics. Bibby (2011) argues that our most fundamental desire is for a secure identity, to know who we are and to feel that who we feel ourselves to be is seen, recognised and valued by those who are important to us. She contends that a secure identity therefore implies that we feel valued and acknowledged. The recognition that Helen and Chloe received may have provided

evidence that the way they were seen by significant people accords with the way they like to think they are seen. Bibby (2011) argues that if this gap is not too big then some sense of security is achieved. Brown and McNamara (2011) also found in their study that for some students a significant transformation occurred. However, they argue that the trainees' 'happy resolutions' related primarily to qualities of affect and pedagogy such as being sensitive, patient and supportive and mask their continuing anxieties relating to their own mathematical abilities

Tom and Amy, two of the students who identified themselves as confident with their mathematics subject knowledge at the beginning of the course, did not seem to have such secure identities as teachers of mathematics. I asked both how they saw themselves as mathematics teachers.

Amy: I see myself as having a lot to learn still. Maths is one of the subjects I really do struggle with to explain to children in my maths classes. The number of times I've said er and um is phenomenal. I really don't know how to explain things a lot of the time and it's trying to think things through. Once you've done it once, it becomes a lot easier. I think it will just come with practice. I don't really know how I see myself as a maths teacher. With all the other subjects it was a lot easier to assess how much they could do and also, it was almost self-differentiated because the end product, there wouldn't be a right or a wrong answer, whereas with maths it is right or it's wrong. There isn't really in between ground and so that's really difficult then because you need to then set questions that they are able to get right but which challenges them, so you really, really need to

know them well in order to do maths. It is the hardest one to assess, definitely.

Tom: A novice…I don't know…strangely, I think maths, for me, even though it's one of my stronger subjects, is still one of the ones I think most about when I'm planning and therefore, don't necessarily feel the most comfortable about teaching. I don't know if it's just about maths, I know it's not about right or wrong answers but it is more about right or wrong answers I think than other subjects. So, I think it's slightly harder to plan for than other subjects.

JA: Why?

Tom: Even after this year, I still think it's a harder subject than others not to fall back on worksheets. I think, again, that comes back to the right and wrong thing in maths but I know you'll probably argue that it's not necessarily right and wrong but I mean, obviously, if you're looking at like summative testing of maths, there are right and wrong answers. There's not so much scope for different thinking, I don't think, because you do have a right answer and you do have a wrong answer.

However, Tom seems to contradict himself later in the interview.

Tom: That's one of the things I've really liked to learn this year, is the many different ways children are allowed to work things out, because it wasn't even an option really, it wasn't something we were told we could try out other ways of doing things, when I was at school.

JA: Was that something your teacher was doing in her class?

Tom: Yes, though some of that seems to be normal practice now, doesn't it? I really see the value of giving children opportunities to use different methods to do things. I mean, maybe that's a different conversation but that's one of the things I've enjoyed learning that's changed since I was at school. I think this is very beneficial.

Both Tom and Amy draw on absolutist discourses of masculinity of the nature of mathematics and binaries of right and wrong. They seem to be constituted by a discourse of mathematics which frames it as a process for discovering a body of pre-existent truths (Mendick, 2006). These discourses, which tend to dominate UK classrooms, served Tom and Amy well in their educational biographies and enabled them to be positioned strongly academically in relation to their peers. Tom is aware that by aligning himself with this discourse of the nature of mathematics he is resisting conflicting perspectives offered during the mathematics course by acknowledging that I will 'probably argue that its not necessarily right and wrong'. Barrett (2005) argues that where a discourse invests one with power, it produces desires which work to maintain it. Perhaps Tom and Amy are reluctant to consider

competing discourses of mathematics for fear of losing their positioning as 'good at mathematics' and so choose to comply with authoritative discourses of mathematics sanctioned by their schools. However, Tom does align himself with less restrictive forms of mathematical knowledge in the second extract, though this was sanctioned by his class teacher. It could be that these authoritative discourses may have acted powerfully upon them in ways that MacNaughton (2005) proposes, makes 'it difficult to imagine thinking, acting or feeling in any other way' (p. 32) about mathematics. Tom refers to SATs tests in his response to my question about himself as a mathematics teacher, aligning himself with another authoritative discourse. In discussing how pupils learn mathematics, Hardy (2006) speculates that it may be that retaining a limited view of mathematics as right or wrong answers permits students to sustain a more complete picture of themselves as learners in relation to mathematics as a subject. It is easier to trust the mathematics if it only requires you to get the right answers. In the same way, perhaps Amy and Tom wish to retain a simpler view of what it is to teach mathematics. Neither seems be feel strongly positioned as mathematics teachers. Maybe they did not receive the kind of recognition that they desired from their class teacher and supervisor, which did not allow them to form a strong identity of themselves as 'good teachers'. Perhaps this encouraged them to hold on to their familiar discourse of mathematics in which, in the past, they felt valued and recognised.

By contrast, another two students who identified themselves as not feeling confident with their own mathematics subject knowledge during the course, report feeling more confident as teachers of mathematics.

Anna: Well I definitely see myself as more confident, particularly in second placement than the first one. I think I'm just getting more and more confident with it as I go on. I'm less scared of it than I definitely thought I was going to be. I didn't want them to be like failing their maths because I didn't know how to make it fun for them. So I feel a lot more confident that I can do some more interesting lessons for them where hopefully they won't be bored.

Mike: I hope I'm the same as an English teacher and a science teacher and an R.E. teacher and you know as far as I'm concerned there is no different need for a different subject. I'll try to be as kind and fair and interested and engaging. I want the children to have fun because I didn't have fun learning maths but then that's true in every lesson, really.

Both Anna and Mike focus on their role and success in making mathematics 'fun' for their pupils. Brown and McNamara (2011) found that a key feature in student teachers' construction of their own professionalism during their training related to their assuming some empathy with the children they encountered in schools. They felt that since they had suffered with mathematics in their own schooling they would have some success in sympathising with children when they encountered their own difficulties in mathematics. Brown and McNamara (2011) conclude that the students understood difficulties with mathematics as a problem resulting from transmission-oriented approaches to teaching. However, despite this approach being identified as the problem, the sophistication of the trainees' conception of teaching did not

develop sufficiently for alternative styles to be effectively implemented in their own teaching. Rather, they sought to achieve a less severe version of transmission, a delivery of mathematics but with an attempt to make it more enjoyable. Klein (2008a) also found in her study that student teachers positioned their pupils' interest as of utmost importance when teaching mathematics. She argues that there is an underlying notion that they are sharing their power with the pupils by harnessing their interest to invoke an inherent and unquestioned competence. The assumption is that if the pupils are interested they will learn. She argues that the teacher, deferring to humanist perceptions of the child, will favour enjoyment while the post-structuralist might insist that the opportunity to learn some robust mathematics and actively participate in the discourse might be more relevant.

When I asked Nicola and Pippa to tell me about themselves as mathematics teachers; how they saw themselves, they both started by discussing aspects of pedagogy.

Nicola: Creative. I like listening to children's ideas. I like encouraging children to work together on certain things. These kids were extremely used to working independently, just getting things done. I don't like that. It makes the teacher's life easier in terms of being quiet in the classroom and stuff so that they could get on with other work but then that's not teaching is it, in my opinion. I'm much more confident than I was before.

Nicola focuses on engaging with children and children talking and working together. She is clear about what she thinks teaching is not. It is not about the teacher

abandoning children ‘to get on with other work’. Bibby (2011) argues that entering the teaching profession involves a move to identify with social fantasies about teachers. These fantasies are similar to those of the ‘perfect mother’ and include caring, love and self-sacrifice. Perhaps Nicola is drawing on and resisting the practices of teachers who taught her and who expressed apparent indifference to pupils and lack of care by not engaging with them during lessons. Nicola’s concern with listening to children could also be viewed as an avoidance of engaging with robust mathematical knowledge.

Pippa seemed to avoid answering my question about how she saw herself as a mathematics teacher directly, instead discussing the way her placement schools planned for mathematics and her dissatisfaction that different mathematics topics were taught in isolation as individual, unconnected lessons.

Pippa: I think both schools were following ‘One hundred Numeracy Lessons’ and I didn’t get what the point of it was because it’s like 2 or 3 weeks on topic B3 or something and the last one we did in year 3 was like, the first day we did addition then we did multiplication, then we did fractions, then we did shapes then we did angles and I thought how are they even connected? What am I refreshing with these children if you only spend one lesson on adding? So, the school I will be working at, if they’re doing a similar thing, then I’m going to have to be really careful to look at my week’s worth of maths lessons and think what’s the point of this unit? It’s to learn about shapes and fractions and refresh addition and subtraction. So, I almost need to be able to see, right I need to teach about multiplication and

> doubling and halving to help them with equivalent fractions. The lessons in the little book [One Hundred Numeracy Lessons] just goes, you've got to teach them this and I think 'Why'? I don't get the point, it wasn't really connected.

She explains how she intends to plan lessons in the school where she will be working in the autumn. She focuses on different areas of mathematics and how she can support children in seeing links between the topics, giving an example of making connections between multiplication and equivalent fractions. Pippa's discussion made me think of the findings of the study carried out by Askew et al., (1997) who concluded that highly effective teachers emphasised the links between different aspects of the mathematics curriculum and believed that being numerate requires having a rich network of connections between different mathematical ideas. Pippa's discussion of pedagogy is much more specifically focused on mathematics than Nicola's. Nicola prioritises ways of learning, listening to children's ideas and collaboration, where Pippa focuses on supporting children's ability to develop understanding of mathematical relationships and the importance of a mathematical rationale for planning teaching. Pippa's identity as a strong mathematician, a position valued by government institutions, schools and the education research community alike, enables her to resist, in the interview at least, the regulatory practices of the implementation of the school's scheme of work.

Summary

In this chapter I have explored how social relations and structures interact to shape student teachers' constructions of themselves as teachers. Through student

teachers' accounts of their teaching practices in primary classrooms I identify some of the discourses and regulatory practices that produce students' subjectivities as they learn to teach mathematics.

Students describe the practices and organisational procedures of their placement schools and classrooms. Practices sanctioned within authorititive discourses of school mathematics, characterised by segregation by ability and discursive practices such as the use of differentiated worksheets and discrete lessons, are described by all. It is widely recognised that preparation for high-stakes national tests and performance tables impact upon practices in English primary schools. Discourses of ability and accountability shape education at all levels. Ability is seemingly regarded as an immutable component of the child's personal makeup and becomes part of the discursive practices of the schools into which student teachers are located and constituted. Hart, et al., (2004) argue that processes of sorting pupils into ability groups and differentiating are so familiar and commonplace that, at first, it seems impossible that teachers can accomplish all the essential tasks of teaching and managing a class of thirty without recourse to such judgements and practices. Within hegemonic discourses of accountability either the individual teacher or the pupil are constructed as responsible for the failure of a pupil to demonstrate 'normal' progress.

In accounts of their classroom experiences participants talk about children's mathematical levels and measuring their abilities, segregating grouping practices, differentiation by task, and preparing for SATs. They engage in discursive practices of labelling, categorising and essentialising pupils who resist authorised practices of

teaching mathematics or who are not able to position themselves positively within the construction of school mathematics. I argue that the vocabulary participants use to discuss their pupils and their practices in classrooms signify a submission to and to some extent a mastery of school discourses. I contend that regulatory teaching practices of how teaching should be conducted, which are sanctioned by government policy and taken up by schools, are compelling for student teachers who must position themselves legitmately within these discourses. The stakes are high, as they need the recognition and endorsement of their class teacher and supervising tutor in order to succeed and achieve the status of qualified teacher. Students' accounts are infused with submission, their struggles to survive and to be recognised as legitimate subjects. They are positioned within relations of power and judged by normalising criteria as either satisfactory or unsatisfactory beginning teachers.

Power relations feature prominently in the students' accounts. They are explicitly aware of their compliance within the discursive practices of their settings and for most it is a struggle to take up and perform those practices which are deemed appropriate. I argue that students' developing subjectivities as teachers become strongly constituted through these authoritative discourses. Some students tell of experiences where they felt scrutinised and obliged to conform to specific practices. Many of the students individualise and essentialise the difficulties they encounter, blaming either themselves or their pupils for their lack of knowledge, ability or motivation rather than the regulatory discourses and constraining practices to which both they and their pupils are subjected. I demonstrate that the pedagogical relationship between student teacher and class teacher is one fused with networks of

power. Walshaw (2007) observes that it is impossible for student teachers to practice disinterestedly in schools.

Both contexts, the primary school and the university, regulate the student teacher's behaviour and pedagogical practice. Walshaw (2010b) argues that dividing practices that are at odds with each other are most keenly felt by student teachers as they move from one disciplinary institutional site to another. It becomes apparent during discussions about their experiences in schools that students are caught between the tensions and inconsistencies of negotiating their subjectivities within multiple discourses. Most of the students complied with the established practices of the school and class teacher. However, they resist and criticise these practices during interviews. Some students seem to be in the very act of attempting to reconcile contradictory messages and conflicting discourses as they answer my interview questions. Evidence of this disunity is particularly visible in the case of the students who identified themselves as confident mathematicians at the beginning of the course. They draw on absolutist discourses of the nature of mathematics in their discussions of teaching, resisting other discourses offered by the university course. These three students were not able to position themselves equally as strongly as primary school teachers by the end of the course. The male student, however, is able to draw on discourses of masculinity which provide self-worth protection and enable him to reclaim an identity as a potentially successful, enlightened teacher.

The five students, whom in the previous chapter, were not always able to position themselves strongly as mathematicians within the context of the university-based course, identify feeling more confidence in their ability to teach mathematics.

However, for some, their newly constructed identities seem to be built on aspects of the management and organisation of learning such as making mathematics enjoyable rather than the nature of mathematical knowledge and learning. One student does report finding spaces and a degree of agency to subvert some of the dominant discourses of school mathematics and pedagogy. The language she chooses to use in her account emphasises her resistance as she possibly draws on discourses from the university course, describing high achievers rather than high ability children. She modifies and adapts the language and practices of her classroom setting and surprises her pupils by privileging interactive pedagogies and focusing on discussing understandings rather than right answers, thereby disrupting absolutist discourses of masculinity of mathematics.

The students in the study are in the process of becoming primary teachers, of creating an image of themselves and a story about themselves with which they feel comfortable, within structures of power and subordination. They seem to embody the constitution of their teaching identities as an on-going process and a struggle. Both discourses of masculinity and femininity are drawn on as well as educational biographies, internally persuasive discourses and authoritative discourses, framing and shaping their practices. I argue that I have shown that the students' identities as beginning primary teachers are inventions of multiple discourses and produced with fragmented subjectivities, as they navigate and negotiate meanings of how to teach mathematics, of how children learn mathematics and of how to be recognised as successful teachers of mathematics, from moment to moment and between contexts. This process is on-going. Brown and McNamara (2011) maintain there is no final

story, rather there are stories that help for the present, as sense is made of the past and as movement nudges to the future.

Through my analysis I show that for these students, teaching is much more than a straight forward issue of subject knowledge and craft skills, that the rhetoric of government policy sanctions. I demonstrate that the process of becoming a teacher is an activity that requires reconciliation of positioning and identities within contradictory and multiple discourses and relations of power which entails resistance, compliance and negotiation between competing and often conflicting discourses. I argue that learning to teach mathematics is a complex, social activity in which students developing subjectivities as teachers are strongly constituted through the authoritative discourses of school mathematics and discourses of ability and accountability.

Chapter 7

Conclusion

This thesis examines student primary teachers' negotiation of multiple discourses, encountered in policy and practice, as they begin to form professional identities as generalist teachers of mathematics. Teacher education and primary mathematics education are fields that are highly regulated. It is important to examine and make visible the authoritative discourses and regimes of truth that constrain participation of subjects in often inequitable ways.

In this concluding chapter I first revisit the research questions and how they were formulated and then consider the methodological approach taken, particularly in terms of reflexivity and power relations in the research process. I go on to summarise the significance, implications and limitations of the findings presented and finish by suggesting directions for future possible research.

Research Questions

When I started planning this study, my initial research design centred myself in the research to examine my own pedagogical practices as an initial teacher educator of primary mathematics. I was motivated by a desire to empower my students; 'freeing' them from dominant beliefs about mathematics teaching. I believed that I could enable my students to become more critically reflective about the nature of mathematics and how children learn. The original study was driven by my concerns about social justice in mathematics education but also by a desire for

self-formation. I hoped that I could uncover the beliefs and meanings that individuals make to enable me to develop a pedagogy which would empower my students to teach in the way that I deemed appropriate. I began by asking; how can I develop my pedagogy for enquiry-based teaching of primary mathematics and how can I help PGCE student teachers become critically reflective teachers of primary mathematics?

My focus shifted as I became interested in the work of feminist post-structuralists who draw on Foucault's theories of power relations, discourses and subjectivity: I started to question my assumptions about how we come to know and what is knowable and to examine the discourses within which my students and I are constituted and constitute ourselves. The notion of a 'true' self, which is seen as existing outside of the social world as a fixed identity, underpins my initial research questions and methodology. A post-structural perspective views personal experiences as structural, cultural and discursive, rather than individual. I began to question my assumptions about knowledge and learning and reconsider my initial research approach.

My research methodology changed from a humanist quest to discover hidden meanings to an examination of underlying structures which generate meanings and of the way in which discourses construct the subject in relations of power located with the social world. My purpose became not to find the truth of students' understandings but to draw attention to the frameworks through which they view their experiences of teacher education and how they choose to act. I started to become conscious of power relations embedded in dominant discourses of

mathematics and teacher education which were previously unexamined concepts for me. I recognised that there is no 'real' mathematics but many different mathematics, which are products of social relations and multiple discourses. I became interested in the effects of humanist discourses which create seemingly unchallengeable, common sense 'truths' that classify and rationalise subjects into differential positions of power, and the way in which feminist post-structural tools can work to subvert binary thinking. I realised that it was important to decentre myself from the research, in recognition of post-structural perspectives. Collecting and analysing the stories of others, while allowing and prioritising my own mobility, can work to fix in place and categorise research respondents. Skeggs (2002) argues for turning away from self-telling, which relies on accruing the stories of others in order to make them into property for oneself. I am now asking different questions. I use post-structural theory as an analytical tool to identify, in the participants' accounts, which discourses and discursive practices are at work and their material effects. I examine how power operates to constitute learners and beginning teachers and how subjectivities are produced in the context of a teacher education course. My research questions are;

What are the different discourses, subjectivities and practices at play in the context of primary mathematics initial teacher education?

In what way do these discourses, subjectivities and practices shape and/or constrain the pedagogical experiences, practices and relations in primary mathematics initial teacher education?

Where are the spaces for resistance, change and/or transformation within and between these different discourses, subjectivities and practices?

Reflexivity

I aimed to take seriously the impact of my own subjectivity in the research account, which cannot be disentangled from the writing of it. Burke (2002) maintains that values, culture and social positionings are not dynamics that can be removed or isolated from research studies. My research has inevitably been shaped by my own subjectivity and the current socio-economic climate in which education and teacher education are located. Rather than ignore or deny the partial and interested nature of research, I have attempted to demonstrate how my subjectivity permeates my enquiry, impacting on all aspects of the research. I describe instances where I am aware that my investment in oppositional discourses is a deep rooted part of my identity. My humanist desires to emancipate and my fear of indoctrinating my students impact upon the questions I ask the participants and conversations I close down. I acknowledge how sometimes I catch sight of the way in which I draw upon humanist discourses, attempting to be detached and to speak less than the participants, indicating an unconscious effort to capture students' accounts and create boundaries between myself and interviewees in an exertion of power. I acknowledge how emotions play a part in the analysis. Stentoft and Valero (2010) argue that what appears in our analysis is inevitably the result of our prioritising and of our own interpretations. In my discussion of methodology I include some aspects of my perceptions of my own experiences as a learner of mathematics and as a teacher of primary mathematics, to highlight how I am a constituted subject and how my research is influenced by the discursive practices I am subject to. The selections

that I make from my data to include in this research account are not neutral decisions but are a reflection of my own conscious and unconscious baggage, just as my analysis of participants' accounts mirrors my own subjectivity. As a woman who studied mathematics and worked in the male dominated environment of computer programming before becoming a teacher I am interested in gendered responses and performances of gender. My own experiences of being categorised and alienated as a student of mathematics at school and university drive my interest in discursive practices of ability grouping, which currently dominate the teaching of primary mathematics. My efforts to write a reflexive account are inevitably limited as, from a post-structural perspective, the self is not rational and autonomous, capable of full consciousness. However, while detachment is impossible, I demonstrate that I take seriously the subjectivity that always intrudes as I offer a research account that invites questions and re-analysis.

Power Relations

My dual position of teacher and researcher created ethical dilemmas. Working from a feminist post-structural perspective it is necessary to acknowledge the asymmetrical relations of power in the research process and to accept that the researcher occupies a position of power, though as Skeggs (2002) observes, these are rarely easily known and may shift. I made every effort to address these issues through trying to implement a reflexive approach to the research process and I was mindful of the issues of imposing upon students' time during a very short and extremely overloaded course.

My study takes a conventional approach to data collection and analysis as I carried out the data analysis following the field work. This sequence of tasks did not happen by design. I did plan to overlap the data collection process and the analysis but due to the short time span of the research, the timing of the interviews at the end of the course, pressures of a full-time job and my on-going engagement with post-structural theories, I found an integrated approach difficult to operationalise. This meant that I was unable to carry out an interactive and collaborative data analysis which I had hoped would allow me to discuss the data and themes with the students, involving them as co-participants sharing data analysis. The analysis evolved in a rather organic way as I carried it out at the same time as developing my understanding of post-structural theories and discourse analysis. I found myself interpreting the data and my previous analyses with different perspectives and understandings on re-readings. In my discussion of the methodology in chapter four, I include an example of my changing perspectives on my analysis and acknowledge that I do not know if my participants would agree with my analyses or recognise themselves in the research account offered. I invite critique of my interpretations of the data and acknowledge that I can only offer partial and positioned accounts. I do not claim to offer accurate representations of the participants and I am aware that the lack of collaboration in analysing data creates a power relation in which I am positioned with authority. There is danger in this relationship that, if theory is imposed upon the students, their accounts are pathologised and opportunities to destabilise unequal relationships are lost.

There were some aspects of my methodology that were reciprocal and many of these were built on my relationship with the participants who were my own

students. My role as a tutor to mature PGCE students throughout a course based in multiple locations, demands mutual respect and trust. Through conversations during and outside of teaching sessions we shared experiences and information about ourselves. My commitment to my students is driven by this relationship, as is my sense of responsibility in the research encounter and the importance for this research of taking seriously the experiences of my students.

Haney (2002) argues that it is understandable why researchers should refrain from exposing their subjects to the social power of their analyses and texts as it could leave the participants vulnerable and exposed. However, as explained above, this was not the reason why I did not engage more collaboratively in analysis of data with my students. I feel that students did benefit from being engaged in the research as it provided an additional opportunity for self-reflection. I regret not sharing my emerging analyses as I feel I could have done this in a way, in my particular context, which facilitated students in reconciling the competing and conflicting discourses through which they are being constituted. This could have enriched their experiences and my analyses. I am wary of offering these thoughts, in case they are interpreted as a 'confession', as a means of evidencing my reflexivity. Instead I include these reflections only as the identification of an opportunity that was not taken.

Exploring the Research Questions

In the next section I address the main contributions of this work to the field of research on teacher education. I consider each of my research questions in turn and finish by considering the implications for teacher educators.

What are the different discourses, subjectivities and practices at play in the context of primary mathematics initial teacher education?

In this study I highlight some of the discourses that act upon student teachers of primary mathematics as they study for a PGCE in primary education. The field of teacher education and teacher development is discourse rich. An on-going national agenda of improving mathematics education has seen extensive publication of government policy, legislation, initiatives and guidance over the last decade. Within individualising neo-liberal discourses, strong emphasis continues to be placed by successive governments on the management, surveillance and control of teachers, schools and teacher training in the name of public accountability. Managerial discourses, which privilege teacher training rather than teacher education, locate teaching as a practical activity to the detriment of theory and analysis. The competent craftsperson discourse, which promotes teaching as a discrete set of skills and practical activities opens the way for multiple routes to qualification and reinforces oppositional discourses in which practice and theory are conceptualised as binary. In this binary pair, practice is positioned as being more appropriate and powerful than theory, which by contrast is constructed as being abstract and irrelevant.

Within the rhetoric of freedom and professional autonomy, paradoxically the control of teachers and schools is significant. Instruments of assessment, such as SATs, Teachers' Standards and Ofsted inspections, and practices such as target setting, performances tables and the evidencing of professional practice, act as tools of surveillance. Guidance on teaching approaches and best

practice, which include scripted lesson plans for teachers and teaching assistants, contribute to a discourse of blame which pathologises individual teachers, who cannot or do not adhere to these allocations of what it is to teach. In this way acceptable norms of behaviour and practice are established. Emphasis on desirable work habits, such as displaying learning objectives and writing them into books, neatness, speed, correct answers, completion and working independently, indicate that these skills are highly valued, establishing a concept of good teaching that supersedes concerns about children's mathematical understanding.

Discourses of ability have a strong hold in the United Kingdom. Marks (2011) argues that we have lost the capacity to see our everyday use of intelligence as in any way peculiar. In her study of primary teachers, she found that there seemed to be a lack of awareness of just how pervasive discourses of ability are and how much they invade the everyday issues of teaching and learning. Practices, such as differentiation by ability and ability grouping or setting within primary schools, appear to be common sense and natural within these regimes of truth. The product, not the process, of teaching and learning is emphasised and rewarded. This authorises the discussion and identification of pupils in terms of their current National Curriculum levels. Talking about children in this way, as a level, becomes hegemonic and works to essentialise ability. These assigned levels seemed to be unquestionable for the student teachers in the study who are actively striving to position themselves as legitimate within the authoritative discourses which define what it is to be an appropriate primary school teacher.

The hegemony of managerial discourses and the need to survive within a highly regulated environment authorise certain teaching practices. Teaching strategies which prioritise teaching to the test to achieve desired National Curriculum levels and successful SATs results become paramount. Highly structured teaching approaches become recognised as appropriate teaching, including careful control of classroom talk and behaviour, the transmission of knowledge and a focus on rote learning, the modelling of procedures to be practiced by pupils and planning lessons in discrete packages independent of other learning across the curriculum and devoid of meaningful context. It becomes difficult for teachers, student teachers and pupils to imagine any other way of teaching and learning mathematics. Both school mathematics and teaching are shaped by social agendas and dominant discourses.

The university course proposes different discourses of what mathematics is and how best to teach it. While these may be offered with the intention of enriching professional practices and children's educational lives, they also become regimes of truth for student teachers and these, too, can work to emphasise binaries and oppositional thinking rather than creating spaces for resistance and transformation. Gore (1993) argues that there are no inherently liberating practices or discourses and that power-knowledge can be seen to operate at the micro-level of discrete pedagogical practices. University based teacher education is situated within the same authoritative discourses as compulsory schooling and, as well as resisting dominant discourses, also inevitably acts within them. Student teachers are required to demonstrate that they have met Teachers' Standards (DfE, 2011b). The discourse of the competent teacher impacts upon assessment within initial teacher education. Discursive practices such as subject knowledge audits and skills tests can reinforce

official ways of thinking about the nature of mathematics and ability, rather than offer alternatives. Teacher educators who draw on humanist discourses, like myself, can present learning as a primarily cognitive endeavour in which achievement is linked to skilful teaching and individual motivation. Student teachers are positioned within both conflicting and overlapping discourses in the different locations in which their training takes place. Students are also subjects of many other discourses, which interlink and contradict each other as they form their identities as beginning teachers. Discourses that prevail in popular culture and internally persuasive discourses which originate in autobiography, located in family history, schooling, gender identities, faith traditions, cultural backgrounds and political commitments are all potentially significant. Stentoft and Valero (2010) observe that immediate discursive practices and identities intersect with life trajectories, past experiences and future aspirations of participants to constitute a landscape of learning. I address gender, in particular, in this study and discuss how recent media examples show that biological discourses about male superiority in mathematics are still influential. I highlight some performances of gender in spoken interactions at a micro level and gendered responses within the students' accounts of their experiences of the course both, on campus and in schools. I show how gendered discourses act as a form of control and categorisation of male and female students as they learn to teach.

In what way do these discourses, subjectivities and practices shape and/or constrain the pedagogical experiences, practices and relations in primary mathematics initial teacher education?

Three of the eight interviewees described feeling marginalised and silenced during my mathematics sessions. hooks (1994) comments that whenever students

share with her the sense that her pedagogical practices are silencing them, she examines that process critically. I attempt to do this, too, through using the tools that feminist post-structuralists have developed. I have observed many students respond to the experience of being in mathematics sessions by seemingly withdrawing participation and not outwardly contributing to discussions. To try to change the pattern of interactions during sessions, I increasingly attempted to minimise the amount of time that I talked and to increase opportunities for small group tasks and discussions. My unexamined assumption was that all students would then be able to talk and be listened to.

My analysis of students' accounts of their experiences during university based mathematics sessions identifies micro-relations of power between students that do not always allow for the full and legitimate participation of all. I argue that gendered performances of confidence and capability in mathematics establish unequal power relations. Bibby (2002b) contends that currently dominant discourses of mathematics are excluding generalist primary school teachers. Many live with an epistemology of mathematics that necessarily casts them as deficient in some way. Some students seem to be able to establish their legitimacy through a performance of their capability in mathematics by drawing on discourses of masculinity of competitive interactions with peers, performing a mathematics characterised by a speedy contest for right answers, rather than an intellectual and collaborative process. These positions are held in the study by both male and female participants. Their performances impose upon other students, notably those who draw on more discourses of femininity of supportive peer interaction. One student positions herself strongly within the female discourse of the primary teacher to occupy a powerful

position, a sub-teacher to her peers. Another finds security and a space to develop her subject knowledge and her mathematical identity through coalitions with other students. One male student positions himself within both a competitive discourse of masculinity and a collaborative discourse of femininity depending on the micro-context of his peers and his relationship with them. I disrupt the binary of powerful-powerless by arguing that the participants, at times, can be both powerful and powerless in different instances as they defend their positions, take up competing discourses and perform category maintenance work to re-establish acceptable norms of behaviour within group sessions, positioning themselves and their peers in shifting locations.

Stentoft and Valero (2010) argue that learning is an action performed in and through discursive practices and is strongly connected to the immediate identity of the learner. It is of great concern that the mathematics course is unable to disrupt either discourses of mathematics as masculine or student subjectivities that categorise some as lacking in innate mathematical ability. It is important that student teachers recognise themselves positively as mathematical subjects in order to construct robust mathematical knowledge and to realise themselves as actively engaged in the mathematics education discourse. As Klein (2004) argues, pedagogic experience is inseparable from what student teachers learn about the construction of mathematics and about instructional patterns and power relations. My study has enabled me to demonstrate some of the complexity of gendered subjectivities and dominant discourses as well as local power relations that generalist primary teachers encounter during university teaching sessions as they seek to construct new identities as beginning teachers of mathematics. I argue that while the mathematics course has

offered students a critique of current primary practice, it has not offered new discourses or made available alternative positions for all students to gain legitimacy. Gendered discourses of both mathematics and communication styles create tensions for the students in the study, as doing mathematics is consistent or conflicts with their gender identities.

My analysis explores power relations which act on students as they describe and make sense of their practices during their school placements. In these contexts all students experienced regulatory practices of how teaching should be conducted which, sanctioned by government policy, are compelling for the student teachers in the study. I received an email from one of my students in early October about one month into the new academic year and his new job. His message illustrates the regulatory nature of the teaching profession.

> Hi Julie,
>
> Just thought I might give an update to how I'm doing. It all seems a lot harder than actual placement but I am surviving. Seem to feel very restricted with my teaching at the moment. Planning power seems to have dissolved away into planning as a group and plans enforced are not the plans I would like to teach. However, I am still trying to inject some of me into the classroom. Really like my class. It is a very diverse mix of children and incredibly chatty, which I'm slowly but surely stamping out of them. My mentor is a life saver and really gives me good pep talks and the other

teachers generally are nice. I find the sheer volume of paper work bewildering but getting stronger every day. Hope you're ok and the next generation of PGCE are a good bunch.

Regards,

Kris

Carson (2007) argues that the powerful effects that the discourses of experienced teachers have on the identity formations of student teachers should not be underestimated. Carson contends that these discourses often pass unchallenged as the voice of the 'real world', as they work to undo other authoritative and internally persuasive discourses. Most students in the study complied with the discursive practices and authoritative discourses of teaching-as-usual. Some were explicitly aware of this compliance and talked about their feelings of being coerced. Others found it difficult to take up some of the sanctioned practices, such as the appropriate differentiation of mathematical tasks, and focused on their struggle to be recognised as legitimate within the discourse of a successful student teacher. For most, survival, rather than resistance, was a priority. Some students did not seem to question the assumptions inherent within school practices or the regulatory discourses and constraining practices to which both they and their pupils were subjected. Many others, while they did question and challenge some of the practices they observed and implemented, were simultaneously positive about their experiences, identifying a new found confidence in their ability to teach mathematics, as they both mastered and submitted to the recognised social role of primary mathematics teacher. Most

students were unable to find spaces to disrupt dominant school practices. Their focus became management and organisation of learning rather than how children learn mathematics and the nature of mathematical knowledge. During interviews the students inhabited shifting subject positions from one answer to the next, as they switched between competing and often conflicting perspectives as they attempted to reconcile their positioning and identities within contradictory and multiple discourses. Just one student in my interview sample reported finding some spaces to subvert some of the dominant discourses of school mathematics and pedagogy. She drew on her own internally persuasive discourses of how she liked to learn mathematics and surprised her pupils by privileging interactive pedagogies and focusing on discussing understandings rather than right answers, disrupting absolutist discourses of masculinity of mathematics.

Another email I received from an ex-student the following Spring demonstrates how, working within the environment of a school that, as a community, has found spaces to resist authoritative discourses of school mathematics, offers her access to different discourses of what it is to teach and learn mathematics. I include the beginning of a lengthy message that she sent me.

> I thought I would drop you a line to let you know that I am alive and kicking in Year 4! You will be very glad to hear that our maths co-ordinator at school is cut from the very same cloth as you and my experience has been fantastic. So great in fact that maths is now one of the lessons I look forward to the most. We are definitely a no worksheet school, and we have all developed interesting ways of getting rid of worksheets.

Where are the spaces for resistance, change and/or transformation within and between these different discourses, subjectivities and practices? (Implications for practice)

Hart, et al., (2004) argue that there is little point in universities being involved in teacher education if they do not see their primary role to be that of questioning existing practices and helping their students to examine alternative ideas which are educationally principled and important, theoretically coherent, evidence based and practically realistic. I argue that if universities are to fulfil this role, then teacher educators need to explore their own assumptions about pedagogical relationships, knowledge and power. According to Klein (2004) we need to create a discursive space that operates to unsettle the taken-for-granted assumptions of coherent identities of the learner as a rational and autonomous agent on which current practice is based. Mendick (2006) argues that we need to find ways of intervening into the binary discourses that frame our words, thoughts, feelings and actions about gender and mathematics. These challenges could be addressed within partnerships between universities and schools to investigate taken-for-granted practices and assumptions about learning and learners through collaborations with student teachers. Power relations between partners should be acknowledged and scrutinised and the status of teacher education within universities examined.

Teacher educators need to analyse what they prioritise during the limited time they have available with students. Walshaw (1999) observes that the task for all those engaged in education, teacher educators, teachers and student teachers, is to understand the way in which teaching is determined within the dense web of educational power. Using tools from feminist post-structuralism, such as Butler's

concept of performativity, can make visible binaries of male/female and mathematical/non-mathematical and how relations of power are constructed and maintained through dividing practices which objectify and classify.

Kalmbatch Philips (2002) argues the goal ought not be for students to examine themselves for the hidden or unsaid as in a rational model of enlightenment but rather to see and hear discourses forming teacher subjectivities and to question the authority of discourses. Johnson (1997) observes that post-structural models see 'expertise' as an ability to make sense of the discourses in which one is successively engaged. However, Bibby (2002b) argues that much as teacher educators might wish to transform the mathematical discourses of primary teachers, they must recognise that students have to manoeuvre themselves in, between or against the competing values inherent within the discursive landscape of 'official' mathematics. Students hold their own views based on personal experiences as learners and teachers and professional development. Carson (2007) suggests that it is in the negotiations between the authoritative discourses and internally persuasive discourses that teaching identities are most crucially formed. This is an important and often troubling site of negotiation for student teachers which, he suggests, is too often abandoned by teacher educators.

Brown and Jones (2001) argue that practitioners have a tendency to expect the research task to tell them 'how it is' so that they can then plan new strategies for the creation of new outcomes. Walkerdine (1998) also highlights the assumption that there is an easy relationship between research and practice. As she observes, we often feel guilty because we cannot simply produce the magic formula and identify

what to do to solve all problems. I am, therefore, tentative about identifying implications for practice arising from my study. I feel the main contribution of my research is to make visible how beginning teachers' professional identities are produced in pedagogic practices within discourses located in social norms. However, I would suggest that some key implications for practice in teacher education include the importance of providing student teachers with opportunities for negotiating their newly forming identities as teachers of mathematics. This could include giving them space, time and resources to identify and think through authoritative discourses from both locations of schools and university, for example, Britzman's (1991) three myths: 'everything depending upon the teacher, the teacher as the expert, and that the teacher is self-made'. Discussion of the implications of these common sense truths for themselves and their pupils could enable students to analyse relations of power in order to learn what is being produced. Student teachers could be encouraged to pay close attention to how discourses of ability work in classrooms to constrain, inhibit and limit achievement and constitute learner identities. Hamilton and O'Hara (2011) argue that this might be supported, not in condemning the use of ability grouping but through encouragement of thinking about practices surrounding it and in exploring the views of pupils who are at the heart of the process. Humanist understandings of empowerment in teacher education need to be reconceptualised. In this way, spaces for resistance can be prised open for both teacher educators and students teachers. Lather (1991) re-defines empowerment to mean analysing ideas about the causes of powerlessness, recognising systemic oppressive forces and acting both individually and collectively to change the conditions of our lives. However, Davies and Gannon (2005) contend that this form of empowerment does not presume freedom from discursive constitution and regulation of self, rather it is the capacity

to recognise that constitution as socially regulated and thus able to be called into question.

hooks (1994) argues that usually it is in a context where experiential knowledge is being denied or negated, that subjects may feel most determined to impress upon listeners both its value and its superiority to other ways of knowing. In relation to my own practice as a teacher educator, I argue that my resistance to official discourses of mathematics teaching and feelings of powerlessness have resulted in a practice that works to regulate students in the same way, by impressing upon them my perspectives on how mathematics should be taught. Through promoting social constructivism, collaborative peer learning and dialogue but not attending to power in pedagogical relationships, I did not address how mathematics is performed as male or female and how mathematics is constructed through discourses of schooling. I need to be open to possibilities for undermining discourses of masculinity of mathematics and to open more spaces for students to embody themselves as mathematics subjects differently and less oppressively, acknowledging that learning to teach mathematics is not solely a cognitive endeavour but one deeply located in social relations and contexts. However, Gore (1993) asserts that the teacher 'is' an authority. In her own practice Gore ceased trying to relinquish her authority on recognising the regulative function of pedagogy and argues for the importance of teacher educators using their own authority to engage students in explorations of pedagogy, which she does by more explicitly revealing her own regimes of institutionalised and feminist pedagogy.

Limitations

I have already integrated some of the limitations to this study in the preceding sections of this chapter. However, I now briefly discuss some additional constraints identified in my research.

Initially it was not my intention to specifically address the positioning of gender in relation to the negotiation of students subjectivities and I did not indicate to students that this was an area in which I was interested. It is beyond the scope of this study to address other identities such as social class, race, ethnicity and maturity. However, relations of power within, for example, classed and raced discourses, though not explicitly visible to me in the data, inevitably exist and intersect with gender and constitute differential positions available to students and the productive nature of interactions and relationships.

The study was small-scale and the field work was carried out over a short period of time. The majority of the data were produced through interviews with eight student teachers at the end of a PGCE course. Some data were generated through reflective emails sent to me by students during the course. The timescale of the course and the Ed D placed constraints on the number of interviews I could carry out. A PGCE course is a pivotal time for students as they start to construct new identities as primary teachers. Carrying out more interviews across a longer period of time and interviews in different forms, such as group interviews, could have enriched the data and produced more collaborative accounts. Power relations are always present, which I endeavour to take seriously through offering a reflexive account of the research process. However, there are limits to reflexivity and the subjectivity of the researcher always intrudes on the research encounter. I address the limitations of

my analysis of students' accounts at the beginning of this chapter and the danger of maintaining unequal power relations through the imposition of theory on students. As previously outlined, reciprocity in this research encounter is limited. Britzman (2000) warns against categorising participants as persons to blame or as heroes of resistance. I try to focus on questioning how the categories of blame and resistance are discursively produced and lived, rather than essentialise respondents. However, humanist views inevitably permeate my research as my subjectivities are discursively produced in dominant humanist discourses and old habits are hard to set aside.

Final Reflections

Further research about student teachers' identity formation as they move from teacher education to their first appointments is needed to extend analyses of how beginning teachers' own experiences and deeply held personal investments fit in relation to the authoritative discourses they encounter. Teacher education is currently experiencing great change as alternative routes to qualification are increasingly introduced and training schools established. Studies are needed to identify the impact of different methods of entry to the profession, to investigate teacher subjectivities and to examine how discourses of mathematics are presented and negotiated. The possibilities for finding spaces for resistance and change within all types of teacher training and education courses require further study, which could include collaborative studies located within networks and communities of teachers and teacher educators working in partnership.

Undertaking this study has been an absorbing and exhausting endeavour in which I have learnt a great deal, albeit not what I was expecting to learn. My initial purpose was a quest: the desire for resolution to a practical problem. Dominant discourses of teaching and teacher education promote teaching as straightforward. These can work to narrow the possibilities for thinking about theory and practice. Instead of gaining enlightenment I went on a different journey, on which I am still travelling. Engaging with feminist post-structuralist theories is a generative experience which has highlighted for me unresolvable problems and different ways of thinking about learning to teach. It is difficult to live with uncertainty. It is an appealing illusion that resolutions to the on-going tensions of transformation for social justice are easily achievable. In this study I have drawn attention to the complexity of the discourses in which my students negotiate their identities as beginning teachers and offer a better understanding of discourses of learning to teach mathematics through a detailed examination of their discursive practices.

Appendices

Appendix 1

Interview Question Guide

General Questions Guide for all participants

Thank you for agreeing to be interviewed. Your identity will be kept anonymous and you can decide to withdraw from the project at any time.

At this point, at the end of your PGCE looking back, can you tell me a bit about your experiences and reflections on the maths course.

How did you feel about your own maths subject knowledge at the beginning of the course? And now?

How did you learn?

Tell me about your experiences of learning maths when you were at school. How did you do? How were you taught?

What maths qualifications do you have?

One of the ways that I hope you will learn is through group discussion and sharing ideas.

Can you tell me a bit more about the discussions you had within your group?

Did you feel you contributed and were listened to?

When was and when wasn't group work effective for you?

We used a range of teaching strategies and activities during the course. What are your views and experiences of these:-

Reading and discussion of reading?

Discussion and analysis of videos?

Practical activities (doing maths, using maths resources)?

Presentations on planning?

Presentations about activities?

The maths audit?

Can you tell me about your views on inclusion in maths learning?

Why do you hold these views? What influenced you? Have they changed?

What is your view on ability setting?

What is your view of mixed ability grouping?

What messages did you take from the course on inclusion?

You learnt to teach maths in two very different places; at University and at school during your placements. Can you tell me about these experiences?

Did they link together? If so how? If not, in what way didn't they?

What were the similarities/differences?

What did you learn in the two different environments? How?

Tell me about you as a maths teacher – how do you see yourself? Why? Why do you think you are like this?

Has how you see yourself and feel changed over the year? How? Why?

What sort of maths teacher would you like to be in the future? Why?

What sort of learning experience do you want to provide for children?

What did you find most difficult about learning to teach maths? Why?

What were the difficulties or barriers to your learning during the course? Why?

How do you think you have learnt best during the year?

Do you feel that you've had space to reflect and think about maths and maths teaching this year?

If you reflect back now at the end of the course on your own experiences during the year of learning to teach maths what are the significant things that you experienced and the most important things that you learnt?

Questions for Tom

You say a number of times in your emails that you enjoy time to discuss with your group and you find this beneficial. Can you tell me a bit more about the discussions you had. Why you found them enjoyable and beneficial?

I remember during Semester 1 when you were presenting an individual lesson plan to the group you said at one point that 'we have decided to group the children by ability but I know we are not supposed to do that'. I found that very interesting as the implication was that you felt you were saying something that would perhaps be frowned upon. Can you tell me about it?

Questions for Helen

You say in an email that you found it hard to learn partly due to the people you were sitting with. Can you tell me a bit more about the discussions on your table?

Is it true to say that you were not very confident about your own maths subject knowledge during the course? You said in an email that you found maths quite tough. Can you tell me a bit more about what and why?

Questions for Chloe

You say a number of times in emails that you enjoy discussion. Can you tell me a bit more about the discussions you had and your experiences in terms of learning?

Did you feel you could ask questions whenever you wanted to?

You say that reading Briggs opened your eyes to the negative aspect of worksheets in terms of inclusion and differentiation. Can you tell me more about this?

Is it true to say that you were not very confident about some aspects of your own maths subject knowledge when you started the course? Can you tell me a bit more about that and why?

Questions for Nicola

You say in an email that you like doing activities with your table and being able to chat. Can you tell me a bit more about the discussions you had with your group?

You say in an email that you have become accustomed to being 'talked at'. Tell me about this?

You say in an email that you think pedagogical knowledge is the most important thing. Can you tell me about this?

Questions for Pippa

Can you tell me a bit more about the discussions you had with your group. What are some of the advantages and disadvantages of this way of learning?

You say in an email that some people hardly ever talk – did you find this true in group discussions? Why do you think this is?

You say in an email that you know you speak a lot in class. Is this important to you?

You say in an email 'it is also good to teach us like we are being told to teach in class'. Can you explain what you mean?

Questions for Anna

You say in an email that maths was the lesson that you were most afraid of teaching. Why?

You say in an email that you realise that you are better at maths than you thought you were. Can you explain/give examples?

You say in an email that you have been given a whole new perspective on the subject. Can you explain what you mean?

Questions for Mike

You say in an email that the course has given you lots more confidence which was evident in your teaching during BSE1. Can you explain/give examples? How has this come about?

You say in an email that maths is not your favourite subject. Can you tell me why?

You say that after the first shape session that sometimes the group went a bit fast for you. Can you tell me more about that?

After the algebra session you say that you are able to get to a certain stage beyond which you need the support of the others in the group who help you to understand how to construct patterns algebraically. Can you tell me more about that?

You say that it is sometimes a painful experience working in a group. Can you tell me more about that?

Questions for Amy

In one of your emails you said that it was useful to try and explain answers to the class and that it helps you think about how you'd explain this to your class. Can you tell me more about what you mean by this?

Roehampton University London

Appendix 2

Research participant Consent Form

Title and brief description of Research Project:

The aim of the study is to improve my practice as a teacher educator of primary mathematics. To help me reflect on my professional practice I would like to explore your learning experiences as a student on the mathematics PGCE course and the factors that impact upon your learning to teach mathematics to primary pupils. These might include your previous experiences as a pupil in school learning maths, your experiences of teaching maths in your placement schools and your reflections on your learning during mathematics sessions. It is hoped that the extra opportunity to reflect on your learning during your PGCE studies will be beneficial to you.

To carry out my research I would require participants to allow me to use in my study, work they complete as part of the PGCE course, such as written and verbal contributions. In addition you may be asked to participate in individual and group interviews. There will be no more than 4 one-to-one interviews at intervals across the programme. Any interviews carried out will last no longer than 40 minutes.
You may also be asked to allow me to observe you teaching mathematics during school placements.

Your decision to be involved in the project is entirely voluntary. Whether you are involved or not will not affect your progress on the PGCE programme in any way. You will be free to withdraw at any time without giving a reason, and free to request that what you have said prior to withdrawal is removed from the records.

Interviews will be audio-recorded and transcribed. I will be bound by strict ethical guidelines not to disclose any personal information or the name of any participant.

Findings will be submitted to the examiners of the Ed. D. research project and published in journal articles and conference presentations. No names or identifying personal details will be fed back to the University or given in any presentation of the findings, and it should not be possible for anyone to recognise you in any report of the project.

All information you give will be kept securely in a locked filing cabinet and will be destroyed six years after the final completion of the Ed. D. and publication of the findings.

Name and status of Investigator:

Julie Alderton

Senior Lecturer in Education

Room GH230, Grove House, Froebel College

Tel: 0208 392 3494

E-mail: j.alderton@roehampton.ac.uk

Consent Statement:

I agree to take part in this research, and am aware that I am free to withdraw at any point. I understand that any personal information I provide will be treated in confidence by the investigator and that my identity will be protected in the publication of any findings.

Name ……

Signature ……

Date ……

Please note: if you have a concern about any aspect of your participation, please raise this with the investigator, or with the Dean of School who is Dr Jeanne Keay (Lulham Building room 020, Froebel College, Tel: 0208 392 3571;

E-mail j.keay@roehampton.ac.uk).

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