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Troubling the mathematical child

An analysis of the production of the mathematical classroom and the mathematical child within the becoming of primary school student-teachers in England

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Submitted for the degree of PhD

2014

Abstract

In this thesis, I answer the question how is the mathematical child produced within the becoming of primary school student-teachers in England, and how does this include and exclude people within the mathematics classroom. This question arises out of the problematic discourses that student-teachers are exposed to when embarking on their journey to become a teacher. In particular, I focus on discourses that arise from the domains of educational policy and mathematics education research. Educational policy is chosen as this study is set within the New Labour (1997-2010) neoliberal era of marketization, accountability and performativity. Mathematics education research is chosen as this knowledge often circulates unproblematically and with taken-for-granted 'truths'. In addition, in my role as a university teaching fellow, I had noticed that these discourses were dominant and offered conflict.

To explore my research question, I carried out a case study of six student-teachers over the period of their three year degree course. I analysed their talk in relation to dominant discourses of mathematics education from within educational policy and mathematics education research. In order to unpack the truths that circulate, I stepped outside 'enlightened' epistemologies and instead, use a poststructural Foucauldian approach. This questions language and contends that meaning is produced within discourses. Furthermore, using Foucault, I contend that subjects become products of normalisation through governance rather than authoritarianism.

Overall, I argue that the mathematical child in much of mathematics education research and educational policy is absent yet present. This position of the mathematical child covertly underlies much of the discussions concerning the teaching and learning of mathematics. However, although the mathematical child is rarely spoken about, they are produced through discourses as a normalised cognitive performance of the mathematics classroom. Specifically, in New Labour's educational policy the mathematical child is produced as functional, and often indistinguishable from a mechanical automaton. Whilst in much of mathematics education research the mathematical child is naturally mathematically curious; what I call 'romantic'. This is produced through simplistic interpretations of discourses such as understanding, confidence and progress, which (inadvertently) normalise a discourse of 'natural ability'. Within this, the student-teachers take on various aspects of discourses – such as 'natural ability' and normative progress - and ignore others, such as mathematics for all. This happens as the children the student-teachers meet, are neither functional, naturally curious, nor normative in their behaviour. It is this mismatch of expectation and experience that includes some, such as the naturally able, within mathematics and excludes others.

Declaration

Aspects of Chapter Six have been published as either Llewellyn (2012, p. 25) and Llewellyn (2013b). Some of the quotations and ideas used in Chapter Five, and eight are also found in Llewellyn and Mendick (2011).

Statement of Copyright

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I have to begin by thanking Peter Gates. He was the first person who suggested that I could and should study for a PhD. Without his guidance and support, I would not have had the faith in myself, or the desire to study further.

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Throughout the many years I have been working on this thesis, I have had the pleasure of meeting many fellow PhD students and/or academics who I have gained a great deal of encouragement from: in particular, Cathy Smith; Agnes Ringer, and the community of Mathematics Education Society (MES), for example Kathy Nolan, and Paola Valero, to name but a few. They must know that to be treated fairly, and with respect for myself and my ideas, goes a long way in helping a PhD student persevere with complex arguments, and becoming part of an established community. I must also thank my examiners Tony Brown, and Paul Ernest, who have both been supportive and influential in writing this thesis.

My biggest thanks has to go to my supervisor Heather Mendick. It is fair to say that this thesis would have not gone in the direction it has without her, also, it would not have been finished without her. I have to thank her for her patience, and resolute manner, and for sticking with me through which, at times was a very challenging process. I have learnt so much from her, that it is impossible to summarise it succinctly here. She is without doubt an excellent supervisor and person, whose attention to detail, and interest in her students' work is beyond anyone I have ever met. I am eternally grateful for her support and outstanding direction.

Of course I need to finish by thanking, Helen, the person who with I am very happy to share my life.

Prologue

During the thesis process I was asked by my supervisor, Heather, to write an autobiography of the question. Eventually, (after five years) I reluctantly attempted it. On reflection, I have decided to share it here.

Anna Llewellyn was born and raised in a small mining town in the South Wales Valleys. Mathematics forms some of her earliest memories. Family outings to Wimpy involved her adding up the bill before it arrived. In the infant class, she was taken into the big class to recite the times-tables – this was pleasing for her, but embarrassing for her cool older sister. In junior class she worked alone at her desk on the blue book number 5, the highest in the class; she quickly worked through the exercises. Her report said "Anna thinks mathematically".

At secondary school, mathematics was still easy and she was still singled out as the pupil who would finish first and get the most correct, though this did not help her make friends. So she adapted, she got things wrong, and she tried not to try. The week before her GCSEs, Anna and her class were told they had not covered the work for the higher paper, due to the class doing two tiers of papers. Anna was annoyed, but did fine with a bit of revision the night before.

College was okayish, A-Levels were okayish, definitely harder than GCSEs. Anna still wasn't used to working hard.

Her undergraduate degree (in mathematics) was awful, but University was messy for so many reasons. Anna gave up on mathematics and probably on herself, but for so many reasons not just impenetrable mathematics. It was too different from what she new. She drank a lot and smoked a lot.

She followed her father (her favourite parent) into teaching. Her PGCE year was hugely enjoyable. It was her first positive experience of education since the first few years of secondary school. Anna met her first teacher/tutor who seemed to believe in her; he was, and still is, a big inspiration. She became really engaged in academic work, which she was surprised she was quite good at, and she loved the classroom and the kids.

In school, Anna became frustrated with systems and structures and being told what to do. She decided to study more. She found a job at a University that would let her both teach and study. She was asked at the interview, "Why should we give you the job?" She replied "I don't think you should"; she often thinks this was the right answer.

Anna was once positive, maybe idealistic, about both mathematics education and education generally. Now she is more cautious, and more suspicious.

Anna dislikes being told what to do and what to think.

Anna does not have the answers and is suspicious of people who think they do.

Sometimes, Anna wishes she could think in straight lines, rather than messy shades of grey.

Anna lives in Newcastle, with her partner Helen and her cat Jasper. They are all very happy.

Act One: Rehearsal

1 Chapter 1: Introduction

1.1 'Best' practice in mathematics teaching

Sometimes I wonder about my teaching. I sit down in a seminar, and I cannot help but facilitate it in a certain way. I push, I probe, I ask for explanations 'why'. I ask students to expand their answers, or to clarify what they mean. I encourage responses. I encourage reflection. I encourage the expression of opinions. But I am not opening the dialogue freely; I am instead conditioning people to behave in a certain way, to become someone particular. My experience of teaching in schools and universities has taught me to manage situations, to control them, to push towards the discussion I want to hear, or the mathematics I want to see. That does not always work of course and sometimes people do or say what they think is best. The nagging doubt I have is, 'what if this is not the best way', and 'what if I am wrong'. Doubts about my manner of teaching, of course, make me a 'good' reflective practitioner. However, we could alternatively state, that through reflection, I am a teacher, who conditions myself to develop in a predefined Eurocentric liberal manner of best practice. I promote a good Western education that is designed to offer emancipation, and autonomy. But am I? Or am I instead, supporting people into a preconditioned manner of thinking? Am I facilitating a modern Western straightjacket? This introductory paragraph raises three important points: that 'best practice' is context and time specific; that the teacher is always involved in surveillance; and finally, that we cannot help, in some way, being a product of our experiences, and in turn, shaping the very things that we encounter.

For mathematics education, the topic of this thesis, that means that I learnt and taught mathematics in a way that is a product of my time and context. Though, with the risk of homogenising and essentialising culture, it may have similarities to other people, educated in a small mining town in the South Wales valleys, in the 1980s and 90s. At age nine, my school report said "Anna thinks mathematically"; that statement is part of my mathematical production. It helped to contribute to my belief at the time that I was always already good at mathematics. This is reflective of the common public discourse of mathematicians, that there are those who are naturally good at mathematics, and there are those who are not. Of course, this discourse is not particularly helpful. It may leave us wondering why teach mathematics at all.

There are other apparently straightforward discourses that are part of common knowledge in mathematics education. For example, mathematics is produced as important by society, and simultaneously a society is constructed that is a product of the importance of mathematics. Within this, mathematics is viewed as a gatekeeper for success (Gates, 2001), and a good grade at school mathematics is deemed to be very important. Another taken-for-granted truth, particularly of mathematics education research, is that the best mathematics teaching involves active pupils who understand the mathematics. As alluded to in the opening paragraph of this thesis, it asks 'why' questions, and allows for discussion. Indeed, recent UK reports into mathematics education (Ofsted, 2008; A. Smith, 2004; Williams, 2008) attest to this.

> The fundamental issue for teachers is how better to develop pupils' mathematical understanding. Too often, pupils are expected to remember methods, rules and facts without grasping the underpinning concepts, making connections with earlier learning and other topics, and making sense of the mathematics so that they can use it independently. (Ofsted, 2008, p. 5)

These reports on mathematics education, and this quotation, also assert that mathematics teachers are not as good as they should be. This is part of a wider production of "discourses of derision" (S. J. Ball, 2006; Kenway, 1990) that permeate education (Alexander, 2010). Though to suggest this derision in mathematics education is a new 'truth' is problematic, poor results and "imperfect teaching" of mathematics were 'evident' around the time of the first UK education act in 1870:

> In arithmetic I regret to say worse results than ever before have been obtained – this is partly attributable, no doubt, to my having so framed my sums as to require rather more intelligence than before: the failures are almost invariably traceable to radically imperfect teaching (HM inspectors written in 1876, cited in Cockcroft, 1982, p. xii)

It is perhaps odd to think we have not fixed a 'problem' that was identified over 100 years ago. Particularly as the main concern of mathematics education research is to improve performance (Boero, 2008; discussed in Pais & Valero, 2011). Furthermore, and by design, we have exposed ourselves to an array of teaching ideas and research that are deemed to improve classroom and pupil outcomes. As such, much of mathematics education research concerns itself with "the problems of practice" (Silver & Herbst, 2007, p. 45), and concomitantly is bounded by these parameters.

From this, there are several areas to question. In the first instance the notion of linear progress in mathematics education is dubious and consequently, so is the concept of idealising

pupil progress – the measure that education (schools, governments and research) seeks to improve. However, "from the 1990s, the official discourse tells the story of a sustained programme of improvement/reform of education in England, linked to the creation of objective 'depersonalised' judgement and increasingly driven by apparently objective data." (Ozga, Simola, Varjo, Segerholm, & Pitkanen, 2011, pp. 114-115). Similarly, focusing primarily on improving pedagogies within mathematics education research is contestable; particularly as we are always already searching for this. Moreover, what is also clear, from above, is that our ways of thinking, are often bounded by who we are, where we are, and the practices we are allowed to promote. In the above instance, there is a particular kind of preferred pedagogy that is specific to the UK, but also common in other parts of the worlds, such as the US and Australia. This pedagogy favours the active student that exemplifies this through verbal engagement. A simple cultural contrast to this is provided by China, where the education system is built upon Confucian ways of being, and the culture of respect and hard work. Here, teaching for student involvement is not excluded; however, it is thought that this can be best achieved through mastery of skills first, via the repetition of mathematical methods and cognising through listening. This pedagogy is often constructed as a passive, deficit model by Western writers, although recent work in cultural and language studies questions this Othering and derisory, discursive positioning (Grimshaw, 2007). From the Chinese perspective, it is this practice that allows pupils to think and hence develop their own methods and autonomy (Jin & Cortazzi, 1998). This is possible within a Confucian based culture, where values of respect are paramount. However, we must be careful of adopting an essentialist position, where approaches to culture and learning are homogenised and viewed as fixed within a country. For instance, Chinese educators will be diverse in their practices. Moreover, China, through increased globalisation, is currently very much responding to the influence of Western approaches to learning (Grimshaw, 2007). Hence whether following a discourse, or resisting it, objectifying and separating best pedagogy from the cultural regime of truth of the time and context is fallacious.

1.2 The neoliberal culture of the UK

The culture of the UK is currently caught up in a neoliberal performative agenda – a policy regime defined by "the progressive enlargement of the territory of the market" (du Gay, 1996, p. 56). It is widely acknowledged that England is a broadly neoliberal society, (N. Rose, 1999a) and has been moving in that direction at least since the Conservative government of the 1980's (Newman, 2001). Though neoliberalism is not constrained by national boundaries and "is affecting

education in areas as diverse as Europe, the United States, South America and Australia (Grek, Lawna, Lingard, & Varjoc, 2009; Hultqvist & Dahlberg, 2001)" (Llewellyn & Mendick, 2011, p. 50).

> Neoliberalism is in the first instance a theory of political economic practices that proposes that human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets and free trade. The role of the state is to create and preserve an institutional framework appropriate to such practices. (Harvey, 2005, p. 2)

Hence "the most basic feature of neoliberalism is the systematic use of state power to impose (financial) market imperatives, in a domestic process that is replicated internationally by 'globalisation'" (Saad-Filho & Johnston, 2005, p. 3). This rise in neoliberalism has seen significant reform in education throughout the world (Apple, 2003). And it is this reform that provides "the appearance that the state has taken responsibility for improving society and, therefore, increases the state's legitimacy" (Hursh, 2007, p. 18). This has significant implications for anyone involved in education. For instance, as traced above, it is imperative that official discourses show that education is improving.

One way in which this is actualised in England is the shift towards the privatisation of the public sector, or by the blurring of these boundaries between these previously distinct sectors. In education, this is evident through the introduction of private sponsors to run schools, but also in the manner that schools are managed and monitored. Significantly, the market has begun to drive general educational reform and policy (S. J. Ball, 1993a; Ozga, 2009; Whitty, Power, & Halpin, 1998). As such, terms such as 'economy', 'efficiency' and 'measured outcomes' have entered both educational policy and discourses. Quality assurance and evaluation have become a method of governing (Grek, et al., 2009) and "comparison for constant improvement against competition has come to be the standard by which public systems are judged" (Grek, et al., 2009, p. 123). Hence, complex systems and processes become over simplified into categories and data, for the purpose of 'value' judgement (S. J. Ball, 2003). This is evident in the widespread normalised use of performance indicators, league tables and pupil data. As such, education has become fabricated around these measurable statistics and is in effect "governing by numbers" (N. Rose, 1991) or 'educating by numbers'. Student-teachers of mathematics education are part of this performative agenda. As much as I, or other university tutors, pretend they are not, student-teachers are graded and judged by their performance, which partly comes from their pupils' results. It is difficult and unsound to consider 'best' pedagogies, without considering this wider neoliberal context.

Within this neoliberal education system, surveillance is high as the public sector borrows management models of working from the private sector (S. J. Ball, 2003). Subjects become self-regulating (S. J. Ball, 2003, 2008) whilst management models create the appearance of autonomy both within policy and within classroom practice discourses (S. J. Ball, 1994). As alluded to in the first paragraph. I follow the accepted best practice of mathematics education. I promote discussion, and questioning yourself, and the mathematics. In this, I allow my students the appearance of autonomy, of freedom, however I regulate them, and surveil them, and hence I attempt to produce them in a preferred manner. But what if they have different preferred ways of thinking? What if they want to teach mathematics by mastering methods, as in China? There is no reason to suppose this limits or pacifies the pupils. This assumption would suggest that structure and agency are exclusively opposed (Buckingham, 2011). Everyone is capable of being active and passive within the situations with which they are presented.

This is fundamentally what my thesis is concerned with, unpacking the taken-for-granted truths, for example about best pedagogy, of mathematics education, within the current neoliberal context. In addition, I move beyond this to focus on the subsequent discursive productions of the mathematical child; thus I explore how the producers of education produce their subject. My specific research question is: **How is the mathematical child produced within the becoming of primary school student-teachers in England, and how does this include and exclude people within the mathematics classroom?**

1.3 Information about the thesis

Particularly, in this thesis, I question discourses concerning mathematics education, such as the already mentioned progress and pedagogies, and examine the manner in which these and other norms of mathematics education are produced within the neoliberal context in which knowledge circulates. I argue that by examining these productions, I can tell 'alternative' stories that seek to open up the mathematics education world, and perhaps avoid the perpetual stories of mathematics education and dissatisfaction (for example Boaler, 1996, 2014; Burghes, 2008; Cockcroft, 1982; Gardiner, 1995; Ofsted, 2008; A. Smith, 2004; Williams, 2008). My assumption is that by looking at anything from the same position we restrict ourselves to seeing similar results. My concern is that mathematics education (schooling, government and research) is blinkered by the narrow positions, outlooks and conventions that we tend to adopt. Moreover, we may be complicit in creating some of the problems we contest; for instance, mathematics education 'feeds itself' upon the promise of improvement, hence the stories we can tell are always already concerned with this. Thus specifically, my study examines the positions and discourses constructed

by mathematics education research and also by educational policy, which I argue are two dominant producers of knowledge and truths within mathematics teacher education. The focus on educational policy comes as this thesis is set within a time of heavy political investment in education. In particular, it is set within the era of New Labour, 1997-2010, where "education, education, education" (Blair, 1996), and particularly mathematics education, were positioned as a priority of neoliberal government. New Labour's neoliberal government differed to the previous one, with its commitment to social equality. Hence, this "third way" of neoliberalism (Arestis & Sawyer, 2005), contends to shift from the entirely individualistic nature of the Conservative restorationists. As discussed, this regime both creates and limits the type of knowledge that can circulate.

To explore how these dominant discourses of educational policy and mathematics education research are taken up within the classroom, I compare and contrast them to positions negotiated by student-teachers. Specifically, I use a case study of a group of six student-teachers, with whom I worked over their three years (2006-2009) on a primary education undergraduate degree situated in the North of England. Student-teachers are interesting in that they are 'fresh' and at the beginning of their careers in education. As such, they have little background knowledge to make sense of the multitude of discourses to which they are exposed, some of which are in conflict or competition (Walshaw, 2007). They have mathematics education baggage but not necessarily the same, or perhaps as much, as me. As a teaching fellow on various Initial teacher Education (ITE) courses, I had noticed that the positions offered by mathematics education research and educational policy were often divergent. As alluded to above, a results-driven neoliberal era, does not always sit with a desire to allow pupils to explore mathematics 'openly', as mathematics education research usually prefers. Thus in seeking the student-teachers' perspectives, I am not only concerned with what is said within mathematics education, but also with what is allowed to be heard, and what is produced in the performance of the classroom. Thus I am studying both the macro level of systems, and the micro level of practice. Specifically, I am taking into account that there is a difference between the intentions of policy and the practice by groups and individuals (S. J. Ball, 2006).

Initially my research question was, 'in relation to the 'becoming' of primary school student-teachers in England, how are pupils included and excluded within the mathematics classroom?' However after lengthy analysis of the data, a more pertinent question gradually emerged, concerning the mathematical child. My focus on the mathematical child again is alluded to in the opening paragraph of this thesis. Specifically, as teachers, we are always already complicit

in producing a subject that is a certain way, and that does mathematics in a certain way. Moreover, within discourses of preferred pedagogical practice, that subject takes on a very specific form; we are constructing a specific kind of mathematical child. However, the preference and potential exclusion of others who cannot embody this mathematical child, is rarely acknowledged.

For mathematics education research this child is predominantly an "active cognitive subject" (Valero, 2002, p. 542), who is often devoid of cultural, social context. As a teacher of ITE, this is a homogenous construction that I find concerning. This thinking and practice is particularly evident within the department where I work, and where this thesis is set. As such, it influences the literature the students are advised to read, the dissertations they choose to explore, and potentially, the manner in which they teach. This final question is my area of interest – how did the student-teachers, at my University, make sense of this discourse of the cognitive mathematical child, particularly in relation to the strong voice of New Labour policy, which as far as I could see, did not always acknowledge the other. I initially began playing around with this idea in the journal article, Llewellyn (2012) (appendix 1). It is the analysis in this publication, and the presentations that accompanied it, that encouraged me to unpack the rest of my data in a similar fashion.

As may already be evident, from my discussion and use of language, for example the phrases: discourses; always already; production; and normalisation, throughout the thesis I take a poststructural position. In particular, I use Foucauldian discourse analysis, both explicitly and tacitly. This is an attempt to step outside the dominant paradigms that circulate within mathematics education research, which are part of the critique of this thesis. In addition a poststructural perspective challenges the perception that mathematics is rational and absolutist (Walkerdine, 1990; Walshaw, 2004a). More broadly than that, Foucault allows for a critique of human sciences, and for alternative perspectives on cultural truths and established practices; he allows for the interweaving of multiple disciplines and the use of a wide range of sources of knowledge. By exploring these power structures, we can acknowledge and expand the prescribed (both covert and overt) limitations on our actions (Foucault, 1972/2002), in this case those of mathematics education. As with other poststructural writers, I take language to be ambiguous, constructive and created through action (MacLure, 2003). From a personal position, the works of Foucault are also where I find meaning; they allow me to make sense of the data and dilemmas I encountered during this project and more generally in the world. Furthermore, they allow me to find a position between right and wrong, the lack of which is something I frequently find troubling in both mathematics and in mathematics education; these "discourses of dichotomy" (Alexander,

2010) are something which this thesis seeks to unpack. Hence Foucault allows for spaces which do not exist in everyday, common sense discourses. Amongst others in mathematics education research, I have been particularly influenced by the poststructural work of Walshaw (2007), Walkerdine (1988, 1990, 1998a), Hardy (2007, 2009), Mendick (2006, 2011) and Valero (2002, 2004).

1.4 Organisation of the thesis

In order to best facilitate the argument, I have structured my thesis into three parts, Act One: Rehearsal, Act Two: Performance, and Act Three: Overture. A similar structure is used in parts of Miller's (2006) doctoral thesis on the identity of student-teachers of primary science. The use of the word performance (Butler, 1999/1990), rather than something more 'objective', is in keeping with poststructural research and suggests that this analysis is one of many possible analyses, it is not the only analysis that someone could perform. More than that, the student-teachers are involved in the performance of the interview, and indeed in their performance in the classroom, where the pupils are performing too. To clarify, this performance is not a contrived way of being; instead it is a response to subject positioning within the discourses that are available (Butler, 1999/1990). The key point is that it does not demonstrate a natural, static identity. Specifically, we are not always the same in every situation; instead we perform to the various fictions of which we find ourselves a part. In brief, Act One sets the backdrop of the thesis, which is what you need to know before considering the analysis and arguments. Act Two is where the analysis happens and where the data are performed. Act Three, draws together concluding remarks and offers directions for further thought.

The acts are bookmarked by an Epilogue and a Prologue, which offer a personal position in relation to this thesis; this partly makes up for the lack of an 'autobiography of the question' (J. Miller, 1995) in the introduction. The reader can choose to engage with this, or not.

The chapters in Act One: Rehearsal are from one to four.

As observed, Chapter One provides a brief introduction to the aims, themes and context of the study.

Chapter Two sets out my epistemological position. For my thesis this has to be done at the outset, as all of my discussions are framed around this way of making meaning. In the first instance I introduce poststructuralism, which I argue is an attempt to question and "escape the patriarchal paradigms of western thought" (Moi, 1988, p. 5). Moreover, I argue that language and discourses constitute meaning as opposed to replicating already established meaning (Walshaw, 2007). Then, I focus on the work of Foucault who critiqued the supremacy of reason, rationality

and progress (Foucault, 1970/2002). Specifically, I explore the Foucauldian notions that I utilise throughout the thesis: discourse; power; normalisation; governmentality; subjectivity; and deconstruction. In addition, I examine the paradoxes that arise from using poststructural thought. In particular, the claim that postmodernism is the master narratives of the end of master narratives (Lather, 1991; Morris, 1988).

In Chapter Three, I move on to set the background of the current "regime of truth … that is, the types of discourse which it accepts and makes function as true" (Foucault, 1980c, p. 131). This chapter is in two parts: part one explores constructions of childhood and the child, whilst part two examines the child within the discourses of mathematics education. Within this, and where relevant, I also discuss discourses of the teacher. My aim is to show how some positions change and some remain static across time and context. As such, I trace the relationships between the child, mathematics education, and the teacher through recent history and highlight the connections between changing political positions and dominant discourses in mathematics education research, policy and schooling. I also highlight discourses that have remained static, such as mathematics as a gatekeeper of success (Gates, 2001). Hence these are not chapters of analysis but scene-setting that enables the later analysis chapters of Act Two to happen

In Chapter Four I outline the specific methods that I used for this research study. This includes a discussion of research methods and methodologies that relate to my thesis. Primarily I discuss case studies and my search for "particularisation not generalisation" (Stake, 1995, 2005). This is followed by a small discussion of the selection of the participants. Next, I specify the particular methods and schedules for data collection, before moving on to justify - and critique - my focus on interviews as a tool for data collection. In particular, I explore the type of interview that is appropriate for a study such as this, which seeks to question norms, power relations, and hierarchies that are always already present within the interview situation. I move on to justify and critique my selection of educational policy documents, which continues to set the context of the thesis as bounded by New Labour's neoliberalism. My own role within the research project is also discussed throughout. I explain the methods of analysis I used, showing how I made constricted, systematic and eclectic choices. Hence I am exploring the manner in which poststructural and Foucauldian research methodologies can be realised in practice. The chapter concludes by refocusing on the research question which leads onto the second part of the thesis – performance.

Act Two contains the Chapters Five to Eight. In a prelude to the Act, I introduce the results of the thematic analysis and justify my subsequent focus on the four themes of: progress; understanding; confidence; and ability. Specifically that they are dominant productions within the

data, and also barriers to mathematics. I also reassert the overall focus on productions of the mathematical child. The main chapters (five to eight) are similar in structure. Each is focused around a theme and explores the key arguments in each domain before discussing the theme in relation to the overall perspective.

Chapter Five begins the analysis section by exploring notions of 'progress'. This is a dominant topic of mathematics education. Indeed, it is a prerequisite of a modern successful society and of educational research. Thus it sets the scene for the rest of the analysis chapters. I begin the chapter by interrogating this commitment to progress. Next, I examine progress within the domains of mathematics education research and educational policy, before moving on to examine how these discourses are negotiated by the student-teachers of the study. Specifically I show that progress within dominant mathematics education research is concerned with 'natural' cognitive development and hence offers a 'romantic' version of the child. However, educational policy's view of progress is much more mechanistic, hence the mathematical child of educational policy is constructed as a functional automaton. In particular, I argue that mathematics classrooms are constructed around a functional linear temporality assumed in educational policy, but this is not realised in practice. Moreover, I show that our investment in progress allows certain things to be possible, and excludes others. For this thesis, that means there are certain types of mathematics education and mathematical children that are preferred. This is investigated further in the next two chapters where I unpack two norms of the preferred mathematical child. These norms are different in that one is deemed cognitive (teaching for understanding) and the other emotive (teaching for confidence). However, I show that they both construct productions of the mathematical child as a 'romantic natural enquirer' in education research and 'functional automaton' in educational policy. Moreover, both of these productions are concerned with a 'normal' cognitive mathematical child. Hence it is this that supersedes teaching principles such as 'developing confidence or understanding'; the mathematical child is always already there.

Chapter Six builds on the previous chapter by examining the romantic child of mathematics education research and the functional automaton of educational policy from the perspective of 'teaching for understanding'. As discussed, this is a norm of mathematics education, which I argue is akin to the (re)search for the Holy Grail. As such, it can be a barrier to accessing mathematics. Similarly to the previous chapter, I unpack notions of understanding in mathematics education research and educational policy before moving on to examine how these discourses are negotiated by student-teachers within the domain of the mathematics classroom through student-teacher talk. I focus on one student-teacher, Jane, to show how she negotiates tensions between

'romantic' discourses of understanding within mathematics education research and 'functional' discourses of understanding within neoliberal mathematics educational policy. I move on to discuss this in relation to perspectives from the other student-teachers. I argue that a romantic discourse constructs understanding as an aspect of being, resulting from the 'natural' curiosity of the child. A functional discourse constructs understanding as performance, within which the child is indistinguishable from machines. I argue that Jane takes on both functionality and romanticism but they collide creating a disorderly discourse of understanding that reproduces inequity.

Chapter Seven builds on Chapters Five and Six by using a similar structure and central argument. It examines a different theme, the concept/construct of 'confidence', within the same domains as before, and with the same outlook that the requirement to be confident can also be a barrier to accessing mathematics. In addition, it builds on the previous two chapters by arguing that conceptions of confidence are legitimised within discourses of progress and discourses of understanding. Specifically, I show that the functional production of the mathematical child in educational policy is maintained through the notion of confidence which is produced as unproblematic, performative and cognitive. It draws on the work of Hardy (2007, 2009) who discusses how confidence and competence are conflated in educational policy. I argue that student-teachers replicate the conflation of confidence and competence, but fail to get the functional results from their children and hence some children are more easily excluded from the mathematics classroom. I show that confidence is a preferred option within the neoliberal classroom, as it is an easier barrier to envisage overcoming than 'understanding' (Chapter Five).

Chapter Eight is the final thematic chapter and focuses on 'ability'; again I show this can be a barrier in the mathematics classroom. I argue that 'ability' permeates all of the previous thematic chapters in Act Two and is a central concept of the student-teachers' mathematics classrooms, indeed it was the most dominant theme from their interviews. I show how for a neoliberal discourse to succeed in educational policy, mathematical 'ability' must either be absent or constructed as fluid. If it is not, constraints are produced which can demobilise the child. However, much of mathematics education research leans towards romanticism, and (unintentionally) constructs mathematics 'ability' as 'natural', and hence fixed. Student-teachers are caught between these two positions, as they construct mathematics 'ability' as undeviating yet are frustrated when pupils conform to their expectations. However, in both educational policy and mathematics education research, there is a special group of pupils who are deemed to have a 'natural mathematical ability'; these are allowed to understand, allowed to be confident, and are allowed to make elevated progress. Hence, these are the children that are included in the

mathematics classroom; they are the 'impossible' fictions that everyone else is measured against and as such, required to be.

Act Three: Overture, contains the concluding chapter, Chapter Nine. It begins by drawing together the analyses and arguments from the previous chapters, reiterating that, the mathematical child is constituted as a functional automaton in educational policy, whilst in dominant strands of mathematics education research, the child is romanticised as 'naturally' inquisitive. This chapter moves on to evaluate the research study and its contribution to knowledge, before offering some suggestions for mathematics educators, which includes policy makers, researchers, initial teacher educators and classroom teachers. It is important that these proposals are not viewed as sacrosanct and instead taken within the context of poststructuralism.

Before moving onto Chapter Two, it is worth pausing for a moment to think about the position I am taking and the reader's own position within the field. I acknowledge that most readers will already have a conception of mathematics and of the mathematics classroom, and probably a commitment to them both, however in this thesis, I ask you to "suspend your belief in the innocence of words and transparency of language as a window on objectively graspable reality" (MacLure, 2003, p. 12). Thus it is important to remember I am not considering what the mathematics classroom 'is', instead I am questioning how it is constructed within mathematics education research, educational policy and student-teachers' talk and action in classrooms. It is this unpacking that allows me to explore mathematical exclusion and question what is possible for mathematics educationalists.

2 Chapter 2: The Epistemological Framework

2.1 Introduction

Before we go any further into this thesis it is important to discuss the epistemological position that frames it. Furthermore it is imperative that this discussion takes place near to the beginning of the thesis, as the words and thoughts presented are foregrounded, and backgrounded, by this position. The reader needs to be aware of how the text has been used. This is particularly important for poststructuralism and immediately brings one of the key and paradoxical issues of this thesis to the forefront – that language, always already evokes meaning. Language is ambiguous and fluid and hence dependent upon time and context (MacLure, 2003). Every word of this thesis should be seen from this position. Specifically, in this chapter, I begin by giving a brief introduction to key aspects of poststructuralism. I then move on to discuss the work of the primary influence upon this thesis – Michel Foucault. I explore in depth, aspects of Foucault's work that have particularly influenced my thoughts and analysis. This is structured around: truth and fiction; discourses; power; 'Man', the subject and subjectivity; normalisation; governmentality; and deconstruction. Despite the linear and discrete presentation of the topics, they should not be interpreted as such. The aim is to discuss the key positions that allow me to view mathematics education from this alternate perspective discussed in the introduction. Hence this chapter sets out what is possible for this thesis.

2.2 Introduction to poststructuralism

Historically, poststructuralism may be viewed as a reaction to structuralism. Whilst both philosophies have some aspects in common, such as the decentring of text from dominant discourses, poststructuralism is more often viewed as a movement away from structuralism's rigid view of reasoning, language and of underlying 'truths'. Hence I use 'poststructuralism' in this thesis so that it is inscribed as its own position, rather than 'post-structuralism' where it inscribed within a progressive relationship to structuralism. A key concept is that both of these positions are critical responses to the Age of Enlightenment, an era where reason and the rational subject were legitimised (MacLure, 2003) and where education and childhood found prominence (discussed in more detail in Chapter Three). Indeed Foucault asserts reason and the rational subject to be the major arc of ongoing philosophical thought. He states,

> I think that the central issue of philosophy and critical thought since the eighteenth century has always been, still is, and will, I hope, remain the question: *What* is this Reason that we use? What are its historical effects? What are its limits, and what are its dangers?

> How can we exist as rational beings, fortunately committed to practicing a rationality that is unfortunately crisscrossed by intrinsic dangers? (Foucault, 1984a, p. 249)

Hence a critical question to consider is 'what version of rationality and reason dominated during this period of Enlightenment and what version dominates now?' Or more importantly, whose version was it, and as a consequence who was included and who was excluded. These are questions which run throughout my thesis, as I attempt to show that there is no aspect of mathematics education that does not privilege some over others, however innocent and universal it may purport to be. Though to do this, I am of course engaging with apparently 'rational' arguments in order to present a coherent piece of academic work, whilst simultaneously arguing against the over-reliance upon the rational. This is one of the many paradoxes found within poststructural writing which I cannot avoid. However, I can attempt to navigate it, in part by acknowledging it whilst I write. In addition, some of the methodologies I use question the status of reasoned thought. Hence following Foucault, I am attempting to navigate the dangers of running heedlessly into an all-consuming rationality.

Therefore we can view poststructuralism as an attempt to question the reasoned mind and Western privilege (Moi, 1988). It is an endeavour to pull "ourselves free of the web" (Walkerdine, 1998a, p. 15) of rules that runs through rationality. The themes and content of this thesis are of course, caught up in this web. In particular, education, and mathematics education are shaped by rules and paradigms born of hegemonic times, many of which are unspoken and have come to be passed as common sense truths (this is discussed further throughout this thesis, particularly in Chapter Three). In this thesis, I attempt to both acknowledge and critique these webs, as I endeavour to move free of them. Moreover, my tool of analysis, poststructuralism allows us to "think more about how we think" (Flax, 1987, p. 624) and consequently we can avoid casually taking up common sense assumptions, which happens often in education. Instead poststructuralism allows for the mess, and for the "daily struggle and muddle of education" (Donald, 1985, p. 242); in fact, it positively encourages it.

2.3 Introduction to Foucault

As mentioned previously, this thesis is heavily reliant upon one particular theorist Foucault; many of his key concepts run explicitly and implicitly throughout my thesis. Indeed, I have already mentioned Foucault's critique of the hierarchy afforded to reason and rationality, and the resulting difficulties of writing within rational argument. In the rest of the chapter, I discuss key aspects of Foucault's work, whilst being aware of the paradoxes they inscribe, some of

which I explore here. For example, in spite of being presented under distinct headings Foucault's categories should not be read as discrete constructs. Hence at times, I explore how the notions overlap and contribute to each other. In addition, I struggle with the restrictions of using a linear narrative when ideas are not so. It suggests the direction of 'development' is necessarily linear and progressive (Foucault, 1988) and mine certainly has not been, in spite of the presentation as such. Indeed, I have revisited the ideas in this thesis for the past eight plus years, despite of the fact that they are mainly presented here as a coherent whole. Indeed, there are many areas of Foucault's work that I have had to negotiate. For example, how can you 'faithfully' use a theorist who encourages you to pick and choose fragments of his work and who encourages fluidity? How do you manage to work within an epistemological position, when part of the epistemological position is to disobey rules of epistemological positions? Should I even define it as an epistemological position? Indeed, how do you use someone's work who questions the notion of truth and the authorship of language and specifically who questions the value of specifically referenced quotations (Foucault, 1980a). Thus to use Foucault, I must acknowledge and negotiate these paradoxes, whilst conforming to the rules of the academic production of theses. This is of course true for all poststructuralism or postmodernism; Lyotard made the paradoxical observation that postmodernism is the master narratives of the end of master narratives (Lather, 1991; Morris, 1988). However, as Lather points out "to write 'postmodern' is to simultaneously use and call into question a discourse, to both challenge and inscribe dominant meaning systems in ways that construct our own categories and frameworks as contingent, positioned, partial" (Lather, 1991, p. 1) and this is what I intend to do - "to write paradoxically aware of one's complicity in that which one critiques" (Lather, 1991, p. 10). In this sense, I hope that my writing is uncomfortable, that it provokes reaction and emotion.

At times my work steps outside of Foucault and is supplemented by reference to wider thinkers. Foucault said "one should be able to read everything, to know all the institutions and all the practices" (Foucault, 1989i, p. 14). This is not possible, but it does encourage wide references. Moreover, it resists the urge to interpret his theories through a blinkered lens and instead to set them within a more extensive context. He reiterates this point throughout his work. For instance:

> All of my books … are, if you like, little tool-boxes. If people want to open them, or to use this sentence or that idea as a screwdriver or spanner to short-circuit, discredit or smash systems of power, including eventually those from which my books have emerged so much the better. (Foucault, 1975; cited in Patton & Meaghan, 1979, p. 115)

Furthermore he states that "it's not up to me to establish users' rules" (Foucault, 1989e, p. 213). Thus, using Foucault is not about taking all of his words verbatim, or indeed using ad hoc quotations. For me, using Foucault, is locating where I find meaning, and it involves remaining sceptical about the value of Foucault altogether; we must consume and critique his ideas.

Foucault's interpretation of critique is an important notion which runs through his work and through this thesis. I include a lengthy quotation where he makes this explicit,

> Criticism is no longer going to be practiced in the search for formal structures with universal value but, rather, as a historical investigation into the events that have led us to constitute ourselves and to recognize ourselves as subjects of what we are doing, thinking, saying. In that sense, this criticism is not transcendental, and its goal is not that of making a metaphysics possible: it is genealogical in its design and archaeological in its method. Archaeological – and not transcendental – in the sense that it will not seek to identify the universal structures of all knowledge [*connasissance*] or of all possible moral action, but will seek to treat the instances of discourses that articulate what we think, say, and do as so many historical events. And this critique will be genealogical in the sense that it will not deduce from the form of what we are what it is impossible for us to do and to know; but it will separate out, from the contingency that has made us what we are, the possibility of no longer being, doing, or thinking what we are, do, or think. (Foucault, 2003g, pp. 53-54)

Hence Foucault does not look for a 'truth', but for what we perceive the truth to be, and how it came to be constituted. He examines how knowledge comes to be, but not from the perspective of historical accuracies but from the position that questions those readings of history. Thus the question becomes how are we constituted into becoming who we are, and how are things constituted into becoming what they are? How do contingencies – not causes – shape the world around us and shape knowledge and truth? How are some things allowed to be, whilst others are not permitted? Moreover, how do events come together when we question the underlying value of rationality and reason? Each of these ideas are explored in detail in the rest of this chapter. I begin with one of the most fundamental aspects of poststructural thought, that truth is a fiction created in time and context.

2.4 Truth and fictions

> I am quite aware that I have never written anything but fictions. I'm not saying for all that this is outside truth. It seems to me the possibility exists to make fiction work in truth, to induce effects of truth with a discourse of fiction, and to make it so that the discourse of truth creates, 'fabricates' something that does not yet exist, therefore 'fictionalizes'. (Foucault, 1989e, p. 213)

For Foucault and poststructuralism there is no singular truth, nothing that accurately describes the world. Instead there are ways of making sense of the world. These ways of making meaning, differ in their status and their power to have effects in the world. Some will acquire the status of truths while others will be dismissed. In this thesis, I am concerned with the 'truths' found within contemporary mathematics education, and within political governance within the recent neoliberal New Labour context. My concern is to examine these as constituted truths of a time, rather than as universal Truths. In addition, I consider what work these truths do in the classroom and how they include or exclude people from mathematics. My aim is to ask: "'What's going on just now? What's happening to us? What is this world, this period, this precise moment in which we are living?' Or in other words: What are we?" (Foucault, 2003e, p. 133). It is these questions which allow us to examine how we are constituted and what we think we are.

Truths are not absolute; instead they are determined by time and context. For instance, forty years ago many people would have thought that boys were better than girls at mathematics. Indeed, some people may still do so. How can this be damaging? Well, it may be that teachers holding such beliefs deliberately exclude girls from mathematics, or conversely they may praise girls more, as they consider them to need more encouragement, which could exclude boys. Another gendered example is the notion that girls prefer pink. This can appear as a timeless, universal truth, however, this is actually a modern concept that has only been around since the 20th century, and is specific to certain parts of the world. But how can it be bad to think that girls prefer pink? Well, what if you are a boy who likes pink, does that mean that there is something wrong with you and perhaps you are not a 'real' boy? So somewhere, and at some point, this 'truth' was created. I do not mean that someone sat down and thought, 'hey, I know what would be good marketing, let's produce everything for girls in pink and for boys in blue'. Instead, I mean that through time and the use of language and practice, and in this case with the rise of consumerism for children (see Chapter Three), we have come to accept something as having meaning. We have internally accepted it as the truth. Thus "reality is neither single nor regular" (Taylor, 2001, p. 12), for example the preferred colours for boys and girls in a remote village in Cambodia may be very different to those in the UK (though even they are likely to be impacted by global media). Instead we have to consider what we know, what we perceive to be the 'truth' and what we view as 'reality', within specific times and contexts. Moreover, we consider how 'truths' are constructed by the constraints around them. For instance, the girls who are thought of as 'poor' at mathematics are positioned as such by power relations that run throughout the social system. Hence "truth is a thing of this world: it is produced only by virtue of multiple forms of

constraint. And it induces regular effects of power" (Foucault, 1980c, p. 131), as I explore in more depth later in this chapter.

Thus rather than view society as run by rational ideologies, society is constituted through various contingencies concerning truth and power within specific eras. Therefore, time periods in history can present 'ideologies' (products of knowledge and power) that masquerade as the 'truth'. For example and relevant to this thesis, effective mathematics teaching may be described very differently one hundred years ago or even twenty years ago than how it is today. Specifically for Foucault, "each society has its regime of truth, its 'general politics' of truth that is, the types of discourse which it accepts and makes function as true" (Foucault, 1980c, p. 131). The argument that 'truth' and 'regimes of truth' are produced by power and discourses is explored in more depth below.

2.5 Discourses

In simple terms, discourses are permitted truths. In the first instance, this requires us to reconsider viewing language as factual, and instead consider "language as fragile and problematic and as *constituting* social reality rather than *reflecting* an already given reality" (Walshaw, 2007, p. 5). In a Foucauldian sense, language is only part of what constitutes discourses; it has a broader and more encompassing meaning. Discourses,

> are not, as one might expect, a mere intersection of things and words: an obscure web of things, and a manifest, visible, coloured chain of words ... [discourses are] practices that systematically form the objects of which they speak. Of course, discourses are composed of signs; but what they do is more than use these signs to designate things. It is *more* that renders them irreducible to the language *(langue)* and to speech. It is this 'more' that we must reveal and describe. (Foucault, 1972/2002, pp. 53-54 original emphasis)

Hence creating meaning is about more than language, it is about the way we act towards something and about how it acts with us. Thus we can state that discourses create meaning; they are constructive rather than descriptive. Moreover, it is a two way fluid relationship; the subject is produced through and produces discourses (Walkerdine, 1997).

In addition, discourses are everywhere; they operate on many levels, within the social world and within disciplines. Above, I described a discourse of gender in relation to colour, that general society perceives boys to prefer the colour blue and girls to prefer pink. I argued that this discourse was specific to this regime and context. Indeed, it can be seen as part of the consumerism and marketization that has over the past few decades moved from adults to children. From this, we can begin to appreciate how marketing companies and consumers have

been part of this production. They add to a version of the truth where girls prefer pink and boys prefer blue.

There is little space for alternative discourses in the mainstream. Hence some discourses are more easily heard than others, and some discourses are taken up as the 'truth'. For example, what would happen if a teacher acted like they did not want their students to pass their examinations? This way of acting and speaking would not be permitted; instead the teacher may be ignored and/or branded abnormal or incompetent. A more pertinent example is to suggest that mathematics is not useful, which was the argument discussed recently by Pais (2013) at the conference *Mathematics and Contemporary Theory*. Even here, within this liberal academic space, resistance to his argument stemmed from the principle that Pais is saying something that this group of people did not want to hear. In their work, a lot of mathematics educationalists implicitly and explicitly refer to the usefulness of mathematics; it is very difficult to comprehend another position. This applies to some of the content of this thesis. Throughout this year, I have given presentations concerning the overall themes and argument of my thesis. Whilst this has been well received in places that can appreciate my philosophical position, in a very traditional mathematics education faculty it was condemned. Quite directly, I was told my work was offensive. Hence, quite possibly, my work threatened the order and reason upon which the academics that were present based their careers and work. I dared to challenge the normal discourses of mathematics education. Thus discourses:

> authorise what can and cannot be said they produce relations of power and communities of consent and dissent, and thus discursive boundaries are always being redrawn around what constitutes the desirable and the undesirable and around what it is that makes possible particular structures of intelligibility and unintelligibility. (Britzman, 2000, p. 36)

Moreover, we are often complicit in perpetuating discourses and in producing or maintaining boundaries; this is shown in the examples above from within the mathematics education community, and it is shown in the previous example of the relationship between gender and toys. Another case is this thesis - it is bound by particular discursive relations and hence constraints. Thus in writing this, I am propagating the fiction of academic discourse and of a PhD thesis. As such, with every word I write, I preserve the list of rules and norms that are acceptable, and the ones that are not. There are several troubling paradoxes, such as this, which run throughout the thesis. I negotiate this one by stating that the pursuit of the alternative within this thesis, does trouble the norm, and hence there is an attempt to break the hierarchy and privilege of academic

thought. I am attempting to question dominant discourses of mathematics education, and I am attempting to find a place of resistance.

Consequently, as well as creating rules of inclusion "discourses are exclusionary: they *rule out* other ways of thinking, talking or acting" (MacLure, 2003, p. 178 original emphasis). Yet, the question is, what enables some discourses to be taken up and accepted as normal, and what contributes to the marginalisation or resistance of other discourses. For instance why is the usefulness of mathematics the story that is allowed to be heard? Or how has this story become dominant, and how are others excluded? This is particularly pertinent in education where discourses which suggest improvement are abundant; hence most educational journal articles contain 'solutions' to educational (and societal) 'problems'. As such, the power of the journal article helps to maintain certain particular discursive practices. However, this is an over simplistic analysis and only part of the picture; discursive positioning is developed through many contingencies rather than being reliant on a simplistic cause and effect (Foucault, 1977/1991, 1978/1998, 2003g).

With this push for improvement, there are actually many different discourses in education. There are multiple discourses of mathematics education, discourses of educational research, and discourses of the mathematics classroom. Many of these are referenced and/or explored in this thesis; ones that have already been mentioned are the usefulness of mathematics and the desire to improve education. Another that should be mentioned concerns the favouring of the psychological child within education (Burman, 2008a; Henriques, Hollway, Urwin, Venn, & Walkerdine, 1998) this frames the central argument of this thesis. These and other key discourses are discussed in detail in the next chapter.

This does not mean that other types of talk do not occur; it means that these are the most acceptable discourses, and consequently these are the ones that are more easily taken up as common sense wisdom. It is this that creates regimes of truth, and establishes what it is possible to know (Walshaw, 2007). It is this which gives voice to some, whilst silencing others. As such,

> discourses not only circumscribe what it is possible to say, know and do, but also establish what kind of person one is entitled/obliged to 'be'. It is impossible, in other words, to speak without *speaking* as the kind of person who is invoked by one discourse or another. As Foucault [(1977/1991, p. 217)] put it, the individual is thus 'fabricated' into the social order. People are woven into, and woven out of, discourse. (MacLure, 2003, p. 176 original emphasis)

Hence everything we do, and who we are, are shaped by discourses; there is no discourse-free position. As such, I have stressed my position throughout, and I will continue to explore the discourses that shape my thinking (Haraway, 1988). In addition, I aim to draw attention to the many researchers and governments who do not stress theirs. Hence in this thesis, I articulate the hidden discourses that shape our very way of practising mathematics education. There are webs of discourses that interweave, coalesce and clash. Indeed "it is this relationship among discourses, this inter-discursive framework or web, that we should try to analyze" (Foucault, 1989f, p. 163), as it is this conflict that creates opportunities for knowledge. Moreover, education is messy, and student-teachers are exposed to these webs of competing discourses; hence in this thesis I examine how student-teachers negotiate this, and the discursive productions that are possible for the mathematical child. I am not looking at just what the discourses are, but how they are allowed to be. The salient point is that "we should not 'burrow' into discourse looking for meanings. We should instead look for the external conditions of its existence, its appearance and its regularity" (Threadgold, 2000, p. 49). One way in which we do this is by examining power relations, which are explored in the next section.

2.6 Power

Fundamental to Foucault's work, and my thesis, is the notion of power. Foucault argues that in designating what is 'normal' and what is the 'truth', "discourse transmits and produces power" (Foucault, 1978/1998, p. 101). Hence, power and discourses are part of the same production; as such power circulates within all aspects of my analysis and this thesis, and it is often hidden from plain view. However, discourses and power should not be viewed as dual concepts but instead can be viewed as a "three-dimensional constellation including discourse, knowledge, and power, ... that is, both invaded and controlled, constituted as an object formulated in 'truth' and defined as an object, as the target of a possible knowledge" (Foucault, 1989f, p. 162). Hence where we find permitted truths (discourses) we find power circulating and producing knowledge. Thus for Foucault power and knowledge are inextricably linked. He states:

> We should admit rather that power produces knowledge (and not simply by encouraging it because it serves power or by applying it because it is useful); that power and knowledge directly imply one another; that there is no power relation without the correlative constitution of a field of knowledge, nor any knowledge that does not presuppose and constitute at the same time power relations. (Foucault, 1977/1991, p. 27)

This way of thinking is very different to many 'traditional' forms of knowledge, as it acknowledges how 'truths' (discourses) are constituted by power/knowledge relations and vice versa. For

instance, as I explore in detail in the next chapter, this is shown in the psychological notion of the cognitive child, which appears as a 'truth' reasoned from an impartial standpoint. Foucault argues that it is this positioning of truths as impartial knowledge that can be dangerous (Foucault, 1977/1991, 1989i). Furthermore, he suggests the production of power/knowledge comes from systems and structures as opposed to belonging to individuals; again this contrasts to 'traditional' Western reason which is often premised on 'great' individual thinkers. Thus Foucault's power is found circulating within a system. It is a strategy rather than something which belongs to a dominant population.

> [Power] is a machine in which everyone is caught, those who exercise power as well as those who are subjected to it ... Power is no longer substantially identified with a particular individual who possesses it or exercises it by right of birth. It becomes a machinery that no one controls. Obviously everyone in this machine occupies a different position; some are more important than others and enable those who occupy them to produce effects of supremacy, insuring a class domination to the extent that they dissociate political power from individual power. (Foucault, 1989c, p. 234)

Thus power/knowledge relations are omnipresent; specifically "there are relations of power as fundamental as economic or discursive relations, that absolutely structure our lives." (Foucault, 1989h, p. 143). Power can be used to gain superiority, though it does not belong with that person, it circulates within the system.

To illustrate this, we can consider the construction of truths around standards in education and/or society. Specifically, through relations of power, governments impart their 'knowledge' of standards upon teachers, schools and the wider public, usually by "discourses of derision" (S. J. Ball, 2006; Kenway, 1990); "the destruction of the past" (Hobsbawm, 1994, p. 3), to enable the suggestion of a better future. "That is to say, power and knowledge are fused in the practices that comprise history" (S. J. Ball, 1994, p. 2) and the present. For example, the government adopt a "discourse of myth" (Alexander, 2010, p. 25) where the past (for example 'underachievement' – discussed in section 1.1) is attacked to suit the political agenda of today (Alexander, 2010), hence (re)writing history. In simple terms, a government denounces the current or previous position in order to propagate their own position (for education and society). This also demonstrates that this government can deliver progress. In addition, these 'truths' are centred around 'what is acceptable' within a British cultural context – they are stage-managed. However, these 'truths' are not sustained by a top-down passive model, instead they are maintained by the way they act within systems, and by the way they are taken up and reproduced by subjects. In this instance, teachers actively work to recreate these standards, and the permitted standards become

discourses. Here, power can be thought of as a method of control through negotiation and surveillance rather than as wielding an authoritarian presence.

Thus there is no oppressive position, instead individuals "are always in the position of simultaneously undergoing and exercising this power" (Foucault, 1980d, p. 98). This is very different to a Marxist or juridical view of power which Foucault vigorously critiqued. These versions of power are unidirectional and can be viewed as reductive. According to Foucault, a Marxist view of power is “conceived primarily in terms of the role it plays in the maintenance simultaneously of the relations of production and of a class domination which the development and specific forms of the forces of production have rendered possible" (Foucault, 1980d, pp. 88-89). It is important to note that, Foucault does not deny there is class power, but rather argues that power is not found in hierarchical structures, simply because they are hierarchical structures. The lack of reductionism within the reading of power relations is pertinent within education, as it allows us to work with the messiness of the practice of education, and work with its complexities. Power relations are not stable, instead “power is constantly being transformed along with the productive forces” (Foucault, 1989c, p. 236). Consequently individuals can shift their roles within this relation; they can “become powerful or powerless depending on the terms in which her/his subjectivity is constituted” (Walkerdine, 1990, p. 5). Therefore, “power is not something that is acquired, seized or shared, something that one holds on to or allows to slip away; power is exercised from innumerable points, in the interplay of nonegalitarian and mobile relations” (Foucault, 1978/1998, p. 94). “Power is ‘capillary’ in its operation” (Walshaw, 2007, p. 21), such that it flows through all levels of society and relations. Hence, power is not authoritarian. For Foucault, power

> traverses and produces things, it induces pleasure, forms knowledge, produces discourse. It needs to be considered as a productive network which runs through the whole social body, much more than as a negative instance whose function is repression … If power was never anything but repressive, if it never did anything but to say no, do you really think one would be brought to obey it? (Foucault, 1980c, p. 119).

Perhaps the simplest way to present this idea is to consider power as a verb rather than a noun, such that it is something to be done, rather than something that is or that someone has.

In summary, power is constituted through discourses; it is a positive, enabling and a productive force. It “circulates within institutions and social bodies, producing subjects who exert a ‘mutual ‘hold’ on one another” (MacLure, 2003, p. 49). As such, power runs through this thesis, and through the social systems that I discuss within it. Power enables and disables the student-

teachers who participated in my study, and it also permits and restricts me and my writing. “It is not possible for power to be exercised without knowledge, it is impossible for knowledge not to engender power” (Foucault, 1980b, p. 52). Thus with power, there is knowledge, and the creation of knowledge is the thrust of this thesis, as I explore the ‘truths’ that are permitted. Finally “all relations of force imply a power relation ... and each power relation can be referred to the political sphere of which it is a part, both as its effect and as its condition of possibility” (Foucault, 1989e, p. 211). Hence, this thesis seeks to highlight the power that runs through the political system of the classroom. And by political, I mean the influence of government but also the political governance found in mathematics education research; this domain is particularly good at appearing impartial. Put simply, power is something which allows people to act in a certain way, and encourages people to desire a certain way; neither of which are necessarily repressive. Consequently where you find power you will find resistance to this power and you find new forms of knowledge or behaviour (Foucault, 1978/1998, 1980c). It is these ways of behaving that are the thrust of my thesis. What happens when different discourses are found in the classroom – how do student-teachers act, and what knowledges are produced? Emerging from this power/knowledge, discourse relationship is the subject, both active and passive. Hence, this is explored in the next section.

2.7 ‘Man’, the subject and subjectivity

The poststructural “decentred self” (Walshaw, 2007, p. 5) is shaped by and shapes discourses. Power/knowledge relations constitute the self, (Foucault, 1989i), another example of their productivity. As power shifts and flows, it follows that the poststructural self is not fixed but instead is a fluid subject able to occupy different subject positions; it is a production of subjectivity and there is no true self to discover.

> Foucault, following Nietzsche, sees all views of human nature as the expression of contingent histories and social practices. Any particular theory of what a person ought to be like by nature is false, and has effects of constraining human possibilities and marginalizing those who fall outside the ‘nature’ (Pickett, 1996, p. 452)

This is a vital argument for my thesis, which focuses on various productions of the mathematical child. Many of these positions make implicit or explicit reference to the ‘natural’ child and assume that identity is fixed. “Indeed, the presupposition of the individual as a unitary entity, a thinking, feeling machine which is self-directed as far as thought processes are concerned, is basic to a child-centred pedagogy and to developmental psychology” (Henriques, et al., 1998, p. 102). I

argue that this child, explored in the next chapter, is not something to be discovered or engineered but instead is a discourse created within practices (Walkerdine, 1997, 1998b), and as above, "has effects of constraining human possibilities and marginalizing those who fall outside the 'nature'".

This is very different to the notion of the individual commonly found in psychological conceptions of humanity that seek to shape, classify and regulate man. Foucault rigorously critiqued the human sciences, his "initial critique of human sciences is that they, like philosophy, are premised on an impossible attempt to reconcile irreconcilable poles and posit a constituting subject" (Best & Kellner, 1991, p. 42). He argued that "one has to dispense with the constituent subject, and to get rid of the subject itself, that's to say, to arrive at an analysis which can account for the constitution of the subject within a historical framework" (Foucault, 1980c, p. 117). I attempt to contribute to this project, by arguing that the mathematical child is created by particular discourses within particular regimes of truth. This critique is particularly pertinent as the human sciences are currently popular in both general culture and in educational discourses. This popularity propagates this discourse, and encourages the fabrication of the subject around a 'real' self as something to identify with, and aspire to. As such, the modern person can be drawn to essentialised discourses of the self that are aligned to psychological models. This fits well with the neoliberal landscape where the autonomous, and entrepreneurial figure is central and we are under the illusion that we govern ourselves (N. Rose, 1999a). For the modern person this involves striving to make their lives meaningful and make sense of themselves: to see their life as an ongoing project (N. Rose, 1999a). From a Foucauldian perspective, the modern person is "not the man who goes off to discover himself, his secrets and his hidden truth; he is the man who tries to invent himself" (Foucault, 2003g, p. 50). As Foucault would argue, we "govern (themselves and others) by the production of truth … the establishment of domains in which the practice of true and false can be made at once ordered and pertinent" (Foucault, 2003c, p. 252). Hence we govern ourselves to accept fabricated fictions as the truth.

Thus Foucault argues that Man is a discursive construct (Foucault, 1970/2002), and moreover it is a modern invention perpetuated by the human sciences, or as Walkerdine puts it "the subject was a fictional construct produced in those regimes of truth that claim to describe them" (Walkerdine, 1997, p. 61). From this perspective, the concern is not to determine what the person or subject is, but what position the subject takes up within the available discourses, and how this position demonstrates that they are a 'legitimate' subject? Specifically, the subject is located and locates itself in the discourses where they find meaning and which we read through

the absence and presence of signs. For instance a school pupil may locate themselves as a 'good' mathematics student; they may display this through the sign of acting 'confident', which in turn may be presented through instances such as speaking up in class and/or answering questions quickly (Hardy, 2007) (see Chapter Six). Outside of the mathematics classroom this student can adopt different roles and hence can perform to different fictions (Walkerdine, 1990, 1998a). For example they can act as a 'troublemaker', 'coward', 'lad' or 'geek' – these positions are possible within a framework that views subjectivity as unstable. The point is that a person's self is not fixed, instead the subject is capable of performing various roles at various times, and as such takes on assorted relations to power. Moreover "there [is] no necessary coherence to the multiple sites in which subject-positions [are] produced, and … these positions might themselves be contradictory" (Henriques, et al., 1998, p. 203). In the next chapter I discuss how this relates specifically to teacher identity.

It is important to note that, even though Foucault emphasises the discursive regime, the subject is not subjected to these roles from a position of all-obliterating domination. In his later work, Foucault argues that "technologies of the self" work alongside "technologies of domination" to position people in discourses. He states that technologies of the self,

> permit individuals to effect by their own means, or with the help of others, a certain number of operations on their own bodies and souls, thoughts, conduct, and way of being, so as to transform themselves in order to attain a certain state of happiness, purity, wisdom, perfection or immortality. (Foucault, 2003f, p. 146)

Hence, subjects are not only oppressed but instead have a constrained agency, with the capacity to be aware of their own actions, thoughts and desires. Moreover, their positioning in discourses is not just determined by power and production within social mechanisms but also from "the possibility of self-determination and the choice of their own existence" (Foucault, 1989a, p. 452). Writing this thesis is an example of the self and agency, I am both subject to the disciplining machine of academia, but I am also attempting to critique the fictitious relations upon which much of academia is proposed. Hence I am in conflict with the power that circulates in mathematics education, of which I am also a part. As such, I am "keep[ing] watch over the excessive powers of political rationality" (Foucault, 2003e, p. 128) and, I am using "resistance as a chemical catalyst so as to bring to light power relations, locate their position, find out their point of application and the methods used" (Foucault, 2003e, p. 128). Hence, the subject is not predetermined but is produced through its actions, within the social systems that are available. "In our involvement in a wide range of social practices, we will often be categorised quite differently from one context to

another" (Walshaw, 2007, p. 100). Once again we see that the self is neither stable nor coherent, but fluid and messy. Thus my thesis considers this, and in particular, considers how power relations position the subject within discourses, rather than searching for an explanation of unvarying individuality. Hence just as there is no Truth, there is no True self, but rather a self in relation to time, context and positioning.

However commentators, such as Sarup (1993), argue that Foucault did not really have a theory of the subject. In fact some researchers (such as Henriques, et al., 1998; Walkerdine, 1997) turn to psychoanalysis and in particular to the poststructural psychoanalyst Lacan to explore subjectivity. Psychoanalysis is attractive to many as it offers a theorisation of how we resist change (Henriques, et al., 1998); it also suggests connections between the social and the psychic, something which is outside of Foucault's work. I do not wish, or have space, to explore Lacan or psychoanalysis in depth. However, I do draw on people that have used these theories, in particular to offer explanations of subjectivity within discourses.

In the next two sections I go on to explore how certain versions of the subject come to dominate, and how these are propagated through systems of governance and regulation. This idea of normalisation is a key concept for Foucault and also for my thesis as I argue the mathematics classrooms can propagate it. Differing from psychoanalysis, this draws upon the social and cultural, rather than the 'psychic'.

2.8 Normalisation

An aspect of both power and discourse is that they install and propagate normalisation (Carabine, 2001), a process that encourages a specific version of the 'normal' that subsequently becomes taken-for-granted or 'natural' (Foucault, 1977/1991, 1978/1998). If we examine this through the gender examples discussed earlier, we find that 'normal' girls prefers pink and play with dolls, crafts and make up etc., whilst 'normal' boys prefer blue and play with construction toys, cars and action heroes. This discursive positioning creates what is possible for both girls and boys, boys being active heroes, whilst girls are often passive homemakers; a familiar gendered discourses (Walkerdine, 1990, 1998a; Walkerdine & Lucey, 1989). The key point is that there is nothing natural or inevitable about this perceived normality. Instead, this 'normal' is created within the axis of power/knowledge. Just as "the subject was a fictional construct produced in those regimes of truth that claim to describe them" (Walkerdine, 1997, p. 61), so is the 'normal'.

Normalisation is a key concept for my thesis. In Act Two I explore what is 'normal' and how the pursuit of the 'normal' happens within the New Labour neoliberal educational context. It is, of course, a key concept for Foucault, he see it as all pervading.

> The problem is: aren't all powers currently connected to one specific power, that of normalization? Aren't the powers of normalization the techniques of normalization, a kind of instrument found just about everywhere today, in the educational institution, the penal institution, in shops, factories and administrations, as a kind of general instrument, generally accepted because scientific, which makes possible the domination and subjection of individuals? In other words, psychiatry as a general instrument of subjection and normalization – that, in my view, is the problem. (Foucault, 1989h, pp. 139-140)

Hence for Foucault, the role of psychiatry and psychology are problematic as, as above, he argues that "modern definitions of normalcy are invariably constructed by the human sciences." (Pickett, 1996, p. 453). In particular the 'normal' child of human sciences, that I unpack in the next chapter, is defined by developmental targets and criteria that they must achieve. However, I argue that taking into account the context of schooling and the neoliberal regime of the day, the pursuit of the normal child in modern education is broader than this child. This exploration is the crux of my thesis. In particular, I show that through looking in turn at progress, confidence, understanding and ability, that the specifications of the 'normal' mathematical school pupil are formed through comparison and reference to fabricated criteria. For instance the school, the classroom, the teacher, the pupils are all expected to reach 'normal' targets of attainment or exceed them. In addition, there are 'normal' ways of behaving in school – around the corridors, in the classroom, in the playground. Yet, the 'normal' pupil of the playground may not be the same as the 'normal' pupil of the classroom. Regardless, space and roles within the classroom/school can become normalised and thus we have permitted ways of behaving. Hence, many aspects of the classroom and of teachers, pupils and schools are constructed around a version of the normal; which I call the production of 'the mathematical child'. Within this, we find there are ways of acting that are less tolerated and that would brand someone or something abnormal.

Walshaw (2007) argues that normalisation in schools is propagated by the, covert and overt, surveillance and supervision that circulates. She states that a school

> performs a normalising function – and does it admirably well, by the way; disciplining intellect through remedial classes and extension groups, setting/streaming, repeat testing and examination, and so on ... Students every actions and interactions, and their understandings of their place in the school, are just some of the aspects of their place in the school, are just some of the aspects of their subjectivity that come under the constant gaze of teachers, principals, other students and so on. The gaze differentiates and compares. The tiniest deviation from normal practice is noticed. (p. 130)

Hence, the fictional normal pupil/classroom becomes desirable, and any person or system that diverges from this is designated deviant and undesirable. As mentioned above, these disparities are monitored through systems and structures such as judgement, comparison, tracking and other instances of 'support' and surveillance. Subsequently, restoration is sought to bring pupils/classrooms into line; as such they can tend towards homogenisation. Thus as Foucault states, normalisation is "another system of surveillance, another kind of control. An incessant visibility, a permanent classification of individuals, the creation of a hierarchy qualifying, establishing limits, providing diagnostics. The norm becomes the criterion for evaluating individuals" (Foucault, 1989g, p. 197), which is an all-pervading feature of education.

Pickett (1996) notes that schools (and universities) are particularly problematic sites as "they transmit a conservative ideology masked as knowledge" (p. 455), and hence as the truth. Generally, we do not usually question what we are told by schools; instead we expect them to be sites of professional expertise that offer opportunity and erudition. This is an attractive fiction to which many may want to adhere. Indeed, one persuasive aspect of normalisation is that it

> opens up membership to social entities that have a sense of cohesion about them ... Education is one such social institution. It provides a perfect demonstration of how easy it is to be seduced by its emancipatory rhetoric. Membership to its services is through practices and understandings that measure up to the norms it sets. (Walshaw, 2007, p. 130)

Hence normalisation can thrive in education, as we often aspire to improvement and/or liberation. And the suggestion of a unified system to achieve this is very appealing. Belonging to the system can become paramount as it is a marker of this desired advancement.

Of course the version of normalisation that is found depends upon the regime of truth in which knowledge circulates. The present knowledge base is caught up in truths of neoliberalism, discussed in detail in section 1.2. Normalisation functions in a particular way within neoliberalism. As we saw, neoliberalism normalises a particular model of selfhood as autonomous, psychological and entrepreneurial (N. Rose, 1999a). Within this, subjects become self-surveilling as they seek self-improvement and pursuit of the normal (S. J. Ball, 2008). In schools "students learn to monitor their own being, and they do this by practices of self-regulating, ever mindful of the gaze of others" (Walshaw, 2007, p. 131). As Foucault's work shows surveillance and regulation are not unique to neoliberalism, but they have become central within our neoliberal system. Such social systems constrain, not through the use of force, but through the production of normalised subjects. This process is called governmentality, and is the focus of the next section.

2.9 Governmentality

Explicitly, governmentality is the principle that governments or social systems constrain, not through the use of force, but through the production of normalised subjects, thus people are governed into practices of normalisation as opposed to governed simply by authoritarian principles (Walkerdine, 1990). In the gender example discussed earlier, the demand that boys prefer blue or 'action' toys is not administered through dictatorship, but instead is managed through surveillance, supervision, and 'choice'; specifically through the creation of a preferred norm, i.e. toys shops being split into blue/boy and pink/girl sections. And everyone wants their children to be normal, and children themselves want to be normal. Hence governmentality is not restricted to governments as "practices of the government are, on the one hand, multifarious and concern many kinds of people – the head of a family, the superior of a convent, the teacher or tutor of a child or pupil" (Foucault, 2003b, p. 233). Thus, governmentality applies to any social system rather than just to state politics. Moreover,

> studies of governmentality are not sociologies of rule. They are studies of a particular 'stratum' of knowing and acting. Of the emergence of particular 'regimes of truth' concerning the conduct of conduct, ways of speaking truth, persons authorized to speak truths, ways of enacting truths and the costs of so doing. (N. Rose, 1999b, p. 19)

In terms of this thesis, I am interested in the social systems that are found in the school and classroom, in relation to the government and universities. I am exploring who is allowed to speak and who and what is heard. In addition, I analyse how we come to know mathematics education, and how this version of events is constructed as the truth. Specifically, I tell stories of how the New Labour government enticed subjects into normalised patterns of behaviour and how this behaviour became positioned as good for everyone. Similarly, this principle applies to mathematics education research, where again a preferred way of being is produced. This is not achieved via tyranny or dictatorship but instead is accomplished through a covert and subversive manner of governing that breeds a specific acceptable version of the normal. Indeed the role of state, or the institution, is to create a regime of truth that demands this 'normal' behaviour (N. Rose, 1999a). Governmentality is a means of legitimatising, systemising and regulating the use of power, but one that is discursively produced as for the good of both the system and yourself. Hence, I am interested in how governmentality works in government, but also in universities and the community of mathematics education research, and explicitly how practices position themselves as fact. I am investigating "how forms of rationality inscribe themselves in practices or systems of practices, and what role they play within them - because it's true that 'practices' don't

exist without a certain regime of rationality" (Foucault, 2003c, p. 251). Subsequently, I analyse these two systems of governance (mathematics education research and education policy) in relation to another educational establishment, the mathematics classroom through the student-teachers' talk. Hence this thesis is the study of governmentality within several interconnected sites of power/knowledge. In particular, "the school and the university both perform the function of a technology of power ... without, of course, resorting to physical restraint. They train people towards acceptable behaviour" (Walshaw, 2007, p. 102). For the university, it is vitally important that as a critical institution, we are aware of our own practice in the formation and maintenance of 'truths'. Yet, there seems to be little questioning of the knowledge imparted and often little interrogation of the systems and strategies employed. Indeed, education establishments are most often positioned as places of universal good, and are symbols of mastery of nature and society (Dale, 2001).

Governmentality is governing by tactics as opposed to governing by law (Foucault, 2003b). The tactics constitute a system where there is "enforced obedience to rules that are presumed to be for the public good" (Walshaw, 2007, p. 102). It is not about obeying the 'governors' but it is more about influencing the conduct of individuals and societies. Thus "to govern humans is not to crush their capacity to act, but to acknowledge it and to utilise it for one's own objectives" (N. Rose, 1999b, p. 4). Within this, it is important to remember the role of (constrained) agency. For instance governmentality "also embraces the ways in which one might be urged and educated to bridle one's own passions, to control one's own instincts, to govern oneself" (N. Rose, 1999b, p. 3). This is coherent with the current regime of truth, neoliberalism, where subjects are concerned with self-regulation (S. J. Ball, 2003, 2008), within this, the subject has agency, and is both passive and active.

> 'Governmentality' implies the relationship of the self to itself, and I intend this concept of 'governmentality' to cover the whole range of practices that constitute, define, organize, and instrumentalize the strategies that individuals in their freedom can use in dealing with each other. (Foucault, 2003a, p. 41).

Thus, governmentality is concerned with "maximising the forces of the population collectively and individually" (N. Rose, 1999b, p. 23). Hence, it is not limited to the individual, but is concerned with using and normalising the population, through power/knowledge relations. This is particularly pertinent within New Labour's version of neoliberalism, which is sometimes labelled as "neoliberalism with a human face … the third way" (Arestis & Sawyer, 2005, p. 177), which mediates between "'collectivism and capitalism'" (Wacquant, 1991, p. 63). It is governance which

is rationally marketed as best for the consumer and for everyone; it is individualism with a collective social conscience, which can be very appealing and can draw upon the image of education as liberation. This is highlighted in Chapter Five, on progress when I look at problems with this image.

Thus in summary, like normalisation, governmentality takes on a specific purpose within neoliberalism. Power is thought to be decentred and individuals are regulated through self-regulation. The role of the state, or the institution is to create a regime of truth that demands this individuality (N. Rose, 1999a). It is not a tyranny or a dictatorship but a covert and subversive manner of governing that breeds a specific acceptable version of the normal. 'Freedom' is offered but this is an illusion, and instead people are governed through discourses of freedom, for example through notions such as the promise of enterprise, entrepreneurialism and/or autonomy (N. Rose, 1999a).

The question of how we examine governmentality and normalisation, how we take into account power/knowledge, and how we unpack discourses/truths is explored below. It concerns unpacking a notion, a person, a system an event, hence in the case of this thesis, it concerns unpacking mathematics education. This process of how Foucault unpacks discourses and social systems is discussed next.

2.10 Archaeology, genealogy, and deconstruction

Using the concepts discussed above, Foucault tended to talk about two ways of doing analysis.

> 'Archaeology' would be the appropriate methodology of this analysis of local discursivities, and 'genealogy' would be the tactics whereby, on the basis of the descriptions of these local discursivities, the subjected knowledges which were thus released would be brought into play. (Foucault, 1980d, p. 85)

Hence Foucault examined the conditions of possibility of social mechanisms, and particularly the emergence of accepted norms and practices; all done through the ideas discussed in this chapter. Hence in this thesis, I do analysis by looking for contingencies rather than causes; in addition, I take nothing as the 'truth' and instead examine the conditions that allow discourses to be positioned as such. I do this by using Foucault's readings on truth and power, on discourses and subjectivity, and on normalisation and governmentality, as tools of analysis. Hence my analysis concerns decentering text, destabilising oppositions and unpacking 'truths'.

Some poststructuralists would describe this as deconstruction, and there are times when I use this terminology. Hence, in the next part of this section, I unpack the use of this word, from a general and a specifically Derridian perspective.

Derrida states that deconstruction,

> is an analysis which tries to find out how ... thinking works or does not work, to find the tensions, the contradictions, the heterogeneity within their own corpus ... Deconstruction is not a method or some tool that you can apply to something from the outside. Deconstruction is something which happens and which happens inside. (Derrida 1994 in Caputo, 1997, p. 9)

As this definition suggests, it is quite problematic to be too specific about what deconstruction is or indeed how to do it. The aim is to

> be essentially anti-essential and highly unconventional, not to let its eyes wax over at the thought of either unchanging essences or ageless traditions, but rather to advocate an in-ventionalistic incoming, to stay constantly on the lookout for something unforeseeable, something new. (Caputo, 1997, p. 42)

Thus like all poststructural research, I attempt genealogy or deconstruction from the premise of non-essentialism, such that meanings are not there to be found, but instead are shaped by and shape discourses/text. As Lather (1991) states, "deconstruction includes a Foucauldian awareness of the oppressive role of ostensibly liberating forms of discourse" (p. 13). The aim is to not take anything as given and to question everything – to apply a close reading of the text. Moreover, "deconstruction is made of: not the mixture but the tension between memory, fidelity, the preservation of something that has been given to us, and, at the same time, heterogeneity, something absolutely new, and a break" (Derrida 1994 in Caputo, 1997, p. 6). Thus it should lack uniformity and take from old and new. However, it is not an attack on everything that has been, "deconstruction ... is always an attempt to open it up, not bash it or knock it senseless" (Caputo, 1997, p. 74), which again parallels a Foucauldian analysis, which through genealogy examines how histories create present day regimes of truth.

The other aspect of deconstruction that is commonly referenced to Derrida concerns the Other and the positioning of binary oppositions. This is by no means exclusive to Derrida, the idea of the Other is commonly found within psychoanalytical frameworks of analysis. Some of my analysis draws from this; in addition, I frequently refer to researchers that have used both Derrida's reading of deconstruction and psychoanalysis. Derrida contends that text is composed of dualisms and that these "binary oppositions are one of the key ways in which meaning and

knowledge are produced" (MacLure, 2003, p. 10). Thus they exist only in relation to each other, and are value laden; for example, us and them; black and white; boy and girl. "According to Derrida (1998), this oppositional logic reflects a form of 'metaphysical' thinking that has been practised by Western philosophy from Plato onwards, and which he called 'logocentrism'" (MacLure, 2003, p. 10). One term is established as more important, and more valuable, to the detriment to the other:

> Relations of difference and opposition, and the epistemic, 'violence' that they effect, can be found everywhere – from the minutae of in-group academic skirmishes … to the fundamentals of philosophy. They are of course everywhere to be found in the discourses of education. (MacLure, 2003, pp. 10-11)

These "simple [binary] claims are more effective than complicated ones" (Buckingham, 2011, p. 7). They allow us to work out who are the 'goodies' and who are the 'baddies', (Buckingham, 2011) which is a familiar cultural trope. Alexander terms these oppositions as "discourses of dichotomy" and agrees that they are prominent within education (Alexander, 2010, p. 21), and that they can restrict what is possible for education. Examples of dualisms that are interrogated in this thesis include: traditional pedagogy/progressive pedagogy (Chapter Five), knowledge/understanding (Chapter Six), doubt/confidence (Chapter Seven), hard work/natural ability (Chapter Eight), and occasionally structure/agency, masculine/feminine. Derrida contends that identity is formed from the difference represented in these dualisms, and by the wider context of reference to that meaning. Thus identity is dependent on excluding the Other. This difference is how meaning is produced.

> Identity is not the self-identity of a thing, this glass, for instance, this microphone, but implies a difference within identity. That is, the identity of a culture is a way of being different from itself; a culture is different from itself; language is different from itself; the person is different from itself. (Derrida in Caputo, 1997, p. 13)

Doing deconstruction (or genealogy) involves acknowledging and highlighting these oppositions, their presence and their interplay. It is an attempt to destabilise hierarchies, taken-for-granted notions and Western thought, it can be thought of "as a project of resistance to the institutionalized forgetting that takes place when matters attain the status of common sense, in educational policy, pedagogy and research itself" (MacLure, 2003, p. 179). Thus deconstruction and genealogy are attempts to unpack relations and disrupt unifying truths and hegemonic grand narratives and that is how they are used in this thesis.

2.11 Chapter Summary and concluding remarks

The aim of this chapter was to introduce the work and thought of Foucault, and to discuss how it has influenced this thesis. It was to set up the tools of analysis I use, and the epistemological position of this thesis. It specifically drew out ideas of discourse as permitted truths and power as capillary. “Power invents, power creates, power produces” (Foucault, 1989f, p. 158), thus power is not destructive but constructive. Power produces meaning and discourses that are found within social systems. My thesis examines power relations within systems to explore what can and cannot be said and what are the permitted truths. In particular, I explore these in key social institutions within mathematics education, (mathematics education research, education policy and the classroom); they are institutions that, I argue, are complicit in normalisation through the process of governmentality. That is they both permit and restrict until there is a preferred version of being that can be perceived as natural or inevitable. This is not done through authoritarian procedures but instead through tactical governance and agency. Within this, subjects are both passive and active and capable of taking up multiple subject positions. This thesis explores that positioning, and seeks to unpack, or deconstruct, common sense taken-for-granted truths of mathematics education. Hence, my aim is to take apart what we know, and what we perceive to be the Truth, with regards to mathematics education. To do this, I focus on various aspect of mathematics education that allow me to talk about one of the hidden, normalised, and intensely governed objects of current mathematics education – the mathematical child.

In the next chapter, I continue to set up the analysis of Act Two, by unpacking dominant versions of the child, primarily ones found(ed) in psychology. In addition I explore other key discourses of mathematics education, particularly pedagogy and the teacher, so that I can provide an appropriate backdrop to the current regime of truth that circulates within the mathematics classroom.

3 Chapter 3: Unpacking Dominant Discourses

3.1 Introduction

In the previous chapter I set up the notion that discourses are ways of being that have come to be accepted as the truth. Hence, they construct what can and cannot be said, and heard. Moreover, through power relations, they sanction who can and cannot speak. Thus discourses are constructive of meaning and subjects positioning within them. They can differ with time and context, and each society has its "regime of truth", that is govern the discourses they accept as true.

In this chapter, I analyse key discourses that provide a backdrop to the analysis found in Act Two of this thesis. Specifically to unpack discourses of the mathematical child, I examine discourses of the child, mathematics education and within this, the primary school teacher. My aim is to summarise and position the discourses within the current cultural context, teasing out dominance, and hence notions of the 'truth'. It is not my intention to do a full historical, genealogical or archaeological analysis, as there is neither space nor need for this, and a more thorough analysis of specific themes is provided in Act Two. Thus in some respects my account is an oversimplification. However, my work does have some aspects in common with a Foucauldian genealogy. Specifically, and like genealogy, I am "concerned with describing the procedures, practices, apparatuses and institutions involved in the production of discourses and knowledges, and their power effects" (Carabine, 2001, p. 276).

This chapter is split into two parts. In part one I begin to unpack the image and positioning of the 'child'. This is the crux of this thesis. Without the child, there cannot be a teacher and there cannot be childhood education; "views of the nature of the child have a profound effect on the aims of schooling and the nature of education" (Ernest, 1991, p. 132). In this chapter, I show how dominant productions of the child are part of the power/knowledge/discourse axis found in the cultural production of our time. Thus two important issues arise, first that it is problematic to view the chid as 'natural', and second, it is problematic to accept versions of the child presented as the 'truth'. This is developed in Act Two of this thesis, where I argue that this version of the child is often an assumed and homogenous part of educational policy and mathematics education research.

In part two of this chapter, I examine supplementary discourses that provide the background for my analysis of the mathematical child. I focus these around discourses of mathematics education pedagogy. The study of mathematics education is primarily concerned

with teaching and learning. Within the discourses of mathematics education pedagogy, I concentrate primarily on two dominant types – 'traditional' and 'progressive'. I discuss how these have dominated the mathematics education landscape in the UK, whilst interweaving the discussions with the corresponding discourses of the primary school teacher, and occasionally of the mathematical child (bearing in mind the in-depth analysis is kept for Act Two). Hence, in this section, I make connections between part one and two, arguing that certain productions of the child, the teacher, and pedagogy are more easily available than others. By showing how these are situated within the wider cultural context and time, I demonstrate that these are not 'natural' but instead are socio-cultural, political, productions.

3.2 Part one: The child, the educated child and child development.

3.2.1 Introduction

My aim in part one, is to demonstrate how the child is part of the regime of truth, and how certain concepts of the child draw from particular ontological and epistemological positions. I follow James, Jenks and Prout (1998), as my intention is to seek out the systems and structures which turn certain constructions of childhood into everyday common thought and practice. In particular, I contest the current concept of childhood in UK mathematics education, which is predominantly influenced by a 'natural', developmental version of the child. This is supported by child psychology and, as I argue, reinforced by our neoliberal society. First, I introduce the child by discussing why the concept/construct of childhood is so appealing. In doing this I am showing that Western culture heavily invests in the image of the child as symbol of the past and as holder of the future. I then unpack childhood as a construct, by examining how it can be culturally and socially constituted around laws and education. Next, I examine different discourses of childhood and of the child, arguing that these are never neutral, in spite of appearing so. Finally, I bring together these discourses, highlighting those that are dominant in the current regime of truth. From this, we should see that there are questions around constructions of the child that may cause conflict in practice, as explored in part two of this chapter.

3.2.2 The appeal of childhood

There is a certain fascination with childhood. The image of the child represents many things a society may strive towards. The child can, and has been used to signify innocence and a purity that adults cannot obtain, the child being yet to encounter the 'troubles' that 'taint' adults. Edelman (2004) states that "the Child has come to embody for us the telos of the social order and come to be seen as the one for whom that order is held in perpetual trust" (p. 11). Hence the

image of the child is entrusted with upholding society - present, past and, above all, future. The child is then broader than its relation to its family; the child belongs to and represents society; "children are everybody's concern and … they constitute an investment in the future in terms of the reproduction of social order" (James, et al., 1998, p. 15). The 'universal' child offers innocence and hope to people and to society.

Burman (2008a) argues that discourses of childhood, help us correct past mistakes as well as make sense of ourselves; "they are part of the cultural narratives that define who we are, why we are the way we are and where we are going" (Burman, 2008a, p. 67). However, our images and recollections of childhood are of course always retrospective. As such, they tend to draw on romantic constructions of the past (Burman, 2008a) and can encourage memories of a golden age, where events were much better, regardless as to how they were at the time (W. Brown, 2001; Kenway & Bullen, 2003) (this argument is explored further in Chapter Five - progress). For example, in their laments of the 'loss' of childhood, Winn (1983), refers to a "golden age of innocence" and Postman discusses "turn[ing] back the clock" (1982/1994), to a time when adults were in control and society was better. Thus the child is symbolic of an almost untenable position, of being both reminder of the past and holder of the future. The child, allows us to look in both of these directions at once. Hence, analysing the present child is problematic, especially with regards to temporality and discourses of progress. Specifically, as the present child is someone that we once were, and adults that will one day be. "On to the child we heap the thwarted longings of decaying societies and try to figure something better. It is a hard burden for children to carry. Surely they should be their own future, not ours" (Burman, 2008b, p. 171). Between this and the aspiring neoliberal government, it is perhaps no surprise that "childhood is the most intensively governed sector of personal existence" (N. Rose, 1999a, p. 123). With, children having a "prominent place in the policy and practices of legal, welfare, medical, and educational institutions" (James & Prout, 1997, p. 1).

As mentioned above, the loss of childhood has troubled many in a civilised society, and "the notion that children are growing up deprived of childhood has become a staple theme in popular psychology" (Buckingham, 2000, p. 21). A common argument is that childhood is being rushed, as children move quickly into traditionally adult domains (for example, Elkind, 2007/1981). However, many of these authors (such as, Elkind, 2007/1981; Kline, 1995; Postman, 1982/1994; Winn, 1983), tend to treat children as a passive, homogenous mass, and/or place their own value judgements on the situation. For example, in his critique of how he sees cartoons replacing classic literature, and "as in a great deal of Marxist cultural critique, Kline paradoxically takes the position

of the 'old bourgeoisie' in his attack on the new ruling ethos … His contrast … is suffused with value judgements which are never explained nor justified" (Buckingham, 2000, p. 160). Of course, as discussed in the previous chapter, power and agency are more complicated than this; and the principle that anyone is in a value-free position is a myth. Thus, childhood is not universal and it is not innocent, it is a sign constituted within discourses, and discourses are not without context and power.

> any description of children – and hence any invocation of the idea of child*hood* – cannot be neutral. On the contrary, any such discussion is inevitably informed by an *ideology* of childhood – that is, a set of meanings which serve to rationalize, to sustain or to challenge existing relationships of power between adults and children, and indeed between adults themselves (Buckingham, 2000, p. 11)

Hence, conceptions of the child are, fraught with power relations, as well as being social and cultural context dependent. This may not be obvious. The image of the child is usually innocent, harmless and worldwide. I contend, this has some connection to the 'romantic' conceptions of the child, explored throughout Act Two.

Crucially, what we define childhood to be is not universal. How we define the child, is often dependent upon what the child is expected to do, and as Buckingham alludes, the child "cannot be imagined except in relation to a conception of adult" (Jenks, 2005, p. 3); childhood becomes in relation to difference and to the marked boundaries created by reference its Other. This perception of examining childhood through difference is supported by recent thinkers in childhood studies, notably James, Jenks and Prout (James, et al., 1998; James & Prout, 1997). It draws on the principle that identity stems from difference, which is shared by many (for example Derrida 1994 in Caputo, 1997), and was discussed in section 2.10. Thus, there is not a magic age where people turn from 'child' to 'adult', though education and the law may tempt us to think as such.

3.2.3 Defining Childhood, through Difference to adulthood

In the UK there are various rules of governance that ascribe the age of an adult. For instance, you can have sex at 16, but you need to be 18 to drink alcohol, serve on a jury or to vote in a government election. If we take the voting age as a sign of adulthood, 18 seems to be the most popular age in many parts of the world, though it can be as young as 16 (for example, in Brazil, Austria, Isle of Man, and for the recent Scottish referendum on independence) or as old as 21 (for example, in Fiji, Philippines). However, for the majority of countries this age limit has been lowered from 21 within the last 50 years, suggesting again how ideas of childhood shift; the UK

changed in 1970. The timescale of compulsory education is similarly problematic, but seems to be moving in the opposite direction to voting law. Currently, compulsory education in England is from 5 to 17 (this has been raised from 16 in 2013 and is due to increase to 18 in 2015 (DfE, 2013, 2014). It had been set at 16 since 1972. From this, we cannot argue that conceptions of childhood have become shorter or longer. However, it does show that the length of childhood, and the type of actions one expects of adults, and of children, are not static, but as discussed above, are part of the cultural production of the time. Indeed, there are times when these laws would not have ascribed adulthood. For instance in the UK women were not allowed to vote before 1918, in addition children were expected to work in the nineteenth and early twentieth century, by society and by parents. My own great grandfather's mother doctored his birth certificate to enable him to 'legally' work down the mines a year early – at age ten instead of waiting until age eleven. Thus how we define childhood varies throughout history; moreover we cannot examine childhood without constituting it within the epoch of the time. In using these forms of governance to discuss childhood, I am not making the assertion that voting or compulsory education defines the timespan of being a child. Instead, I am suggesting it is one marker which contributes towards the construct that we recognise as childhood. However, there is a danger that I am placing childhood in a negative position in relation to adulthood, and I am adopting the position that childhood merely serves as the path to becoming an adult, which is common within the genre (Jenks, 2005). Hence, we may look for other signs that are constituted around the child. For example, we can examine childlike behaviours within their specific cultural context, such as examining childhood through toys or games or children's television. I explore this next, primarily through the work of Aries (1962/1996).

Aries was one of the earliest and most prominent thinkers to question the biological basis of childhood. Mostly drawing on French (and some English) examples, he documented how children have become (re)defined through social and cultural history (Aries, 1962/1996). His detailed account examines how the 'concept' of childhood as a distinct place starts around the sixteenth century, becoming part of common awareness around the time of the Enlightenment. Indeed Postman (1982/1994) makes a clear causal link between the emergence of childhood, and the invention of the printing press in the fifteenth century. This has been fervently contested by Luke (1989) on the point of accuracy; furthermore, as mentioned previously in section 3.2.2, Postman's work depends upon a homogenous concept of the child, and a Foucauldian approach, which I adopt, would suggest that the development of childhood is more dependent upon a range of contingencies rather than a single cause. To illustrate his points, Aries examines the child

through its representation in relation to various concepts and constructs in regards to its distinction from the adult. For instance, he uses examples from seventeenth century portraiture to illustrate children being portrayed within their 'own right', he shows how prior to this they were depicted as miniature versions of adults. As a result of his choice of example, critics of Aries state that his analysis is wholly dependent on the French middle/upper class (Buckingham, 2000). This, of course, does not devalue Aries contributions, but should keep us mindful over comparisons to other countries and contexts. Before this era, Aries argues that the child was not perceived with great importance, although this did not mean that the child was not cared for. Hence, rather than lacking a concept of childhood, previous societies lacked a concept of childhood with which we are currently familiar (Archard, 1993). This is not necessarily temporally progressive, indeed in ancient times there seemed to be more familiar depictions of the child. For instance, the ancient Greeks, believed children should be educated, though they did not share modern developmental views of child nurturance (Postman, 1982/1994), which I discuss in section 3.2.6 of this chapter. For instance, in relation to educating the child, Plato has a far more direct form of ensuring a child's development. He states that "if he [sic] obeys, well and good; if not, he is straightened by threats and blows, like a piece of bent or warped wood" (Plato, 380 BC/2009, p. 44).

As Jenks (2005) point out, the idea of an emerging rather than a pre-existing childhood, is much easier to understand if we consider modern conceptions such as the toddler, or the adolescent which surfaced post war. More recently we have another classification - the 'tween', a pre-adolescent, which seems to have risen within the current consumer driven, high marketing era (Buckingham, 2011). These constituted sub-categories of childhood add to the dissemination of a normalised and governed version of the child. As illustrated by the ancient Greeks, one of the key ways in which this development can be supported is education; as such, the child needed to become in the correct manner.

3.2.4 The construction of education as marking and shaping childhood

As mentioned earlier, one of the ways in which we can define childhood, is by the length of compulsory education. One of the key Enlightenment thinkers responsible for the interest in the needs of children was Rousseau (Robertson, 1976). He is often "credited with inventing the modern notion of childhood as a distinct period of human life with particular need for stimulation and education" (Burman, 2008a, p. 73). But Rousseau and education are not a cause in relation to an effect; it is more complex than this. In a Foucauldian sense, and using contingencies,

> the modern conception of childhood arose as a result of a complex network of interrelationships between ideology, government, pedagogy, and technology, each of

> which tended to reinforce the others; and as a result, it developed in different ways, and at different rates, in different national contexts. (Buckingham, 2000, p. 37)

For the child, and for anyone, education can be viewed as offering freedom and emancipation. Indeed, the right to an education is defined by United Nations Educational, Scientific and Cultural Organisation (UNESCO) as a Universal Human Right (UNESCO, 2000) and universal primary education was defined as a United Nations (UN) Millennium Goal (UN, 2013). However, education is also aligned to a structured form of discipline and governance; and thus education is concerned with shaping children into the correct kind of adult.

> As the child became an object of pleasure he or she also became an object of discipline: a creature in need of education; someone who needed watching. That with the invention of schooling came our modern sense of the long childhood … Children would begin to be schooled for adulthood … Once you invent the child you need something – like a school or family – to contain it. (Phillips in his introduction to Aries, 1962/1996, pp. 7- 8)

Burman (2008a) advances this argument and states that "the process of schooling demanded a state of ignorance in return for advancement of opportunities for a limited few" (p. 75). Specifically, with compulsory schooling, the factory child moved from bread winner to dependent, and the working-class family were programmed to remain in poverty. As such, education was not the architect of equity that it is often claimed to be (Hendrick, 1997). Moreover, education prioritises certain versions of adulthood over others. In this case, someone who is a learned professional, such as a doctor or accountant, is held in higher esteem than someone who is a skilled labourer.

Additionally, as education became for the masses, children (as a whole) became more visible, and the normalisation of childhood, as a distinct period of time and development, was perpetuated. Aries argues, that this was/is propagated by the construction of the school class, which intensifies and formalises a relation between age and stage. This construction can be viewed as powerful, perhaps more so than the previous discussed examples of adolescents and tweens. Not only is the construction tighter, but it is validated by the authority given to an educational institution. In particular, Aries states that the class, as much as the school, helped to shape the identity and perception of the modern school pupil. Specifically "the child changes his [sic] age every year at the same time as he changes his class" (Aries, 1962/1996, p. 172). The child is subject to and subject of, a new curriculum, often a new teacher, and new classroom expectations. "The result is a striking differentiation between age groups that are really quite close together" (Aries, 1962/1996, p. 172); yet this is not questioned. Consequently there is

homogenisation around small age groups and differences within ages are often overlooked, whereas differences between these constructed age groups are amplified (Aries, 1962/1996).

> Today the class, the constituent cell of the school structure, presents certain precise characteristics which are entirely familiar: it corresponds to a stage in the progressive acquisition of knowledge (to a curriculum), to an average age from which every attempt is made not to depart, to a physical, spatial unit, for each age group and subject group has its special premises (and the very word 'class' denotes both the container and the contents), and to a period of time, an annual period end at the end of which the class's complement changes. (Aries, 1962/1996, pp. 171-172).

As Aries highlights, the class is both "container and contents" (Aries, 1962/1996, pp. 171-172). It is the curriculum, the pedagogy and the culture; it is the boundaries and the borders. It both creates and restricts, its physical space confining those within. As such, there is a constructed relation between age and stage. However, it was not until the nineteenth century that the class became explicitly related to age, and largely that is the way it has stayed (Aries, 1962/1996). Previously, if classes existed they were more often formed around 'development', than age. With the age and stage class, standard rates of development gains authority, and becomes normalised. In recent years, this organisation of the class as one entity has slightly altered. The standard class is still bound by age, however, there is an expectation that the teacher provides differentiated levels of work, most commonly three levels within each class. In Chapter Eight, I argue that despite the appearance of individualised concepts such as levelling, neoliberalism and targets make the pursuit of the normal child paramount, and awareness of differences between children is superficial.

Having established the historical, cultural context of childhood, and in particular the connections between childhood and education, I move on to examine debates within the field of childhood studies. These shape the current regime of truth around childhood and the child in school. Issues that arise include: whether the child is social, whether the child has agency; whether the child is natural; and whether development is inevitable. Rather than give a full overview of child development, I show how the popularity of certain fields, such as developmental psychology, has come to create the truth around the child, development and childhood. However, I begin by discussing the child in postmodernity.

3.2.5 Debates in childhood studies

3.2.5.1 The (post)modern consumer child

As mentioned previously the loss or 'death of childhood' has troubled many in academia and society (such as Elkind, 2007/1981; Kline, 1995; Postman, 1982/1994; Winn, 1983). For example, they argue that children's access to televisions, and to the internet, have enabled traditional boundaries, that would have kept children 'in their place', to be broken down. Hence, there is more fluidity between the previously distinct categories of the adult and the child. However, as argued previously, this is not a loss of childhood, but a redefining of socially, culturally, and politically constructed boundaries. Specifically, the modern child is arguably produced by "consumer culture and media culture" (Kenway & Bullen, 2003, p. 2 original emphasis); within this, children have gained economic power within their 'own right' (Buckingham, 2000). This is part of a wider discourse of neoliberalism, where the autonomous individual is sought, and marketization drives many aspects of society. In particular, Western children are explicitly advertised to through overt and covert means. For instance, the creation of television, film, and popular music tie-ins to merchandise has ensured that "children's leisure has become inexorably tied up with the 'consumer revolution' of the post-war period" (Buckingham, 2000, p. 72). Within this, there are often two polarised views of the child. Either children are innocent, ingénues powerless to resist the evil of advertising and popular culture, as stated by some of those who bemoan the 'death of childhood'. Or children are savvy consumers, making active and rational choices, from those proposed by the marketers. "Either we believe in the power of consumers, or in the power of the market; either consumers are autonomous, or they are enslaved" (Buckingham, 2011, p. 33). Though as discussed in the previous chapter, a Foucauldian reading of power, takes power to be both enabling and restricting. As Buckingham (2011) argues these extremes are often positioned against a notion of structure and agency, that suggests these are diametrically opposed. Drawing on Buckingham (2011) and Cook and Kaiser (2004), in this context, and Walkerdine (1990, 1998a) and Davies (2003) in a wider educational context, I propose a position between these unnecessary extremes, and between the model of 'goodies and baddies'. Instead, children are active (and passive) agents who are capable of negotiating multiple subject positions within multiple contexts.

This consumer production does not stop with the child, indeed parents and teachers are consumers too. In particular, children are increasingly surveilled by their parents, who are themselves influenced by the increased emphasis on 'good parenting' and the marketization of appropriate educational experiences at home (Buckingham, 2011). This is part of the wider

resurgence of the human sciences, and in particular the popularity of psychological development, in popular culture. Within this, there is a 'real' parent/child that the 'real' autonomous individual can train themselves towards. As discussed in section 2.7 of this thesis, this can propagate essentialised discourses of the subject. Though, it is clear that these developmental opportunities are not found in equally across all children. These ways of being are invariably connected to the middle class (Buckingham, 2000, 2011).

> Childhood, then, certainly is changing. Children's lives are both more institutionalized and privatized, and less stable and secure, than they were thirty years ago. The boundaries between children and adults have been eroded in some areas, but strongly reinforced and extended in others. Children have been empowered, both politically and economically; but they have also been subjected to increasing adult surveillance and control. And the inequalities between rich and poor have grown exponentially. (Buckingham, 2000, pp. 78-79)

Sociologists James, Jenks and Prout (1998) state that the location of agency with the child can be traced to the rise in the popularity of childhood studies in sociology. The poststructural child draws comparisons to some sociological theories, in that I agree with James et al. (1998) that the child is socially constructed, it is not universal and it has agency. However, the poststructural subject is messy and identity is fluid. The child is shaped by and shapes discourses; as the poststructural child negotiates positions within those discourses (Davies, 2003; Henriques, et al., 1998). Aries' work is part of the wider network of interest in the child as social. The socially constructed child came to prominence around the 1970s "when the dominating philosophical paradigm shifted from a dogmatic materialism to an idealism inspired by the works of Husserl and Heidegger" (James, et al., 1998, p. 26). This is a hermeneutic model of childhood, such that it is one bound by the child's interpretation.

However, in spite of the awareness in childhood studies of the social and of the poststructural child, including multiple identities, and agency, "the study of childhood is typically the province of psychology … [where] the primary interest is in *internal* mental processes" (Buckingham, 2011, p. 49). The more dominant voices in childhood studies, as in all aspects of education, come from cognitive, psychological domains. Some of these have included conceptions of the social, such as Vygotsky who contended that development was the "conversion of social relations into mental functions" (Vygotsky, 1981, p. 165). However, many, including the most popular views drawn from Piaget, are based solely around cognition, where the mind is viewed as distinct from the body. Piaget, with his cognitive theory of development, is considered the most influential theorist within English education (James, et al., 1998). Indeed it has influenced some

interpretations of the consumer child, who envisage the child gradually becoming more rational and informed with each passing age and stage of development (for example McNeal, 2007). Piaget's work is part of a wider field of developmental psychology which gained popularity in the 1960s and 70s and maintains influence in the classroom (Burman, 2008a; James, et al., 1998). Hence within education, and popular culture, this 'natural' child development is normalised; it becomes part of common discourse. In the next section I go into more depth and detail about Piaget's naturally developing child. However, I begin by exploring Rousseau's natural child. As argued earlier, Rousseau is one of the earliest theorists to explore childhood. Traces of his ideas can be found in many examples of educational theory and in Piaget's work. My aim is to provide the background to the principles and ideas that are still part of common discourse in education, and that contribute to the normalisation of the natural child and child development. These sit in contrast to the messy fluid child of poststructuralism that I have presented above.

3.2.6 The normalisation of the natural child and child development

3.2.6.1 Rousseau's child - The natural child

As mentioned earlier, the Enlightenment, and in particular Rousseau, gave rise to the idea that the child required education and this would fix/shape the child. Within this, a specific version of the child emerged; one which is highly influential in education today (James, et al., 1998).

Rousseau's principle thesis was that man in/as a 'state of nature' breeds innocence and consequently brings liberty; he states "nothing is so gentle as man in his primitive state" (Rousseau, 1755/2007, p. 67). He viewed traits such as morality and goodness as innate and hence placed precedence on the 'natural man' without the corruption from the 'evils of society'. Moreover, Rousseau argued that all men should all seek this freedom. In contrast, he stated that "women is specially made for man's delight" (Rousseau, 1763/2007, p. 336); they were the passive to men's active, which kept the state of the 'natural' order. Hence his 'natural' freedoms for men were very much constructed around hierarchical binaries and an essentialised order. Rousseau is clear that for this to be achievable "all that we need … is the gift of education" (Rousseau, 1763/1884, p. 6, 1763/2007, p. 12). Furthermore, education was seen as broader than the classroom it "comes to us from nature, from men or from things" (Rousseau, 1763/1884, p. 6, 1763/2007, p. 12). For Rousseau learning to respond to nature and learning to 'control' responses was the pinnacle of his perfect, educated, natural man. For man to live a good and moral life even within the constraints of an immoral society is Rousseau's view of freedom. Thus in contrast to

some classic educationalists/philosophers such as Plato, Rousseau did not see the pursuit of knowledge as the ultimate goal of man. Rousseau's Child was a reasoned man:

> The noblest work in education is to make a reasoning man, and we expect to train a young child by making him reason! This is beginning at the end; this is making an instrument of a result. If children understood how to reason they would not need to be educated (Rousseau, 1763/1884, p. 256)

However, this reasoning was seen as analogous to character development, which he suggested was achieved through practical experience and not reading. It was also, as his language suggest, exclusive to men; women were subordinates geared to men's development.

Rousseau's primary thesis on education was written in *Emile, or on Education* (Rousseau, 1763/1884, 1763/2007). In it, he documents appropriate interventions for each stage of a male child's (Emile's) life, for instance emotion and sentiment are left until the child is a teenager. Although 'natural' development of the child is assumed, the teacher was a key part of this process. Rousseau's teacher was a solitary tutor who supported by covertly guiding the child; he argued that the child must not be made aware of the teacher's intentions. This 'allowed' the child to respond to nature without the intervention of others. As discussed, Rousseau was only concerned with man, and specifically, the boy Emile. He discussed the role of women through Sophie, who existed in a subordinate, passive role to support Emile's liberation.

Hence for Rousseau, education should be concerned with facilitating man's constructed experiences within the immediate environment; as such, many of his philosophies can be found in the principles of progressive education (Darling, 1994; James, et al., 1998). As can the influence of theorists that drew upon Rousseau's ideas; ones which closely match include Pestalozzi, Froebel, Dewey and Kilpatrick (Darling, 1994). Indeed Rousseau drew on the writings of another influential theorist, John Locke. Specifically, Locke's (1693/1932) version of child development was also based around reason. However, Locke's child was less innocent and less idealised. Locke's child was not defined by innate goodness, but was a child who could develop through exposure to experience and reason. Hence Locke's account combines some aspects of Rousseau's with a more empiricist and perhaps conservative account of childhood education (James, et al., 1998; Postman, 1982/1994).

There are many issues with Rousseau's interpretation of childhood and education. In the first instance, even the apparently free are products of discourse, including discourses of freedom itself. As I discussed in Chapters One and Two, whilst we live under apparent freedom we are in fact governed through freedom (N. Rose, 1999a). Rousseau's child though left to his own devices is

governed specifically through the structured interactions with their tutor, which are tailored around constructed stages in the child's life. Again, as discussed in section 1.2, structure and agency are positioned as diametrically opposite. Though more covert than authoritarianism, this form of governance is still concerned with producing a specific version of the child. In addition, the very idea of an innate child is contested; instead children are products of discourses which are product of the regime of truth which is cultural and specific. Rousseau ignores the cultural situation of his own work; *Emile, or on Education*, was focused around a middle-class French boy around the time of the French revolution. Hence the 'truths' of Emile are not the truths for others around the world. Furthermore, Emile's freedom is only possible alongside Sophie's confinement.

In the next section I explore one of the most influential theorists within education, who took the basis of Rousseau's work but applied a more 'scientific' approach to the study of childhood, Jean Piaget. As such, I am continuing to unpack natural child development, which I argue in Act Two, is the basis for the construction of the mathematical child within mathematics education research.

3.2.6.2 The normal, developed, psychological child – Piaget

Development psychology has emerged over the last century, though its influences date back several hundred years, including to the Enlightenment and Rousseau. A key principle is that the mind is distinct from the body; this gendered binary can be viewed as one amongst many that underlie Western thinking (Lloyd, 1993). In this instance, a cognitive model of normal child development is produced, and most importantly this development is both "natural and inevitable" (Burman, 2008a, p. 69), and leads to maturation (James, et al., 1998). Hence "developmental psychology capitalizes ... on two everyday assumptions: first, that children are natural rather than social phenonema, and secondly, that part of this naturalness extends to the inevitable process of their maturation" (James, et al., 1998, p. 17). This is heavily laden with assumed hierarchies and linear temporalities; "developmentalism implies that the movement from childhood to adulthood involves a linear progression from the simple to the complex and from the irrational to the rational" (Kenway & Bullen, 2003, p. 3). All of which assume a mass homogeneity of children and adults. Specifically, this normal developing child is a natural enquirer, a problem solver and is 'free' to make decisions. In addition, this child is actively engaged, develops from their experiences and produces their own knowledge. Thus, the psychological model of child development can be viewed as a commitment to science, rationality and reason (Burman, 2008a). "The developmental trajectory of children's thinking follows the 'up the hill' model of science and progress (Rorty, 1980): a hierarchical model of 'cognitive structures' emerges whereby a more mature logic arises

from and supersedes earlier and less adequate structures" (Burman, 2008a, p. 252). There are obvious comparisons to Rousseau's child, and to the human sciences that Foucault critiques (see section 2.7).

As discussed, arguably the most influential thinker in this movement was Piaget (James, et al., 1998), who depicted the child as a "budding scientist systematically encountering problems … and learning by discovery and activity (Piaget, 1957)" (Burman, 2008a, p. 251). For Piaget, as for Rousseau, science, rationality and reason could overcome the immorality of humanity. He states, "science is one of the finest examples of the adaptation of the human mind. It is the victory of mind over matter" (Piaget, 1933, p. 7). Again, this is similar to Rousseau's Enlightenment Child, and suggests that the preferred or 'natural' child within is stronger than the society outside. However, in contrast to Rousseau, Piaget's child does not develop into anything, but rather there is a specific child that is the epitome of maturation and intelligence (James, et al., 1998). In addition, Piaget wrote about child development, and not about men and boys as superior to women and girls, as Rousseau did.

Piaget is largely responsible for popularising the view that children think differently to adults (Burman, 2008a). He states:

> Education, for most people, means trying to lead the child to resemble the typical adult of his society … for me, education means making creators, even if there aren't many of them, even if one's creations are limited by comparison with those of others. (Piaget, 1980, p. 132)

Hence Piaget, along with his colleague Inhelder (Piaget & Inhelder, 1969/2000), developed a model of children's thinking as deliberately distinct from higher level adults thinking. Specifically, he devised a theory of growth that specified clear relations between age and stage that would develop through experience. Within this, cognitive thinking begins at the 'sensorimotor stage', where behaviours concern basic motor responses, and culminates in a 'formal operational stage', where high levels of abstract reasoning should occur (Piaget & Inhelder, 1969/2000). These stages of development are hierarchical, temporal, and constructed as normative, though Piaget did not expect everyone to reach this formal stage; from the quotation above, it is clear to see the model is not inclusive of all children. This provides a contrast to behaviourist models that proposed that a person's behaviour has no relation to internal thought, for example, see Watson (1913), Skinner (1938, 1974), Guthrie (1933) (discussed in Driscoll, 1994); these were popular at a time prior to Piaget's work.

Piaget never explicitly set out a model for teaching, he was more concerned with the child developing autonomy, and learning through discovery. Hence teachers and educators have interpreted Piagetian-style teaching as facilitating the activity of the child (Driscoll, 1994) usually through the use of problem-solving or creative tasks (L. Smith, 2001), this is explored more in part two of this chapter.

Piaget's critics cite his approach to research as flawed, which was largely based upon observing and experimenting with his own children (L. Smith, 2001). In addition, some have questioned the explicit and exclusive structure of the stages, as other observations of children have shown that children can move between stages or apply thought in a different stage within localised situations (Driscoll, 1994). Furthermore, Piaget is often criticised for removing the social from the child (and the child from the social). More significantly, and as explored throughout this thesis, we can dispute any claim that is reported as a universal truth (Burman & Parker, 1993). For instance, these truths are solely based around Western, and specifically European culture.

> Developmental psychology's commitment to a view of children and child development as fixed, unilinear and timeless is not only ethnocentric and culture-blind in its unwitting reflection of parochial preoccupations and consequent devaluation of differing patternings, but is also in danger of failing to recognise changes in the organisation of childhood subjectivity and agency. (Burman, 2008a, p. 82)

Thus the psychological cognitive child is not a universal child, but a white, middle-class Western child removed of their cultural and socio-political context. Furthermore, this child is not a reflection of society but is actively negotiated within cultural contexts. Hence, rather than assume that Piaget describes childhood, we can examine how psychology produces childhood within the social structures where it is found. Here, "the child is a sign created within discursive practices" (Walkerdine, 1997, p. 61) and more specifically "'the child' is deferred in relation to certain developmental accomplishments"; the very practices that claim to discover the child actually produces the child (Walkerdine, 1997, p. 61). Similar critiques can be found in Burman (1992, 2008a, 2008b), Burman and Parker (1993), Henriques et al. (1998), Walkerdine (1998a) and Walkerdine and Lucey (1989). In addition, this is one of the main arguments followed throughout Act Two of this thesis. Thus I argue that,

> Development psychology was made possible by the clinic and the nursery school … They thus simultaneously allowed for standardisation and for normalisation … It thus not only presented a picture of what was normal for children of such an age, but also enabled the normality of any child to be assessed by comparison with this norm. (N. Rose, 1999a, pp. 145-146)

Hence developmental psychology produces and is produced by comparisons to the normative and the normal child becomes the desire of education and everyone else is constructed as deviant; "it is the normalisation of development that makes abnormality possible, and vice versa" (Burman, 2008a, pp. 20-21). It is this version of the child that has come to dominate current perceptions of the child in education. This is within the neoliberal context of the human sciences that facilitate the fabricated subject (N. Rose, 1999a); it is within the child as a product of consumer and market discourses. Hence the "will to know" (Foucault, 1978/1998), may cohere to the psychological child. The simpler categories of the psychological child offer a logical and achievable model one that fits into the current system. Hence this 'developing' child is the 'real' child, and anything removed from this is Othered. However, what happens in these spaces of conflict is what is explored in Act Two of this thesis. I begin mapping these spaces in part two of this chapter.

3.2.7 Some concluding remarks to part 1

As discussed "our imaginings about the child have not always set out from the same starting point, and neither have they always had the same purpose in mind" (James, et al., 1998, p. 8). Hence when we consider childhood and education, we must remember that educators and/or laypersons, are not always talking about the same version of the child in spite of the presentation as such. As I argue in Act Two, this is often the assumption of dominant discourses of education – mathematics education research and educational policy.

In part two, I situate this constructed child within the field of mathematics education. Hence I move on to examine Piaget and Rousseau, and other relevant educational theorists, in relation to mathematics education, both broadly and within the contemporary UK context.

3.3 Part two: Mathematics education: pedagogies, the primary school teacher and the mathematical child

3.3.1 Introduction

In Act Two of this thesis, I examine how the mathematical child is constructed around norms of mathematics education. Specifically, though rather simplistically "mathematics education is devoted to the study of how students learn and how teachers teach" (Clarke, et al., 2004, p. 1). Hence, in this section, I discuss some norms of mathematics education, particularly in relation to preferred learning and teaching pedagogies, whilst relating this to constructions of the mathematical child. Within this, I highlight the relevance of the neoliberal regime of today and also the figure of the primary school teacher.

3.3.2 Mathematics Education: Pedagogies; mathematics and the mathematical child.

As already discussed perhaps the most influential thinker in education was Piaget, and the most influential movement within education, and mathematics education, comes from developmental psychology. Indeed, writing in 1994, Lerman (1994) notes that the "mathematics education community has always been influenced by developments in educational psychology, and in that community Piaget's work was still dominant" (p. 42), privileging the cognition of the mathematical child. This slightly dated remark remains relevant within the neoliberal New Labour era (1997-2010), with the marketization of education, and the current popularity of the human sciences.

Specifically, under neoliberalism, governmentality (discussed in detail in Chapter Two, section 2.9), the principle that social systems limit the subject through normalisation, is in the ascendance. Hence we live under the illusion of freedom, but instead we are automata, governed through this freedom (Foucault, 1977/1991, 1978/1998; N. Rose, 1999a).

> The human sciences have actually made it possible to exercise political, moral, organizational, even personal authority in ways compatible with liberal notions of freedom and autonomy of individuals and ideas about liberal limits on the scope of legitimate political intervention... these new forms of regulation do not crush subjectivity. They actually fabricate subjects ... capable of bearing the burdens of liberty (N. Rose, 1999a, p. viii)

Consequently the modern person strives to make their lives meaningful and make sense of themselves (N. Rose, 1999a). As such they can become drawn into normalising essentialised discourses of the self; this applies to researchers, teachers and pupils. Even those who specify that they are 'finding themselves', which is a popular trope in the human sciences, are 'inventing' themselves around specific models of selfhood. Education is part of this production, conjuring an emancipatory narrative where redemption can be sought by both the individual and society. However this is the autonomy that Foucault critiques. Specifically, "in their development the human sciences lead to the disappearance of man rather than his [sic] apotheosis" (Foucault, 1989d, p. 16). As discussed in the previous chapter, Foucault and poststructuralism "dis-assembles the humanist subject – the thinking, self-aware, truth-seeking individual ('man') who is able to master both 'his' own internal passions and the physical world around him, through the exercise of reason" (MacLure, 2003, p. 175). Instead poststructuralists, and I, argue that the notion of autonomy is a fabricated myth and the humanist subject is a fiction acting through discourses (Walkerdine, 1990). Hence, the popularity of developmental psychology in mathematics education

is paralleled by the rise of the individual within neoliberalism, and the governance of individuals through the promise and positioning of autonomy (N. Rose, 1999a).

Piaget, and developmental psychology, have been extremely influential on mathematics education, particularly with regards to the proposed manner of learning and teaching. This, as mentioned, is in spite of Piaget not specifically addressing teachers and teaching. In mathematics education, we may crudely split mathematics pedagogy into two principal philosophical domains, and two resulting pedagogies. 'Progressive' also known as reform, open, nontraditional, and student/child-centred – which has its roots in developmental psychology; and 'traditional', also known as closed, teacher-led and subject-centred, which can have its roots in behaviourism. Several scholars warn against propagating these false binaries (including Alexander, 1994; 2010; and Pring, 1989); however, in mathematics education these polarised ways of being in the classroom, seem to hold resilient positions. This is evident in the UK, and around Europe, but is also reflected in the 'Math Wars' found in the US, where proponents of reform and traditional mathematics education fiercely advocate each position and corresponding curricula. Indeed, "there is evidence that the two sides of these math wars are not attending to the points made by the other side" (Davison, Mitchell, & Montana, 2008, p. 143). Thus I am presenting these philosophical pedagogies as a polarity, however I do not believe this to be 'real'. My argument is concerned with exposing the tendency to strongly advocate one position, over another and create a dualism, in this case to promote progressive or traditional education. As discussed by Alexander (2010), these discourses of dichotomy are prevalent within education and limit possibilities. Opinions are restricted to these binaries, discussion is focused around extremes, and consequently the creation of new knowledge is constrained. Furthermore, people are positioned into feuding from mythical fixed locations. This tendency towards tunnel vision is common within political and educational discourses, where strong principles as statements of worth are required. As in part one of this chapter, my aim is to explore and expose these mathematics pedagogies as products of socio-political discourse, and forms of governance. Moreover, my thesis discusses how each discourse produces a preferred version of the mathematical child (and the mathematical teacher).

As mentioned, progressive education has its foundations in educational reformers such as Rousseau (see Rousseau, 1763/1884), Dewey (see for example Dewey, 1902/1956; Dewey, 1916) and/or development psychologists such as Piaget (see for example Piaget & Garcia, 1989; or Piaget & Inhelder, 1969/2000). As such (and as discussed in the previous section), the basis of progressive education is that the child is positioned as free, and knowledge is produced through experience. Thus, the progressive child is thought to be predisposed to education and development, which is

seen as both natural and inevitable. Specifically for progressive education or "child-centred pedagogy, 'the child' is deferred in relation to certain developmental accomplishments" (Walkerdine, 1997, p. 61), for example Piagetian stages, where the child learns in 'logical' developmental blocks.

Within mathematics education, progressive education is often produced as synonymous with constructivism. In simple terms, and similarly to progressive education, constructivism is the perspective that human beings construct their own knowledge of the world (Wood, 1998). There are of course variants of constructivism: radical, progressive, conservative and reactionary (Phillips, 2000) and/or individual/cognitive (often linked to Piaget) and social (linked to Vygotsky) (Sjoberg, 2007), and there are differences between these. However my concern in this thesis is not with this minutiae, but instead is focused upon how the broad definition of constructivism is taken up and used as a dominant discourse within mathematics education pedagogy, and what this means for the mathematical child. Within this domain, the term constructivism is often used as an umbrella term when referring to any child-centred learning or teaching, inquiry or discovery based activities (Sjoberg, 2007); as such, I also use it as broadly, and often refer to it as constructivism or progressive mathematics education.

Fosnot (2013), an eminent writer/researcher on constructivism, describes the constructivist pedagogical perspective in more detail:

> A constructivist view of learning suggests an approach to teaching that gives learners the opportunity for concrete, contextually meaningful experience… the classroom in this model is seen as a mini-society, a community of learners engage in activity, discourse, interpretation, justification and reflection … what the teacher knows begins to dissipate as teachers assume more of a facilitator's role and learners take on more ownership of the ideas. Indeed, autonomy, mutual reciprocity of social relations, and empowerment become the goals. (p. preface)

From this, the constructivist thinker produces the constructivist child as a problem-solver, a negotiator, and an interrogator; the child is very much ready to learn, and is a natural active agent. Hence, "the notion of the active creative child, building her or his own concepts, was offered a theoretical rationale by constructivism, which argued that learning is something that children can only do for themselves" (Lerman, 1994, p. 41). Moreover, the teacher is thought to be in a less authoritarian role, as they are the facilitators of this experience. They are not the holders of greater knowledge, but are a tool to enable the experience, that helps the child produce their own knowledge. Similarly Simon (1995), in a frequently cited article, proposes the following four principles for a constructivist mathematics pedagogy. He particularly highlights the switch from

teacher to student-driven learning, stating that the teacher's knowledge should also be challenged.

1) Students' thinking/understanding is taken seriously and given a central place in the design and implementation of instruction;
2) The teacher's knowledge evolves simultaneously with the growth in the students' knowledge;
3) Planning for instruction is seen as including the generation of a hypothetical learning trajectory;
4) The continually changing knowledge of the teacher creates continual change in the teacher's hypothetical learning trajectory. (Simon, 1995, p. abstract).

This constructivist pedagogy usually involves the mathematical child in solving problems, discovering patterns, questioning methods and exploring possibilities; thus there is an overall emphasis on reflective inquiry (Handal, 2009). Moreover this perspective can draw from a fallibilist or a quasi-empiricist (Ernest, 1991; Lerman, 1983, 1990) perspective on mathematics; such that mathematics is a human activity, to be contested and continuously reconstructed.

As noted, the self-governing of the child and the non-dictatorial role of the teacher, can both be questioned. The progressive/constructivist child is a product of covert surveillance that masquerades as freedom. The classroom is not without rules, and the teacher is not without governance; they have a role, to facilitate a specific kind of development that they define. For example, Walkerdine (1998a) describes a teacher who feels unable to reprimand boys in her class, concerning their aggressive sexual language towards her. The teacher has determined it is part of the boys' 'natural' development.

In the preferred scenario, this mathematical child is naturally intrinsically motivated, naturally curious and naturally predisposed to education. Thus it assumes that intrinsic motivation, inquisition and curiosity are real. However, if the natural is not evident, the teacher's role is to produce it. Thus a specific kind of mathematical child is privileged. Within this, it is also assumed that structure and agency are opposed, when indeed the actual relationship is more complicated, as subjects take up many positions within available discourses. Additionally, "the cognitive model of the infant as problem solver mirrors that of the assembly worker, with research privileging those activities and products which will enhance performance" (Burman, 2008a, p. 43). Thus constructivism/progressive education is always already focused upon development, more so than the here and now. It is future orientated despite the focus on 'free' play. Attention is given to what the child will become rather than with what the child is now (Burman, 2008a). Therefore the

concern is with a specific kind of development and anyone who does not follow this is deviant (Walkerdine, 1990). Moreover, it is important to note that "the behaviours [of the child] do not precede the practice precisely because their specificity is produced in these practices" (Walkerdine, 1990, p. 138). This mathematical child is not natural, but is a production of discourses of progressive education, and developmental psychology (Burman, 1992, 2008a; Burman & Parker, 1993; Henriques, et al., 1998; Walkerdine, 1997, 1998a; Walkerdine & Lucey, 1989).

Traditional education is often set up as a contrast to this. Transmission models tend to be based upon direct instruction, where learning occurs through the transference of knowledge from a teacher ('master'), to a pupil (novice). Hence they follow a more behaviourist model of learning (for example, see Watson (1913), Skinner (1938, 1974), Guthrie (1933) (discussed in Driscoll, 1994)), or indeed may be influenced by a more Lockean (1693/1932) view of childhood, where "the child is an unformed person who through literacy, education, reason, self-control, and shame may be made into a civilised adult" (Postman, 1982/1994, p. 59). In mathematics pedagogy this may be through the repetition of standardised questions and practice, or through the modelling of methods and solutions. Hence traditional mathematics education, values recognised methods and techniques for doing mathematics. Also, they may focus on 'the basics', before moving onto more complex tasks; thus suggesting a fixed, hierarchical narrative for learning mathematics. The emphasis is on the teacher as the holder of absolute knowledge, often supported by discourses of absolute mathematics, which have connections to Platonism and/or Logicism and/or Euclidism (Ernest, 1991; Lerman, 1990). All of which suggest that there are mathematical objects that are abstract, independent, free of language and the human mind. This position of mathematics as an absolute truth is prevailing. "For over two thousand years mathematics has been dominated by an absolutist paradigm, which views it as a body of infallible and objective truth, far removed from the affairs and values of humanity" (Ernest, 1991, p. xi). The security of certainty, particularly of mathematics, can be appealing. As Ernest states, "if its [mathematics] certainty is questioned, the outcome may be that human beings have no certain knowledge at all" (Ernest, 1991, p. xi) and for many that is a very vulnerable position, which can be especially troubling within a school context. Instead, "mathematical reasoning presumes mastery of a discourse in which the universe is knowable and manipulable according to particular mathematical algorithms" (Walkerdine, 1990, p. 72). Placing the same structure around the mathematical child and pedagogy may appear the 'logical' approach.

The dominance of absolute mathematics is not shared by all of mathematics education research. In the majority of mathematics education research, and educational research in general,

traditional pedagogies and learning are often positioned as a deficit model; a few prominent examples of research include: Von Glasersfeld (1991) Schoenfeld (1992, 2002), and Boaler (1997b, 2002). These works are highly referenced, which demonstrates that these works are the acceptable face of mathematics education research, they are what is allowed to be said and heard. More often than not constructivism/progressive education are positioned as the "good guys" and traditional education are the "bad guys" (Sjoberg, 2007, p. 1) in a familiar and simplistic cultural trope (mentioned in sections 2.10, and 3.2.5). This is also evident in classifications such as Bloom's (1956) taxonomy - where knowledge is seen as the lowest classification, and hence the lowest form of intelligence - and Skemp's (1976) relational and instrumental understanding – the latter positioned as an inferior form of knowing. This elevation of understanding over knowing is the focus of Chapter Six. As such the mathematical child of traditional education is very much positioned as inferior. Dewey (1902/1956), a reformist, argued that if education relied solely on 'traditional' education, where the emphasis is on factual recall and transmission of knowledge,

> the child is simply the immature being who is to be matured; he [sic] is the superficial being who is to be deepened; his is narrow experience which is to be widened. It is his to receive, to accept. His part is fulfilled when he is ductile and docile (p. 8).

Hence a critique of traditional education is that is does not value the child, or indeed that it underestimates the capacity of the child. Other critics, such as Schoenfeld (1992), state that it "trivialises mathematics" (p. 335), and that teaching mathematics as disconnected facts is "impoverished" (p. 335). Another argument is that it adds to inequity, marginalising certain groups of mathematics' students (Boaler, 1997b; Schoenfeld, 2002). Yet, Dewey's remark above demonstrates how advocating one position such as progressive education, is reliant on attacking the Other.

However, what both progressive and traditional pedagogies tend to ignore is agency and the positioning of the subject, with regards to both the pupil and the teacher. Building on the previous chapter, specifically the principle that structure and agency are not opposed, the child is neither active nor passive in either situation, but instead is capable of both of these positons. For example if you believe, as constructivists do, that the child creates their meaning of the world, following methods in a mathematics classroom will not prevent them doing so; working through a method, does not deny agency. Neither of these positons are free from regulatory discourse; each suggests a preferred way of being, where the preferred teacher works towards a preferred pupil. In addition, both of these positions are rather simplistic in advocating a one way is best for all in mathematics education and learning. As such, the mathematical child is similarly positioned as

homogenous. Moreover as these discourses are positioned against each other, they propagate and fabricate each other, often with little acknowledgement of the importance to them of their Other.

Instead of restricting ourselves to these binaries there are many positions in-between that are not so extreme (Davison, et al., 2008). For instance, in a well cited article, Raymond (1997), has five classifications of mathematics pedagogies: Traditional; Primary Traditional; Even Mix of Traditional/Nontraditional and Primary Nontraditional and Nontraditional. These can be viewed as graded classifications of the divide between the extremes of traditional and progressive/nontraditional mathematics education. However, we can question how far this is helpful, as it is a spectrum that is anchored by the 'real' pedagogies (which is a similar argument to one made by Wilchins (2004) about 'real' genders). Raymond's work explicitly draws upon Ernest's (1991) five classifications of mathematical "educational ideologies": industrial trainer; technological pragmatist; old humanist; progressive educator and public educator. The progressive mathematics education, I have descried above is similar to Ernest's Progressive Educator and the Public Educator. Traditional mathematics education would be the Industrial Trainer at its most extreme, but may also be the Old Humanist or the Technological Pragmatist. Each of his classifications specify a preferred pedagogy, but they are broader, in that Ernest also identifies a: "political ideology; view of mathematics; theory of society; theory of the child; theory of ability; mathematical aims; theory of learning; theory of teaching mathematics; theory of resources; theory of assessment in mathematics; theory of social diversity" (pp. 138-139). This neat classification demonstrates how theories of teaching mathematics are embedded with theories of the mathematical child, which is explored empirically in Act Two of this thesis. In addition, Ernest's classification demonstrates that mathematical pedagogies should not be viewed as objective, and isolated from the epistemologies of the educators; moreover, mathematics pedagogies cannot be removed from cultural, social or political context. Hence, the focus within England upon progressive and traditional pedagogies is not a natural position of worldwide, timeless, mathematics education, but instead it is a cultural production of the time and context. They are what is allowed to be said and heard.

In spite of the seemingly fixed appearance of these classifications, Ernest suggests that in practice, perspectives are often mixed. Raymond, does not dispute the fixed classification (though as stated, we could argue that her classifications are a mixing of the two 'real' binaries, traditional and nontraditional/progressive), but she does contend that there are inconsistencies between teacher's beliefs about mathematics pedagogies and their practices. Instead, she argues that there

may be a stronger link between a teacher's beliefs concerning mathematics content (for example absolutist or fallibilist) and their actual practice. However, a poststructural position complicates these categories and this assumption. Soriede (2007) (who, in a Norwegian context, where there was not the same neoliberal agenda) examines in detail the different discourses available to contemporary teachers. She states that conceptions of teaching are related to identity, and in particular identity construction "occurs through the identification by the individual with particular subject positions within discourses" (Weedon, 1997, p. 112). However "there are no simple, one-dimensional and causal explanations or predictions to why teachers are positioned within some identities as others are rejected" (Soriede, 2007, p. 70). Thus it is too simplistic to say that teachers believe that mathematics is fixed and hence pedagogy and/or the mathematical child are similarly so. Moreover, Zembylas (2003) "challenge[s] the assumption that there is a singular 'teacher self' and an essential 'teacher identity' as implied in popular cultural myths about teaching" (p. 214). As previously discussed, the poststructural self is not fixed, however the common identity of a teacher may be mostly aligned to the normalised discourse of the time; there are of course many spaces for resistance and agency. Thus, (and paraphrasing Zembylas), it is not a question of who, but of what, how and when, which is explored in detail in Act Two.

Hence, there are more positions than progressive and traditional pedagogies within mathematics education, many more than I have had space to specifically mention here. Certainly, a teacher's positioning within this, is more complex than our assumptions suggest. However, my focus on this progressive/traditional dualism comes as it is the binary which has dominated, and still dominates political thought, education research and classroom practice. Thus in the next section, I draw on documents that are designed to shape the practice of school teachers to explain how the English education system has flip-flopped between advocating these positons for mathematics pedagogy. These documents blur the boundaries between political governance and educational research, which is one of the tensions that I am concerned with, throughout this thesis. Within this, I also discuss potential normalised positions of the primary school teacher, and make connections to the current context of neoliberalism.

3.3.3 Mathematics Pedagogy in UK Classrooms: Pedagogies in practice; the teacher and the mathematical child

The debate over the 'best' pedagogy to use in the mathematics classroom is a recurrent discussion within mathematics education. More often than not this is framed around necessary and expected improvement and progress, of grades, education, and/or society. Whilst "the current [New Labour] preoccupation with education is most obviously manifested in the emphasis

on ‘standards and achievement’” (Buckingham & Scanlon, 2003, p. 3), mathematics seems to have always sought this improvement. In particular, this discourse of derision is evident from around the time of the first education act in 1870, as I showed in section 1.1 when I quoted the government inspectors ascription of poor arithmetic to “radically imperfect teaching”. Similar critiques abound in recent reports on mathematics education (Ofsted, 2008; A. Smith, 2004; Williams, 2008). Hence, the ‘incompetence’ of mathematics teachers is a relatively static discourse within education, and within this the failure of the mathematical child to develop fully. As such, they are taken up as truths and become part of common discourse. Alongside this, the importance of mathematics is well documented. It is expected that every person should achieve at least a grade C at GCSE; although this positioning is created by leagues tables, industry, public discourse and the marketization of education within neoliberalism. Thus along with the subject English, mathematics occupies a ‘privileged’ position in schools; it is one of the core, compulsory subjects, and one that has a high status achievement level for the ‘normal’ pupil. For instance, Alexander observes that throughout compulsory education in England, education is concerned with “reading, writing, number and little else” (Alexander, 2010, p. 5).

However, although studying mathematics (or at least number) has always been important, and the teaching and learning subjected to derision, one way the discourse has shifted is with regards to the type of pedagogy that is advocated. Specifically, the pedagogy of mathematics education seems to follow cyclical patterns of dominance; hence, and following Foucault, we can question the notion of linear progress and a teleological approach to history. In particular, and as introduced in the previous section, this dichotomy/divide between the pedagogy associated with transmission and the pedagogy associated with exploratory mathematics has become one of the major and normalised discourses of mathematics education. Within this, different versions of the mathematical child appear, though this is not always in the foreground of the discussions.

As discussed throughout this chapter, Piaget is perhaps the most influential theorist in education, and his ideas are found within progressive education. “During the 1960s this work by Piaget and his colleagues was at the peak of its influence. It was very widely known and widely accepted” (Donaldson, 1978, p. 34), both in mathematics education research as previously discussed, and in official reports on primary education. The ‘Plowden report’ (Central Advisory Council for Education, 1967a, 1967b) (the first report on general primary education since ‘Hadow’s’ (Hadow & Great Britain. Board of Education. Consultative Committee on the Primary School, 1931)) was a particularly influential document that drew largely upon Piaget and progressive education. This is evident through chapter titles such as “the children, their growth

and development". Plowden emphasised the virtues of discovery teaching, and of developing understanding. Consequently at this time, the former became a marker of proficiency for mathematics teachers and the latter became a marker of proficiency for people doing mathematics. Subsequently during the late 1960's and 70's, guidance on teaching mathematics (and general primary education) was predominantly 'child-centred'. This direction can be seen as part of the wider liberal and progressive political thought that gained prominence during this time.

Within this, a specific kind of discourse of the teacher came to prominence, which still holds some influence today. In particular, Woods and Jeffrey (2002) argue that the discourse of the primary school teacher of the 1970's and 1980's was strongly influenced by progressivism and in particular the Plowden report (1967a, 1967b). As such, humanism and vocationalism were key to teachers' roles and identities. Specifically,

> This set of values centres around holism, person-centredness, and warm and caring relationships ... Teachers see children in holistic terms. Basic to this outlook is the child as person. They base their notion of 'good teaching' on child-centred principles, core features of which are full and harmonious development of the child, a focus on the individual learner rather than the whole class, an emphasis on activity and discovery, curriculum integration, and environmentally based learning (Sugrue, 1998). Teachers place a high priority on feelings in teaching and learning, and on making emotional connections with knowledge and with children (Woods & Jeffrey, 1996) ... The Plowden primary teacher ... feels that teaching is a vocation. (Woods & Jeffrey, 2002, pp. 92-93)

This discourse of primary teaching as nurturing (Coffey & Delamont, 2000) or primary teaching as a "culture of care" (Nias, 1999, p. 66), also draws from older and wider maternal discourses (Griffin, 1997). For instance, Walkerdine highlights that the 'Hadow Report' (Hadow & Great Britain. Board of Education. Consultative Committee on the Primary School, 1931) states that women go into teaching "to amplify their capacities for maternal nurturance" (Walkerdine, 1990, p. 22). As such primary school teaching was positioned as a "feminised semi-profession" (Acker, 1989) and as 'natural' women's work. "Like mothering, caring for young children in schools is regularly regarded as a natural sphere for women, making monetary incentives or public tributes unnecessary" (Acker, 1999, p. 4). Walkerdine also shows how the conflict between emotional and rational discourses can leave women caught in an impossible fiction. Particularly, that with the teacher as 'guide', "the servicing labour of women makes the child, the natural child, possible" (Walkerdine, 1990, p. 24). Consequently, "women teachers became caught, trapped inside a concept of nurturance which held them responsible for the freeing of each little individual, and therefore for the management of an idealist dream, an impossible fiction" (Walkerdine, 1990, p.

19). This is particularly true within progressive pedagogies. Walkerdine continues, arguing that this process of normalising the rational is done in a covert rather than an overtly disciplinary manner (see also Walkerdine & Lucey, 1989). Hence the illusion is of the child as "originator of its actions. The autonomous child is the empowered child, the child potentially ready to take its place in a democracy …. [this] is an illusion, an elaborate charade" (Walkerdine & Lucey, 1989, p. 25). Thus Foucauldian surveillance is present, with both pupils and teacher, though, as was apparent in the last section, it masquerades under the notion of natural development of, or what is best for, the child.

However time and governments alter and consequently so do political discourses. In a political backlash to progressive education in England, the then Conservative government of the late 1970's and 1980's implemented an agenda that valued 'traditional' education. On the whole, this saw rote and routine, and traditional values return to the majority of mathematics classrooms. To enable this transition to occur, the government created conditions where returning to basics becomes the 'choice' of the public; as Ball notes "education policies construct the 'problems' they address and, thus, the solutions they propose" (S. J. Ball, 2008, p. 94). As "people think of schooling as the major institution by which to improve society" (Popkewitz, 1988, p. 78), the government created fictions around the failure of progressive classrooms, linking this to failings in wider society. One example concerns the then Prime Minister Margaret Thatcher, who opposed progressive mathematics education; mockingly, she stated that "children who need to be able to count and multiply are learning anti-racist mathematics—whatever that may be" (quoted in Epstein, 1995, p. 64). "Here we have quite explicitly the notion that education (though the action of teachers) is inherently subversive" (Epstein, 1995, p. 65); and in this instance, could contest the principles of traditional education and the values of 'innocent' children. In this instance Thatcher's comment, is one of many that creates the truth that progressive mathematics is not appropriate or good mathematics education, and simultaneously that there is a certain type of mathematics (and society) - both traditional, that is correct. We can see in this statement, that this traditional agenda can be viewed as neo-conservative ideology, as "neo-conservative cultural restorationism ties together education, the family and the state with the past" (S. J. Ball, Kenny, & Gardiner, 1990, p. 5). Moreover, one of the 'aims' of a "'back to basics' curriculum … it is argued, is to reproduce gender, racial, and class distinctions in society" (Popkewitz & Brennan, 1997, p. 302). Hence these events could be viewed as the neo-conservative government seeking more 'control', not just over classrooms, but over the direction of the people and society. However, it is important to remember that whilst these are dominant discourses, they would not have been taken up by

everyone; teachers, pupils and schools still have agency and would still negotiate subject positions. For instance, Alexander (2010) argues that traditional values were never really absent from the classroom. As such the 'actual' picture is more complex than simple binaries and my over simplification suggests.

The 1980s saw the appearance of the influential report on mathematics education *Mathematics Counts: the Cockcroft report* (1982). It was produced under a neo-conservative government and could be viewed as a reaction to their ideology – a form of resistance. In particular, it criticised mathematics lessons for being irrelevant to pupils' lives and for being dominated by rote learning. It states "mathematics lessons in secondary schools are very often not about anything... There is excessive preoccupation with a sequence of skills and quite inadequate opportunity to see the skills emerging from the solution of problems" (Cockcroft, 1982, p. 462). Hence, the Cockcroft report was seen as favouring problem solving. Many in mathematics education (teaching and research), which as established mostly advocates progressive approaches, reference it as such (for example Holton, Anderson, Thomas, & Fletcher, 1999; Watt, 2005), and/or make links to constructivism (for example Romberg, 1997). At the very least, it legitimised progressive approaches, such that it was "'official' recognition of problem solving and investigation" (M. Rose, 2000, p. 31).

However, the advice in Cockcroft given was for a range of pedagogies in the classroom; one of the most quoted paragraphs of the report states:

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

This presents a picture which is focused on investigations, discussion and problem solving, but also includes teacher led activities and the practice of routines. According to Orton and Frobisher, originally writing in 1996, the concern is that problem solving is often neglected, or not done well.

> This [paragraph above] still stands as the best short statement of advice available. The suggestion has also been made frequently, both before and after the introduction of the NC, that mathematics teachers as a whole have been traditionally good at exposition, and

> at teaching aimed at consolidation and practice of skills and routines, but much less good at the other four elements of the Cockcroft report. (Orton & Frobisher, 2005, p. 9)

The implication is that the absence of problem solving and discovery learning, as advocated by Cockcroft, leads to unsatisfactory learning of mathematics. However the issue is that this is still not what teachers seem to do. This again, reflects the discourse of mathematics teachers as not good enough or "discourses of derision".

1988 saw another shift in education in England as the National Curriculum, a prescriptive document that legislated what content had to be taught, was introduced. Thus began an era of more overt political regulation of classrooms and schools. In particular, in the run up to the 1992 general election, the same Conservative government implemented another 'back-to-basics' agenda launching an attack on progressive styles of teaching (Alexander, 2010) and its role in holding back standards. In mathematics, a government Numeracy Task Force was instigated, which was the forerunner for what would become the National Numeracy Strategy, which became a key part of the New Labour government agenda. Alongside this, mathematics education research still promotes child-centered/progressive/constructivist pedagogy as the gold standard of education. One example of a very influential piece of mathematics education research that chose to directly contrast these divisions of progressive and traditional teaching, and that that took place during this time was Boaler's comparative study on "open and closed" approaches to mathematics (Boaler, 1996, 1997a, 1997b, 1997c, 1997d, 1998a, 1998b, 1998c, 2002). This study is explored in more depth in Chapter Six of this thesis, where I contend that the picture is more complicated than these binaries.

In 1997, when Tony Blair's New Labour government came to power, education was positioned as one of its highest priorities. This prestige increased both the value of education and the expectation - specifically the expectation was on the pupils, teachers and schools to 'achieve'. New Labour's policies encompassed broad and inclusive agendas such as *Every Child Matters* (DfES, 2003), hence they advocated a 'whole child' approach to education. However Alexander argues that New Labour "was less about enshrining 'excellence', 'enjoyment' 'breadth' and 'balance' than more about embedding the literacy and numeracy strategies through new frameworks" (Alexander, 2004, p. 36). Hence, in primary schools of the New Labour era, literacy and numeracy were given maximum importance and high status. Consequently, mathematics education was subject(ed) to various initiatives which governed the manner in which it was taught in classrooms (both secondary and primary). Teachers were reshaped with/in these policies and a more overt "state theory of learning" (Alexander, 2010, p. 294), was implemented.

As mentioned, one of New Labour's key reforms was their flagship National Strategies program. This consisted of funding, training and a multitude of resources and policies that were written for the government by private companies. This is reflective of the neoliberal shift towards the privatisation of the public sector, or by the blurring of these previously definitive boundaries. As discussed in section 1.2, in education, this is also evident within the operation of the school, from the private sponsored money, to the management and accountability of staff and pupils. Significantly, marketization had begun to drive general educational reform and educational policy (S. J. Ball, 1993a; Ozga, 2009; Whitty, et al., 1998). Part of the New Labour National Strategy initiative was the National Numeracy Strategy (NNS) (DfEE, 1999), which was the first, and perhaps most significant, mathematics education policy of the New Labour era (1997-2010). The NNS was positioned as fundamental in guiding teachers of mathematics on the subject content to be covered, the pedagogy to be used, and the nature of pupils' learning. Specifically, the NNS pedagogy seemed to dictate that mathematics classes were teacher led, fast paced and had short-term targets; teaching and learning for understanding, so central to progressive pedagogies, seemed to have taken a back seat. This Strategy is very much part of the wider neoliberal agenda and marketization. As such, terms such as economy, efficiency and measured outcomes entered both educational policy and educational discourse. Moreover the discourse of education for education's sake largely disappeared from state schools, and instead "education is now seen as a crucial factor in ensuring economic productivity and competitiveness in the context of 'informational capitalism'" (S. J. Ball, 2008, p. 1); mathematics education being vital in that role as tied to progress (as discussed in Chapter Five). Hence "learning is re-rendered as a 'cost-effective policy outcomes''; [and] achievement is a set of 'productivity targets'" (S. J. Ball, 2003, p. 218). Crucially, performativity is used as a method of legitimising education (S. J. Ball, 1994).

> Performativity is a technology, a culture and a mode of regulation that employs judgements, comparisons and displays as means of incentive, control, attrition and change - based on rewards and sanctions (both material and symbolic). The performances (of individual subjects or organisations) serve as measures of productivity or output, or displays of 'quality' or 'moments' of promotion or inspection. As such, they stand for, encapsulate or represent the worth, quality or value of an individual or organization within a field of judgement. (S. J. Ball, 2003, p. 216)

Moreover the mathematical child becomes part of this production. As such "children are arguably more hemmed in by surveillance and social regulation than ever before" (James, et al., 1998, p. 7). Mathematics and the mathematical child become functions of this system, as we shall see throughout Act Two, as I explored how progress and performances are measured and regulated.

Within this, the teacher is also remodelled around marketization, performativity, and autonomy. Consequently current discourses of education and of the teacher are more aligned with rational, managerial discourses, than with the care and nurturance discourses of the 1960s and 1970's Plowden teacher.

> We have seen how commodified has come to challenge personalized experience. Consumerism has replaced care. Measurable quantities have replaced immeasurable qualities in assessment. Audit accountability sidesteps the personal and local, putting emphasis on the abstract and the universal. Competencies have replaced personal qualities as criteria of the good teacher. (Woods & Jeffrey, 2002, p. 97)

Surveillance and assessment are high, and the teacher becomes both manager and performer.

> The introduction of market forces into the relations between schools means that teachers are now working within a new value context in which image and impression management are more important than the educational process, elements of control have been shifted from the producer (teachers) to the consumer (parents) via open enrolments, parental choice and per-capita funding. (S. J. Ball, 1993b, p. 108)

With image replacing educational processes, arguably pedagogy takes a back seat. Moreover, "professionality is replaced by accountability, collegiality by costing and surveillance" (S. J. Ball, 1994, p. 64). The worth of teacher becomes as a technician and performer, which is quite different from child-centred discourses of the teacher, and education for education's sake. As discussed in section 1.2, within neoliberalism, the private sector influences models of working in the public sector. In particular, the management of the self becomes a priority. Subjects self-surveil, and self-regulate, as they work towards a preferred way of being under the illusion of autonomy (S. J. Ball, 1994, 2003, 2006, 2008). This requires an investment in self-improvement via notions of the "productive self" (N. Rose, 1999a, p. 103). For example, emotion is largely ruled out of contemporary teacher discourses. Instead, the modern teacher must remain calm, rational and objective; they are caught in a web of controlling and regulating their emotions. To maintain their image, they are their own surveillance and discipline (Zembylas, 2003). The acceptable discourses of being are explored more in Act Two, around discourses of both the teacher and the mathematical child.

New Labour's neoliberal government sat through three terms, lasting from 1997 to 2010. Within this, there were minor modifications in overall detail and direction. For mathematics education, in 2006, the NNS was revised in the form of the Primary Strategy for Literacy and Mathematics (DfES, 2006b). In this version it was meant to be less formulaic and in terms of

mathematics there was more emphasis on the "using and applying" strand of the curriculum (the aspect concerned with the development of thinking and reasoning skills). Within this, there seemed to be more emphasis on learning as opposed to teaching, and hence the policies could be seen as more child-centred, and acknowledging the child's perspective, though this still sits within the background of a neoliberal performative agenda.

Regardless of the changes in educational policy, reports that critique the state of mathematics teaching seem to be fairly stagnant and maintain their position as discourses of derision. Recent reports on mathematics (Ofsted, 2008; A. Smith, 2004; Williams, 2008) tend to criticise mathematics teaching and learning for too much rote learning and recall, instead of the favoured understanding. Ofsted (2008) state that "it is vitally importance to shift from a narrow emphasis on disparate skills towards a focus on pupils' mathematical understanding" (p. 3). Though the distinction between research and policy documents is blurry (explored more in the next chapter and in Act Two), as discussed, this view that favours 'understanding' tends to be shared by many in mathematics education research. What 'understanding' is, is unpacked in Chapter Five.

In summary, within mathematics education, a strong discourse is that the results and the teaching are often not good enough, though this is part of the wider discourse of education that is concerned with improvement (Dale, 2001; Mendick, 2011) and the wider neoliberal discourses concerned with self-improvement. Although in educational policies and official discourses, what has varied is the type of pedagogy that has been condemned, and the type that has been championed. Specifically, the advocation of 'traditional' or 'progressive' styles of teaching, has switched positions throughout the last fifty years. This demonstrates how education has taken on an increasingly political function, and specifically how it has become a tool to be held responsible for the creation of a 'good' society. In addition it shows how the mathematical child should not be viewed only as cognitive and individual but as part of the cultural production of the time.

3.4 Chapter summary and concluding remarks

In this chapter I have shown that discourses of the child, teacher and mathematics education, which we accept to be true, are instead time, context and culture, dependent. Specifically, childhood, and what we perceive to be a 'natural' child can be contested as a cultural production found with each specific regime of truth. As such, 'progressive' child-centered pedagogies, that are particularly influential in mathematics education research, are not 'natural' but are a product of design. Hence this is the production of the mathematical child that is favoured, whilst others are excluded. Their dominance with mathematics education research is

often set up in contrast to 'traditional' pedagogies. This false binary, can maintain a mystique around each position, and can prevent educators moving outside of this. In addition, it relies on other binaries, such as the false dichotomy between structure and agency. In the present day, the teacher is predominantly a neoliberal performer of education, which does not necessarily fit with child-centered pedagogies. Hence different discourses compete, as teachers 'choose' to take up subject positions within this. What these teachers produce as the mathematical child is explored in Act Two of this thesis, as I attempt to answer the research question, **how is the mathematical child produced within the becoming of primary school student-teachers in England, and how does this include and exclude people within the mathematics classroom?** Hence, in the next chapter of the thesis I state how I went about this, by discussing my research methods and methodologies.

4 Chapter 4: Methodology and Method

4.1 Introduction to the chapter

Designing a methodology and methods for a poststructural thesis can be problematic. As already discussed in Chapter Two, there can be contradictions that arise from following the rules of accepted discourses when you are keen to challenge them, particularly with regards to notions of rationality and the authority that it affords. Thus poststructural design "impels researchers to re-think research processes – to pose (and re-pose) questions about the relationship between theory and methodology" (Coleman & Ringrose, 2013, p. 2). Deleuze, for example, would argue that "we should never have a method but should allow ourselves to *become* in relation to what we are seeking to understand" (Colebrook, 2002, p. 46). As a doctoral student, I could not follow Deleuze and have no method, if such a position were possible. However, in response to allowing myself and the project to become, my research design, which I describe in detail in this chapter, was structured, yet has fluidity. Other researchers, such as St Pierre (2000) in her Deleuzian ethnography, have sought to move between these two oppositional spaces. In my case the movement between theory, design, analysis and writing has been adaptable and cyclical as opposed to fixed and linear, despite appearances to the contrary in this thesis. In contrast to this

> the majority of methods texts construct the research process as an essentially orderly one, in which surprises are accommodated, anomalies are accounted for and catastrophes are averted. But as Derrida suggests, something important may be lost by the sort of methodological rigour which 'masters every surprise in advance' (Derrida, 1978, p. 172). (Clark, 2003, p. 37)

This chapter discusses how I have dealt with this, in particular by finding a balance between conforming to and challenging the structures and systems a PhD produces, and of which it is a product.

My research design employed both systematic methods and eclectic deviations. Before the fluidity set in, I started out by utilising some standard research procedures. However, in keeping with Foucauldian practice, I remained sceptical about their value. Similarly, the focus of the thesis has also developed throughout its incarnation. I had initial aims, discussed in Chapter One, however the overall direction of the thesis has very much been shaped by the iterative and reflexive work with the data. For instance, I have collected data that I have decided not to use and I have had ideas for chapters which I also foreclosed. By and large I have come to the conclusion that the interpretation of the data is more important than the design of the data collection. Thus

all qualitative data can be rich data providing it is interpreted within its time and context. Moreover, I have relied less upon research texts to 'validate' my 'choices'. Overall my "concern is with the task rather than with theoretical purism or conceptual niceties" (S. J. Ball, 1994, p. 2). That being said, there are some research designs which have more easily helped to answer my research question, and are more aligned to poststructuralism.

As discussed, my central question is how is the mathematical child produced within the becoming of primary school student-teachers in England, and how does this include and exclude people within the mathematics classroom? Specifically, to answer this I employed an embedded case study (Yin, 2008) of a university course and student-teachers within this. What follows in this chapter, is a thorough discussion of specifically what I did, the choices I made and the challenges I encountered. I begin by discussing the way a poststructural epistemology affected these decisions, relating it to case study design. This is followed by discussion and critique of the specific methods I used. This is structured somewhat chronologically, beginning with the identification of the participants, moving on to the collection of the data, and finishing with the analysis of the data. However, I approach my role as a researcher and the rather positivist constructs of validity and reliability, slightly differently. These are discussed throughout the chapter, in order to retain them within the context of the discussions. Moreover, ethical choices were made throughout the research, hence they are also embedded across the text, rather than constructed as a separate section/decision. It should be noted that the research was conducted under British Educational Research Association (BERA) ethical guidelines (BERA, 2004), and was supported by my institutions ethical committee (for ethics form, see appendix 2).

4.2 Genres of research: Poststructural case studies

4.2.1 Dominant discourses in research methods – how we are complicit in the production of truths

As established in the previous chapters, poststructural research seeks to challenge dominant discourses, which includes dominant research methodologies and methods. These approaches maintain power relations and hierarchies, and in doing so allow certain versions of events to be told. Thus I start the discussion of my research design by considering the dominant discourses of educational research, hence I can establish what is allowed to be said and heard.

Currently, there seems to be a preference in educational research for 'evidenced' based practice and for the pursuit of figures that give uncomplicated answers to 'improving' education (Hamilton & Corbett-Whittier, 2013). Oancea and Pring (2008) call this the 'what works'

movement, which they contend has come to dominate educational policy and practice since the 1990's. They give examples from both the US and UK contexts to show how research such as Randomized Control Trials (RCT's) have been held up as the gold standard of education. As such, and as discussed in Chapter One, mathematics education research is caught up in and bound by this construction, such that the parameters that allow it also limit its production (T. Brown & Clarke, 2013). Hence much of mathematics education research is always already concerned with the pursuit of statistical evidence to show 'what works' and what is 'best practice'. This limits our view of education in practice, and in particular suggests that both studying and researching mathematics education can be removed from its context. Hence these dominant research strategies make certain ontological assumptions. For example, they do

> not fully account for knowledge of the world as 'taken' by the person, rather than 'given', or for research that aims to destabilise taken for granted concepts and frameworks rather than replace them with equally closed alternative systems. As such, it is a restrictive model. (Oancea & Pring, 2008, p. 22)

My work follows mathematics education researchers such as Brown and Clarke (2013), Mendick (2006), Walkerdine (1989a, 1990), and Valero (2004) and seeks to antagonise the apparent universality of mathematics education and the research that describes and defines it. As such, my research methods are concerned with destabilising hierarchies and with acknowledging power, knowledge and discourses, both external and internal to this thesis. "Poststructuralism, then, permits – nay, invites – no, incites – us to reflect upon our method and explore new ways of knowing" (Richardson, 2000, p. 929). The particular details of this are discussed in more detail in the next section, where I highlight the alternatives to a power heavy 'objective' style of research. This is done by considering my role as a researcher, my relationship with the student-teachers and the type of sources I used.

4.2.2 Power relations, objectivity (and the role of the researcher)

In the first instance, poststructural researchers must discard the notion of 'objective' research, which always already concerns investing in a hierarchical power relation (Stanley & Wise, 1993). I see little value in removing the 'beauty' of human interaction from the situation and hold to the idea that "to relate to an object as such means to relate to it as if you were dead. That's the condition of truth, the condition of perception, the condition of objectivity" (Derrida, 1996, p. 216). Hence choosing objectivity would only support the positions that Foucault critiques, as discussed in Chapter Two. Instead the research is interpretative and relies upon acknowledging my role in its creation. As such I recognise that "one thing we cannot do, one trick we cannot perform,

is to extract ourselves entirely from the mesh of world goings on – and view them from a distance" (Clark, 2003, p. 42). Thus instead of pretending there are no researcher effects, I follow feminist theory, which has influenced me throughout the project, which advocates acknowledging and discussing these effects (for example, Delamont, 2003; Letherby, 2003; Stanley & Wise, 1993). "Being alive involves us in having emotions and involvements; and in doing research we cannot leave behind what it means to be a person alive in this world" (Stanley & Wise, 1993, p. 161).

As such, I am part of the web that creates the normalising discourses that I critique and I am unavoidably part of the data collection and the analysis; more specifically I am an agent in the research and part of its production (Paechter, 2001). Thus reflexivity must be a key part of poststructural research (M. M. Gergen & Gergen, 2000), self-reflexivity being a key way to interrupt power relations (Coffey & Delamont, 2000; Stanley & Wise, 1983, 1993). Hence I must acknowledge myself and my role in relation to the content of the thesis; "if we are to shed the role of the disengaged observer who records data from afar, then our voices must reflect our own vulnerabilities" (Tierney, 2000, p. 549). Though here there is a balance to be struck. Like Tierney "I am troubled by maintenance of a power-laden voice even if it is in the first person, I am equally troubled by a narcissistic voice that eschews a concern for those with whom the author works" (p. 549). Thus I write in the first person 'I', and make personal commentary where appropriate; however a more pertinent commentary is found in the epilogue and prologue, though in the third person. In this, I am considering that "both researcher and participant are positioned and are being positioned by virtue of history and context" (Olesen, 2000, p. 226), and that this history and context includes both cognitive and emotive responses in the production of knowledge (Griffin in Reinharz, 1992). Furthermore, "the stories told are at least as much about the researcher as the researched" (Povey, Angier, & Clarke, 2006, p. 461). Indeed the poststructural researcher will often carry out research which is aligned to their interest (Taylor, 2001). Indeed this thesis is partly drawn from my interests – the influence of politics on education being one; my own personal relationship to confidence being another. Moreover the critique of evidence based research stems from the frustration with my job, and so does the critique of cognitive based 'teaching for understanding', which is discussed more in Chapter Five. So, even though I made considered attempts to hear participants' stories and their 'voices', I was always aware that I would be reinterpreting them through myself (Stake, 2000) and this would be part of the project.

In addition I must consider my relationship to the participants of this study. In particular, MacLure (2003) is concerned over "the space between self and other, researcher and researched, and the desire to dissolve, or at least ethically regulate it" (MacLure, 2003, p. 4). However she also

states that we can never befriend or collaborate with the researched. Thus I must acknowledge that the space between (my)self and the participants is already loaded on several levels. I am afforded status by my roles as a researcher, a mathematics graduate and teacher, and as a lecturer on the student-teachers' course (albeit in a very minor role). Rather than ignore this, I engage with it and explore it in my analysis. Moreover, my approach towards the participants, and again borrowing from feminism, was to develop an ethics of care around the participants (Christians, 2000). This included involving them in the research process, using ethical interview techniques (discussed in more detail below) and minimising disruption to the participants' schedules.

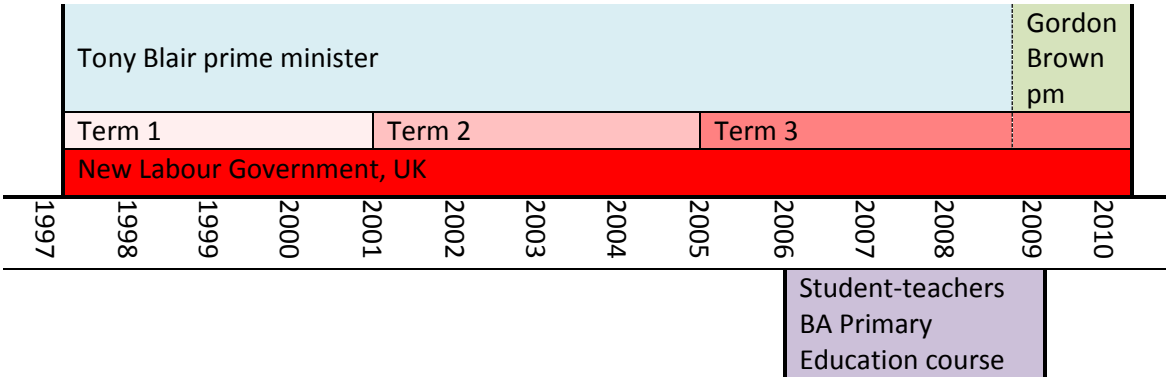
Finally this research project aims to destabilise other methods of normalisation and governmentality by drawing on research that is broader than education, and research evidence that is not the 'gold standard' of education. Thus I use Foucault to unpack hierarchies of current discourse and hence the ethically privileged (Usher, 2000).

My choice of using a case study approach to ensure a depth of analysis is explored below; this includes a discussion of the 'soundness' of the research.

4.2.3 A Case Study Approach

The particular approach I take in this project is to use case studies. The case study approach fits with poststructural research design, in that knowledge is contextualised and specific to the case. Thus I can examine how meaning is created through context-driven discourses, and through subjects' positioning within them. For this thesis, I consider how six student-teachers are produced by and produce discourses within the case of a particular University course within the New Labour regime in England. The following timeline illustrates the premise:

Table 1: Timeline of research study



It is important to note that by naming my process as a case study there may a tendency to include similar named work and exclude others. My work has commonality with many other research

designs which would not share my classification (discussed more in Stake, 2005). Hence my interpretation of case study is discussed in more detail below.

"A case study is an in-depth description and analysis of a bounded system" (Merriam, 2009, p. 40), beyond this, there is some multiplicity concerning its definition and implementation. For Stake a "case study is not a methodological choice but a choice of what is to be studied" (Stake, 2000, p. 435). However Yin (2008), whose approach to case studies is more aligned to his 'scientific' background, includes the research process in his definition, whilst Wolcott (2001) considers the outcomes of the case study within his classification. For my purpose I take the approach that the case is a unit of study (Stake, 2005). The central aim of this and any case study is to add depth and meaning to a situation that other types of research design may not afford. "The study of individual cases has always been the major (albeit often unrecognized) strategy in the advancement of knowledge about human beings" (Valsiner, 1986, p. 11). Specifically, a purpose of using case studies is that they can garner,

> descriptions that are complex, holistic and involving a myriad of not highly isolated variables; data that are likely to be gathered at least partly by personalistic observation; and a writing style that is informal, perhaps narrative, possibly with verbatim quotation, illustration and even allusion and metaphor. (Stake, 1978, p. 7)

The aim is not to look for causal factors or underlying characteristics, but instead to suggest interpretations and nuances based on coming to know the data. Moreover the central purpose is to offer rich description of the case discussed (Hamilton & Corbett-Whittier, 2013; Merriam, 2009; Stake, 1978, 1995).

My approach to this case study was to be selective about the collection of data. As such, I initially selected a group of six participants that would provide the basis of the case. Thus my research design could be described as an embedded case study (Yin, 2008), six cases within a case of a university course. Stake (2005) argues that six participants are enough to provide rich data for analysis; this number allows for the collection of similarities and differences between participants but also maintains depth. This selection could also be classified as a "set of individual case studies" (Hakim, 2000, pp. 63, 72). As discussed in Chapter One, my initial aims were to work with these student-teachers on their 'becoming' teachers of primary mathematics; this could be described as an "intrinsic case study" (Stake, 2000, p. 437), where the data helps an understanding of the case. However, as I became more involved in the project, early analysis of the data suggested that the mathematics classroom and the mathematical child needed unpacking; moreover, the data provided rich opportunities to do this. In addition, my relationship to the study, and my interest in

politics and norms influenced the overall direction. Thus eventually the thesis became less about the participants and more about the systems, structures and power relations of the discourses they produce and of which they were products. This approach could be described as an "instrumental case study" (Stake, 2000, p. 437), which is where a "case is examined mainly to provide insight into an issue or to revise a generalisation. The case is of secondary interest, it plays a supportive role and it facilitates our understanding of something else" (Stake, 2000, p. 437). These classifications of intrinsic and instrumental, are rather crude, though they are useful in helping us think about the purpose of this thesis.

During the early stages of data collection, when I was concerned with student-teacher becoming, my thesis was influenced by a particular type of case study termed narrative research or narrative inquiry (Bold, 2012; Clandinin & Connelly, 2004). Similar projects that navigate teacher identity through narrative inquiry include the classic texts by Clandinin and Connelly (1996; Connelly & Clandinin, 1990) and more recent doctoral studies such as Soreide (2007) and Miller (2006), though Miller does not classify her research as such. In spite of the change in emphasis, there are still aspects of the research that are common between my study and narrative inquiry. This includes that "first-person narratives provide much of the material used" (Robson, 2011, p. 374), and that the remembered events are more important than the event in constructing 'reality'. My particular view is that "I wish to consider self-narratives as forms of social accounting or public discourse. In this sense, narratives are conversational resources, constructions open to continuous alteration as interaction progresses" (K. J. Gergen, 2001, p. 249). Additionally, and similar to narrative research, I was unclear about the theories and outcomes that would arise from the project; instead I was willing to find this out from the student-teachers and let the "case content evolve even in the last phases of writing" (Stake, 2000, p. 441).

Moreover, for the poststructural researcher the use of case study requires problematizing generic concepts such as 'reliability' and 'validity'. Specifically, "recognition, authenticity and validity are not methodological or ethical phenomena at all … but rather *textual* ones—the effects of particular generic conventions for representing reality" (Stronach & MacLure, 1997, p. 49). As such, data are to be interpreted in the context of subject positioning within discourses, as opposed to searching for 'valid' and 'honest' responses as defined by 'natural' or 'objective' research. Hence for my research the notion of triangulation, popular in most research texts, is not appropriate as it can lead us further away from the story at hand (Potter & Wetherell, 1987). Specifically, 'triangulating' evidence can force us into homogenising accounts and searching for 'truths' that are not there. If texts are similar it may be because they serve the same purpose, or

subjects “are doing the same thing with it … there is no reason to suppose that consistency in accounts is a sure indicator of descriptive validity” (Potter & Wetherell, 1987, p. 34). Instead “the postmodern challenge is to accept the multiple mediations at work in the creation of the text and expose them, rather than try to hide them, wish them away, or assume that they can be resolved” (Tierney, 2000, p. 547). Thus each example of collected data is unique and contributes to that particular version of events, and subject positioning with discourses. There are of course ways that I have attempted to ensure my thesis is ‘sound‘, this includes: embedding it in theory and literature; staying close to the data; being reflexive; having a fluid approach to analysis and outcomes; exploring complexities in the themes and not seeking simple homogenisation; providing a thorough account of the research process (in all its messiness); and discussing the implications of my findings in wider contexts (chapter nine). These are very similar to categories discussed by Henwood and Pidgeon (1992) who identify seven attributes that qualitative research should uphold.

Primarily I was interested in the student-teachers’ perspectives, how they produce and are products of their experience and discourses. In particular, and drawing on Foucault, I was concerned with what was allowed to be said and heard by the student-teachers. To explore this, I employed both systematic and eclectic methods of inquiry that allowed both thoroughness and fluidity. In the next section I discuss the specific methods I used in more detail. I begin with the methods of data collection before moving onto methods of analysis.

4.3 Aims and sites of analysis of data collection

In Chapters Two and Three, I established that student-teachers are exposed to a multitude of competing discourses. Specifically in Chapter Three I unpacked some of the complexities around the mathematical child, through a discussion of the child, mathematics pedagogies, and the teacher, the aim being to demonstrate that rather than being ‘truths’ or ‘facts’ these discourses are dependent upon time and context. To unpack these discourses further and within the current context, I choose to examine three key sites for analysis: student-teachers’ talk; educational policy documents and mathematics education research; the justification for each of these is explained in turn below.

In the first instance, I chose to analyse student-teachers’ talk as the thesis was concerned with their becoming and their interpretation of events. Thus, it was imperative that the research methods I utilised were focused on the student-teachers’ perspectives rather than other people’s judgements of them. However, the other two sites of analysis were chosen as I considered them to be dominant discourses to which the student-teachers were exposed. Specifically, the

examination of educational policy, whilst a personal interest, is driven by the recent political 'engagement' with education. In their 1996 pre-election, and hence pre-government conference, New Labour stated their three main priorities as "education, education, education" (Blair, 1996) and with that came a wave of policies, strategies and reform. This prominence should be read against the shift towards a neoliberal version of education. Specifically and as discussed in previous chapters, the market had come to determine educational policy (S. J. Ball, 1993a, 1994; Ozga, 2009; Whitty, et al., 1998). Thus as my thesis seeks to talk about the regime of truth, I argue that it would be unviable to answer my research question without considering educational policy. Similarly, I contend that unpacking mathematics education research is an integral part of interrogating student-teachers' permitted discourses. These reflect the discourses the student-teachers were exposed to during their university course, as mentioned in section 1.3, these were focused around the cognitive mathematical child. As discussed in Chapter Three, I was also concerned that mathematics education research was constrained by the parameters that regulated it and again there were certain things that were allowed to be said and heard whilst others were dismissed. Hence, other areas that I could have examined, such as discourses of the university of their schools, seemed to fall into other more imperative categories, namely of mathematics education research and the student-teachers respectively.

Next I made decisions about the group of student-teachers I worked with, the educational policy documents I examined and the mathematics education research I interrogated.

4.4 Methods of data collection

4.4.1 The selection of the case – the course and the cohort of students

For case studies, the selection of the case is paramount to gaining an insight into the stories the researcher examines. The case of the specific university course was somewhat given to me by my employment, which is not unusual in case study design (Stake, 1995), thus it could be described as convenient (Robson, 2011), though I did view the case as an "opportunity to learn" (Stake, 2005). In addition, I deemed it a practical and ethically sound place for a research project. Specifically, the BA/BSc primary education programme was a three year course, which automatically gave a longitudinal approach to the study. I had also been asked to contribute to it in a minor role, giving a few lectures on year two of the course. Thus ethically I was content with working with these student-teachers as I was not overly invested in them or their outcomes from the course. Moreover, as my background was in secondary mathematics, and thus as a newcomer to primary mathematics education, I was interested in how people from various mathematical

backgrounds and with differing expertise with mathematics 'came' to teach it. Calderhead (1988) for one has suggested that the value of student-'teachers'/learners'' personal experiences is quite high in shaping their own conception of teaching and learning. For example, Brown, Jones and Bibby (2004) note that if student-teachers had negative experiences of mathematics they were "determined to deliver the subject in terms other than their own experience" (p. 174).

For the selection of the group of student-teachers I was generally concerned with normality and mundanity, hence it is possible to describe my case as an 'average' case (Yin, 2008). However the use of the word average must be unpicked; I am not using Yin's version of average as an essentialised interpretation of humanity, instead average refers to normative, such that (and building on my discussion in Chapter Two) the average position is a product of and produces discourses and subject positioning within them. Thus I selected a range of student-teachers with differing experiences to see how they relate to normative constructions.

There are approximately 80 students in each year of the degree and for academic work each year group is divided into four seminar groups. This conveniently gave me a group (X) of 22 to work with, before I would choose a smaller group of six who would become the case study participants. As well as Stake (1995, 2000), Morse (1994) suggests at least six participants are needed to try and appreciate experience; though of course I am not seeking generalisations across these. The choice of group X was both purposive and convenient (Robson, 2011). Specifically, I chose to work with them, as the group contained three male student-teachers (the highest in all of the groups). Hence I thought it gave more chance of a male being involved in the project, though this did not happen. As mentioned, the course ran from 2006-2009. In October and November of 2006, their first year of the course, I invited the entire group for individual interviews to talk about their life histories with mathematics (for specific details see section 4.4.4 and appendix 3). Sixteen of the student-teachers came, 15 women and one man. These interviews took place in offices at the University and lasted between 17 and 35 minutes. There were all transcribed verbatim, some by me and some professionally. Each interview was further edited by myself, checking for accuracy, whilst listening to the audio recordings. From this, I summarised general descriptions of each potential participant (see appendix 4) and consequently identified six potential participants) who seemed to have diverse experiences (Stake, 2000) in relation to: age and experience; engagement with mathematics; the local area; and schooling. The group contained a mixture of young students who had arrived at university relatively recently from school, and more mature students who had arrived at university through doing an access course. I was interested in including both of these groups. In addition, I did not want to only focus on those who identified as

either good or bad at mathematics, or those who only claimed to enjoy or not enjoy it. I also included a mixture of local students and students from the South of England. Furthermore, the group contained one student-teacher who attended an independent school; two student-teachers who were at high achieving comprehensives and three student-teachers who were at low to average achieving comprehensive schools. By using these crude classifications, I aimed to be aware of a range of experiences and to include a range of people. Thus my intention was not to look for homogenous accounts or identities. However, the purpose of this diversity is not to be confused with an attempt to represent all groups in relation to an essentialised take on identity. Instead, I was interested in studying constructed normality, and thus was intent not to be too concerned with any rudimentary classification, or essentialising characteristics. As well as this information, all of the student-teachers chosen were keen to talk, for example I excluded people who gave brief answers in their initial interviews. In addition they had already suggested 'stories of interest' in their first interview. To reiterate, the primary concern for this selection was "opportunity to learn" (Stake, 1995).

I approached these six student-teachers to be part of the project through an email (see appendix 5), hence the selection of the student-teachers was both purposive and opportunistic (Cohen, Manion, & Morrison, 2000). All agreed, bar one (James), who did not respond to contact. However, in the second year I sought another participant to complete a group of six - Jane volunteered. Conveniently, apart from gender, Jane had similar characteristics to James, such as a dislike of mathematics and being educated in a local comprehensive school.

The following table contains my thoughts on the participants from my field notes from the initial interviews. This is a mixture of information and my initial ideas about what they were saying.

Table 2: Initial thoughts on participants

Pseudonym	Time of initial interview (min)	Areas of interest from initial interview
Nicola	27	**Liked maths** – but both positive and negative experience about maths and school. **Grad A at GCSE**. State school to year 7. Independent from year 8 onwards. Took A-Level dropped it after a few months – she was bored (was it too hard?). Talks of maths as rote learning. Had a strong maternal figure. Confident (arrogant?) – wants to be seen as strong and in control – she states she chooses when to work. She identifies as a fast worker who is bored a lot. Positions maths as boring, lots of rote learning. Distinguishes between maths and problem solving as different things. Lots of storying. **Straight from school. From the south. Age 19**
Jane	Interviewed in second year	**Dislikes maths.** but **Grade B. Worked for a bit before uni**. Very self-aware and analytical. Prefers English – nervous about teaching. Quest for understanding – (why? to make maths easy?). Uses BBC bitesize and revision book to help with her maths. Primary school memories of working through books and queuing at teacher's desk. **Localish to the area. Age 26 years**
Sophie	22	**Bad experiences. Good at maths at primary** school – sat in tables. Mum has high expectations – strong maternal. (horrible) story about mum joking 'that's not good enough'. Low in confidence. Identifies as good at English. Describes different methods of learning and book work. Lots of talk about the social side of learning. Working in silence, and with worksheets. Disliked the teaching, but can't remember much about the teachers. Setting- moved down sets. Strong stories. (went to local good comprehensive school – strong achievement and expectations in schools). **Positions herself as bad at maths**. Talks about 'liver's out/livers' in'. Lives at home. **Positions herself as outsider and 'negative thinker'**. – "the worst is going to happen". Binaries. **Local to the area straight from school. age 18**
Kate	25	**A* at GCSE – the only person in set 3 to get an A*** - she went to a high achieving state school. Took A-Level but found it "really hard" got a C (she took 4 other very academic A-Levels). She still likes maths but the A-Level put her off – lots of algebra. "Boring old maths", "you have to know

		the message to get the right answer" she implies maths = genius, = geek. States she was behind at A-Level because she hadn't done the same work as those in the higher sets. **From the midlands. High performing comprehensive. Age 18**
Leah	28	Lost her voice – but spoke anyway. **GCSE Grade D. Foundation access course**, worked in a bank for a bit prior to course. She states her primary experience was good, but really disliked secondary school maths. Talks about "grasping" maths on the foundation course – simultaneous equations…"proving things to other people". Setting – set 2…she felt this was too high. Good storyteller, lots of Binary oppositions. Talks of people as gifted at maths. And "breaking it down" - lots of social stuff. Doesn't want others to feel like she felt at school. Maths as quiet (at school). **Comprehensive school. Local to the area. Age 25 years**
Louise	37	Confident – **A positive attitude**. Better at Maths than English. In Group One – really interesting. **Access course** and GCSE. Got a D at school, but resat last year. Positive maths attitude comes from self not from teaching. Enjoyed Maths. Nice stuff about Carol Vorderman and 'maths geek' and other socio-cultural references. Lots of storying. Positive about university as well. Good, strong, opinions about school and teaching. Good understanding of self. Very strong memories. **Comprehensive school (low performing) Local to the area. Age 27 years**

Table 3: Data collection schedule

Year of study	Year 1 (2006/2007)		Year 2 (2007/2008)			Year 3 (2008/2009)	
Type of data collection	Individual Interviews	Individual Interviews	Group Interview	Lesson Observation/interviews	Group Interview	Individual Interviews	Lesson Observation/interview
Date	Oct/Nov 06	Jun 07	Nov 07	Jan/Feb 08	May 08	Oct/Nov 08	Jun 09
Focus of data collection	Initial Interview	Post first TP	memories	During TP	Policy documents	Start of final year	During final TP
	1	2	3	4	5	6	7
Pseudonym: Jane	X	X (Oct07)	X	X		X	
Sophie	X	X	X	X	X	X	X
Kate	X	X	X	X	X	X	X
Leah	X	X (Oct07)	X			X	X
Louise	X	X		X		X	X (Feb10)
Nicola	X	X	X	X	X	X	X

The table above is the data collection schedule. X denotes these took place, or in the case of group interviews the participants who were present. TP refers to teaching practice. If the interviews took place at a different time this is denoted in brackets.

The aim was to collect small amounts of data at different points in the student-teachers' undergraduate degree course, and to analyse these in-depth. This adds a temporal dimension to the analysis. It is a common method and hence similar to techniques employed in other studies, including Miller's (2006) poststructural doctoral studies of women student-teachers in primary science. However, in keeping with a Foucauldian notion of troubling linear temporality, I have not always acknowledged the time and date of the interview, in my analysis in Act Two. I have only referred to it, when it is relevant to the story. The predominant use of interviews is similar to other poststructural case studies which are based around participants' identities. For example this is the case for Ball, Maguire, and Macrae's (2000) four year longitudinal study of post-16 students, for Brown and McNamara's (2011) study of teacher identity in relation to educational policy, and for Mendick's (2006) study of post 16 student's mathematical identities. I considered other examples

of language collection, such as writing short stories or narratives, however, I saw them as either too time consuming, or too close to university work. Hence interviews were the most ethical method available. As the previous table shows, I did carry out some observations of the student-teachers' lessons; however, instead of providing pieces of data for analysis the observations became methods of facilitating interviews in a different context. This decision was taken as I felt this way too close to my day job of tutor on a Post Graduate Certificate in Education (PGCE) Secondary course, where I regularly, observe and judge lessons. In addition, I wanted to stay close to the student-teachers' perspective, rather than project my judgement of their lesson on to the analysis. However there are more reasons to use interviews than replicating others. In the next section I justify the inclusion of interviews as a primary method of data collection and discuss the type of interviews I employed.

4.4.2 The justification of using interviews and the style of interviews

As we live in a postmodern "interview society" (Atkinson & Silverman, 1997) where interviews are an embedded part of culture and society, I determined that the participants would be familiar with an interview context. Hence, this would give them more ownership of the research than other methods, such as observations. As such, mine and "sociologists' methods and analyses reflect a wider preoccupation with the interview and personal revelation as a technology of biographical constructions" (Atkinson & Silverman, 1997, p. 306). Interviews are a means of helping us make 'sense' of ourselves. As elaborated in Chapter Two, for any discourse analyst, discourse constructs the 'reality' and meaning is relational (Wetherell, 2001). Thus, I view "self-conception not as an individual's personal and private cognitive structure but as discourse about the self" (K. J. Gergen, 2001, p. 247). Primarily I view interviews as "speaking identities into being" (Epstein & Johnson, 1998, p. 105), thus I am concerned with how the student-teachers take up some discourses and resist others as they construct the world around them. "In a significant sense, then we live by stories – both in the telling and the realizing of the self" (K. J. Gergen, 2001, p. 248) thus "narratives do not reflect so much as they create the sense of 'what is true'" (K. J. Gergen, 2001, p. 249). Hence I aim to explore how people present themselves during interviews and conversations, as they are constructing versions of themselves that they want to be seen as the truth. I am aware that "a person's account will vary according to its function" (Potter & Wetherell, 2001, p. 199), which is one reason why I varied the times and settings of the interviews. People should not necessarily express the same opinion at different times, within different contexts, or to different people (Wetherell, 2001). As discussed, poststructuralism seeks to expose and explore the messiness and inconsistencies between accounts (Tierney, 2000).

The philosophical approach to interviewing in this thesis, is similar to that of "active interviews" (Holstein & Gubrium, 1995, 2003, 2004), a process suited to poststructural research design. Specifically, the interview situation is interactive and collaborative. As such both participants and researcher are active agents in the interview process and in the production of knowledge. Furthermore "meaning is not merely elicited by apt questioning, nor simply transported through respondent replies; it is actively and communicatively assembled in the interview encounter" (Holstein & Gubrium, 2003, p. 68). Thus to facilitate the interviews I dynamically listened, I engaged with the participants' ideas and I encouraged reflection. "The objective is not to dictate interpretation, but to provide an environment conducive to the production of the range and complexity of meanings that address relevant issues, and not be confined by predetermined agendas" (Holstein & Gubrium, 2003, p. 75). Hence the direction of the interviews was not wholly dependent upon the interview schedule and the interviews could be described as unsanitised and unique. A principle with active interviews is that neither researcher nor participants are side-lined as the Other. Instead the active interview process queries the inevitable asymmetrical relationship (Maclure, 1993) that arises from the hierarchical interview situation; this has similarities to feminist research (Fontana & Frey, 2000; Holstein & Gubrium, 2003). However, I am aware that removing the power relation is not possible, and instead I acknowledge it in my analysis, in both its ability to restrict and produce. Specifically, I included myself in the interview where relevant and I answer any questions from the student-teachers honestly; I have written myself into the analysis where appropriate. "Viewing the interview as active we can acknowledge and appreciate how the interviewer participates with the respondent in shifting positions in the interview so as to explore alternate perspectives and stocks of knowledge" (Holstein & Gubrium, 2004, p. 154). Hence "meaning is socially constructed" (Holstein & Gubrium, 2004, p. 141) in part between the interview participant and the interviewer (me) but also, to continue with the deconstruction, between the reader (you) and the writer (me).

Though my philosophical take on and hence style of interviewing could be viewed as 'active' (Holstein & Gubrium, 2003), all of the interviews could also be categorised as semi structured (Bryman, 2004). They were based around specific themes (and sometimes questions) though there was also a great deal of flexibility. As discussed, the direction of the interview was determined by both the participant and me during it. However, we must be careful with such uncomplicated categorisations, and remember that to suggest anything is structure free fails to acknowledge omnipresent structures and power relations.

I acknowledge that interview data is always partial and incomplete (Silverman, 2005); however, I argue that knowledge, meaning and histories are similarly so. These interviews are powerful stories that contribute to a body of knowledge in a fragmented and situated world. In the next sections I give specific details about the interviews conducted - both individual and group.

4.4.3 Individual Interviews

The first individual interviews ((1) table 3) were based around past experiences with mathematics, present experiences with mathematics and future ideas for teaching mathematics. I was interested in exploring the student-teachers' experiences from their perspective, with the notion that we are "seasoned by events" (Caputo, 1993, p. 100). At the start of each initial interview, each student-teacher was given a handout, which explained the interview process, context and likely areas for questions (see appendix 3). Whilst some of this is good research practice and necessary for informed consent, the extra details of the interview questions was a specific attempt to bridge the gap between researcher and participant. The aim being to disrupt (in a very small way) the power hierarchy that is present. However, there was one aspect of the initial interview which may have perpetuated the power relations. My first question to the student-teachers was 'tell me about your qualifications in mathematics', the idea being to move "from the particular to the general as interviewees often find abstract questions difficult to address" (A. Brown & Dowling, 1998, p. 75). It is noticeable that for these first set of individual interviews I felt that I had to follow advice from standard research texts such as Brown and Dowling (1998), yet I was also aware of poststructural epistemologies. Perhaps I had not fully negotiated the contradictions that would arise between them. On reflection, asking the participants immediately about their qualifications was not supportive, and instead potentially alienated them. Instead I should have been focused more on building relations by "establishing trust and familiarity, [and] showing genuine interest" (Glassner & Loughlin, 1987, p. 38; in J. Miller & Glassner, 2004, p. 133); though I was conscious of developing these qualities throughout the interview.

The next set of individual interviews ((2) table 3) were placed at the end of the first year, this was to encourage the students to reflect on their first academic year and any changing perspectives. This meant that the student-teachers were on their teaching practice, hence the interviews were conducted in a place of their choosing - three in coffee shops and one in their school. One student-teacher (Leah) agreed to a follow up interview however we did not manage to schedule it – thus it took place at the beginning of the next academic year. In order to facilitate the interviews, prior to each one I read the transcript and listened to the audio of their previous

interview. This assisted me in getting to know the student-teachers, and specifically helped me follow up any statements or information given during the initial interview (1). It could also encourage a bond between researcher and participant, such that I am demonstrating an interest in them. Hence, for these interviews the interview schedule was very flexible and more "active" than the previous one. I had ideas that I planned to ask about their experiences at school and on the course, these included 'how are you finding the course?', 'how have you found school?', 'have you done any teaching of mathematics?', 'when we met before you said …. have you changed your mind at all or do you still … ? '. However, this was the extent of the schedule the rest was negotiated with the student-teachers.

Individual interviews (6) were also carried out at the beginning of the student-teachers' final year. They followed similar themes to the previous individual interviews, concerning 'what are your opinions of mathematics and mathematics teaching'; I was also able to ask 'how does this compare to when you started the course?' and 'how are you finding University?'. These interviews were again very flexible and the routes taken were actively negotiated between the participants and myself. My concern again, was with developing a relationship and a conversation. All of these interviews took place in the University at a time of the student-teachers' choosing.

Due to the flexibility of my interviewing style all individual interviews went beyond the topic of mathematics, in that they often explored wider learning, and sometimes their home lives. Again, I was concerned with creating an "active" conversation that balanced discussing what the participants wanted to say, with exploring areas of mathematics education. All interviews lasted between 17 minutes and 1 hour 25 minutes. This variety in timing transpired from the participants' eagerness to talk. All were audio recorded and transcribed by myself or by a private company. All interviews were further listened to by myself and edited accordingly.

4.4.4 Group Interviews

In the second year, I experimented with group interviews as an alternative to individual interviews hoping that they would encourage more engagement in and expression of ideas (Frey & Fontana, 1993; Madriz, 2000). This was driven by my reading of feminist research strategies which, similar to poststructuralism, seek to disrupt power hierarchies. Hence, the use of group interviews was an attempt to move power away from myself (Madriz, 2000). In doing this, I am not stating that power is static and that it belongs to me, instead, and as discussed earlier, power is in flux and is capillary (Foucault, 1978/1998, 1980a, 1982). Power relations can be actively negotiated within the dynamics of the group interview situation, with power being creative and productive (Foucault, 1989i).

Additionally, some group interviews can align to feminist theory in that they are a "collectivistic rather than an individualistic research method that focuses on the multivocality of participants' attitudes, experiences, and beliefs" (Madriz, 2000, p. 836). Thus following on from my previous discussions, group interviews too can be seen as "active interviews", in that they very much encourage topics to arise from the participants as they co-construct knowledge. As such, group interviews can provide depth and facilitate oblique directions in discussions, specifically if the topic is "habit-ridden or not thought out in detail" (Morgan, 1997, p. 11) – which, as discussed in Chapter Two, discourses of mathematics often are. This suited the changing direction of my thesis, as it became more concerned with unpacking discursive constructions.

A possible advantage of group interviews is that they can be less intimidating and more stimulating for the participants. However the converse argument is that silence (or conforming) may be easier for those whose views do not conform to the group norm or those who are easily intimidated in group situations (Morgan, 1997). This was particularly pertinent in this case, as the participants knew each other, they were peers and colleagues but would not have defined themselves as close friends; this was evident from the interviews and interactions between the participants. In addition, as they were from the same academic group they may have been used to group situations with each other. This could be positive in that familiarity may help the flow of the interview, however it could be problematic in that norms and values may have already been established. Specifically, the student-teachers may already be self-surveilling and have normalised their roles within their group.

As I wanted the student-teachers to engage with their past experiences and with their interpretation of mathematics, I designed the first group interview in October (3) around *memory work*. Specifically, I loosely drew upon Onyx and Small's (2001) interpretation of Haug's (1987) concept of *memory work*. It uses the principle that "the construction of self at any moment plays an important part in how the event is constructed ... [plus] the self is socially constructed through reflection" (Onyx & Small, 2001, p. 774). It is a relatively prescriptive method that is split into three phases:

> in phase 1 the individual's reflections indicate the processes of constructions ... phase 2 is the collective searching for common understanding, with the method allowing for the social nature of the construction of the memories to be realized ... phase 3, the material provided from both the written memories and the collective discussion of them, is further theorized. (Onyx & Small, 2001, pp. 775-777)

My interpretation of this was, phase 1: invite the students to a group interview and ask them to bring an item that reminds them of their experiences with mathematics; phase 2: during the interview prompt discussion about similarities and differences between stories; phase 3: further theorise the information myself or in correspondence with the student-teachers. Hence I have not used the content within Haug's three phases though I have used the main principles. In practice, five of the students turned up to interview and four of them remembered to bring items with them. Again there is no specific 'interview schedule' beyond the description above, as it would have restricted the construction of meaning and the activeness of the situation. Furthermore, I wanted the environment to feel comfortable as I wanted the student-teachers to be engaged and interested in the process.

The second group interview, ((5) table 3), was carried out at the end of the year when the students had returned to the university. From analysis of earlier interviews, my own experience in ITE and my interest in politics, I had hypothesised that government policy provided dominant discourses in their becoming; hence I wanted to explore this. Similarly to the first group interview, I used a prop, or vignette, to stimulate and facilitate discussion (Robson, 2011), though this time I based it around the use of video clips. Vignettes are popular in group interview research (Wilkinson, 1998), they have been used to explore: sensitive areas for discussion; to gain peoples' perspectives; and to breakdown hierarchies in the research situation (Barter & Renold, 1999). I was of course concerned with the hierarchy between 'them' as university students and (my)self as a university lecturer. Thus by using the clips, I was attempting to remove opinion from the immediate environment and place it in another space (the video), freeing the space the student-teachers and I have for more 'open' discussions. This draws from the principle that "the very place of research can be one of the sources of its authority" (Massey, 2003, p. 76). The authority is not removed from the university, but there is an attempt to redistribute it.

The clips I used were:

- TDA (Teacher Development Agency). A recruitment clip of a practising primary school teacher enthusing about her job (TDA, 2008)
- Teachers TV clip of a primary mathematics class and teacher talking about good teaching in mathematics (Teachers TV, 2008)
- Teacher TV clip of David Burghes talking about what is wrong with mathematics teaching (Burghes, 2008)
- A government advert encouraging adult learners to reengage with mathematics (Direct Gov, 2008)

To select these clips, I searched various official government sites, including the TDA and the Department for Education and Skills (DfES), looking for examples of mathematics teaching, or discussions concerning mathematics teaching. In addition, I examined Teachers TV, which at the time, was a web and free to air based television channel funded by the government. This funding of a television channel can be seen as indicative of, both the resources and the involvement that the New Labour government were giving to education. I also included a commercial advertisement for a government project that was currently airing on UK Television; thus this clip sat in the domain of both government discourse and popular culture. These four specific clips were chosen to facilitate discussion around the teaching and learning of mathematics, common perceptions of mathematics and the image of mathematics. They came from official discourses and from respected, professional figures hence the clips had authority, but, as discussed, it was not my authority.

All of the student-teachers had agreed to the group interview date, however only three of the six turned up for the interview. I did not pursue the reasons why some chose not to come. This would have felt inappropriate, as if I were blurring my role between researcher and university tutor. On reflection, it may have been worthwhile following up their reasons for their non-participation, however at the time I was more concerned with them enjoying the project and not being seen as a tutor who had authority. Instead, I surmised that the student-teachers were not finding it easy to participate in the group interviews. Thus I decided to stop using them as a research method and in year three we returned to individual interviews, which have been discussed above.

4.4.5 Post lesson observation interviews

In between the group interviews in year two, I observed the student-teachers teaching a 'numeracy' lesson, and followed this immediately with an individual interview. The aim was to engage with the student-teachers in a different environment, where they performed a different role to that of a university student. Specifically at school they take the position of the teacher, thus potentially this offers a different subject position, and one that is more focused around day-to-day mathematics teaching. This draws from the principle that "meaning is not constantly formulated a new but reflects relatively enduring local contingencies and conditions of possibility (Foucault, 1977/1991)" (Holstein & Gubrium, 2004, p. 149). In addition, I again hoped that this situation would play with the power balance, moving the defining relationship away from myself as university lecturer and them as university students. However, the student-teachers did occasionally seek reassurance from me concerning their teaching methods (even though, on their

course, it was not a university tutor's role to observe them teach, this was assessed by school teachers). Hence, it may not have shifted the balance as much as I had hoped.

Similar to the use of the vignettes (discussed above), the observation of the lesson was used to drive the direction of the interview, and to facilitate discussion around the lesson and their views of teaching and learning mathematics. However, it did not dictate the entire interview; as before, the student-teachers were encouraged to be active in the creation of topic areas. I generally began by asking them if they enjoyed the lesson and/or engaging them in general chat about something about the school or the lesson. Here, I was aware of trying to create an 'informal discussion' rather than a formal evaluation, which the situation could have easily replicated. In addition, and again to contest the formality of the situation, I showed the student-teachers the written notes I had made on the lesson.

In another attempt to break down power hierarchies, in the few days following each lesson observation I emailed each student-teacher my typed notations of their lesson (for an example see appendix 8), inviting their comments and responses. The aim being to not only break down hierarchies but to engage the student-teachers in the production of research, so that they become subjects in, rather than objects of, the study. This draws upon Stronach and Maclure (1997), who used respondent data to inform their study. However I had no responses from the student-teachers. This may be because the student-teachers had already commented on my comments in the post lesson interviews, or simply that they did not want to, or they were busy. Hence when I observed them again in the final year of their practice, (7) table 3, I did not email them afterwards to seek their comments. On reflection, I was perhaps overly concerned with bothering them. On further reflection, whilst my comments on their lessons were intended to invite reflection from the student-teachers, they did veer too close to judgement, and hence may have propagated the hierarchies I was keen to unpack.

Thus I had a small cohort of six student-teachers for a case study and a variety of situations and methods of collecting student-teacher data; however my concern was with exploring student-teachers' discourses in relation to other dominant discourses. As discussed, my particular interest was to explore the discourses of educational policy, specifically through government educational policy documents. This is particularly relevant as the New Labour agenda was focused around education (Labour Party, 1997) and hence they produced a wealth of education policies. It is also pertinent with the shifting face of education as it increasingly becomes driven my marketization and the neoliberal agenda (S. J. Ball, 1994, 2008) (discussed throughout).

Hence the second aspect of my thesis that sits alongside the student-teacher data is an analysis of relevant educational policy documents.

4.4.6 Policy Documents

Ozga identified "the need to bring together structural, macro-level analysis of education systems and education policies and micro-level investigation, especially that which takes account of people's perception and experiences" (1990, p. 359). I share this opinion, and hence that educational policy is a dominant site within education. My aim is to explore how educational policy discourses contradict or coalesce with mathematics education research, and with the student-teachers' accounts. The table below shows the specific educational policy documents I examined, and the reasons I choose them for analysis.

Table 4: Education policy documents

Document	Description	Selected because
Education white papers	White papers are key government documents. They set out the ethos and direction of the government prior to their implementation within legislation.	The majority of general education papers from the New Labour era were examined as they relay the overall aims and direction of the government.
Excellence in schools (DfEE, 1997)		
Schools: achieving success (DfES, 2001)		
Higher Standards, Better Schools for All (DfES, 2005a)		
21st Century Schools: Your schools, yours children, your future, (DCFS, 2009a)		Demonstrates the direction of latter New Labour under Gordon Brown.
Education green paper	Green papers are consultation government documents. They set out the potential ethos and direction of the government. They are designed for debate.	
Every child matters (DfES, 2003)	This strategy brought together everyone involved	This was a key document that had a major influence

	in children's services. It instructed five core principles to be developed in children.	on everyone related to children's services.
Other government document		
The Children's Plan: building brighter futures (DCSF, 2007a)	A broad document discussing the government's vision for children and young people until 2020.	Demonstrates the direction of latter New Labour.
National Strategy Documents	National Strategy Documents: were written for the government by a private company to raise 'standards' in education. High attention was given to mathematics.	Many documents were chosen from the National Strategy as they were the main education scheme of the New Labour government. The majority of documents I selected were from around the time the student-teachers studied.
The National Numeracy Strategy: Framework for teaching mathematics for Reception to Year 6 (NNS) (DfEE, 1999):	Launched by the UK government, the NNS is non-statutory guidance which prescribes how teachers should deliver the National Curriculum in mathematics.	Chosen because these documents were the principle government guidance for the primary mathematics curriculum. The NNS and then the PNS were highly influential. Most schools adhered to them in some manner.
The Primary National Strategy (PNS) (DfES, 2006b):	This is redeveloped version of the NNS and also includes the National Literacy Strategy.	
The associated core papers of the Primary National Strategy (DfES, 2006c)	Extra information concerning the above.	

Supporting children with gaps in their mathematics understanding (DfES, 2005b)	Gives specific instructions and examples of teaching.	Selected to suit theme. A typical example of a document to which teachers would have had access.
Increasing pupils' rates of progress in mathematics (DfES, 2004)	Gives examples of teaching and learning ideas to 'accelerate progress'. Discusses how to embed these in schemes of work.	Selected to suit theme. A typical example of a document to which departmental management would have had access.
Making Good Progress in Key Stage 2 Mathematics (DCFS, 2008b)	This is part of the Making Good Progress series of short problem-focused documents aimed at primary schools. It was one of the main themes of the second wave of the strategy. This document gives examples and characteristics of 'slow moving 'pupils and actions that can be taken to rectify this.	Chosen because these documents were a main strand of the second era of the strategy and hence quite influential.
Getting there: able pupils who lose momentum in English and mathematics at Key Stage 2 (DCFS, 2007b)	Document discussing how to use data to identify pupils, and to take action concerning expected progress. This is also part of the Making Good Progress series (as above).	Chosen as representative of the Making Good Progress series. This series was very much concerned with notions of 'losing momentum' and 'falling behind' expected levels of progress.
Making Great Progress: schools with outstanding rates of progression in Key Stage 2 (DfES, 2007b)	Examples and strategies demonstrating how schools can make great progress. This is also part of the Making Good Progress series	

	(as above).	
Keeping up: pupils who fall behind in Key Stage 2 (DfES, 2007a)	Document discussing how to use data to identify pupils, and to take action concerning expected progress. This is also part of the Making Good Progress series (as above).	
Moving on in mathematics – Narrowing the Gap (DfES, 2009)	Document discussing how to identify pupils by using data and examples of pedagogy associated with pupils who do not make sufficient progress (uses some very similar data and arguments to the Making Good Progress series).	Similar to and possible development of the above (without the Making Good Progress tag).
Securing level 4 in mathematics (DCSF, 2009d)	Gives specific examples of objectives and teaching strategies associated with the level. There are also other documents in the series concerning other levels.	An illustrative example of a document to which a teacher would have access concerning mathematics teaching.
Securing level 2 in mathematics (DCSF, 2009c)		
Mathematical challenges for able pupils in key stages 1 and 2 (DfES, 2000)	Example of activities thought suitable for 'able' pupils.	Chosen as it represents the government's take on 'able' pupils. Selected to suit theme.
Identifying Gifted and Talented pupils – getting started (DfES, 2006a)	A document that illustrates how to identify and work with 'gifted and talented' pupils.	Selected to suit theme.

Identifying gifted and talented learners (DCFS, 2008a)	The revised version of above.	Selected to suit theme.
Independent Reviews	All the 'independent' reviews chosen are sponsored by the government.	I felt it was important to get a feel of official government sponsored but not authored reports. This is to provide balance against other official documents.
Independent Review of Mathematics Teaching in Early Years Setting and Primary Schools (The Williams Report) (Williams, 2008):	This is a UK government sponsored independent review of mathematics education across early years and primary schools.	Chosen as it is the key report on Early year and Primary mathematics teaching in the late 2000's
Independent review of the primary curriculum (J. Rose, 2009)	This is a UK government sponsored independent review of the primary curriculum in England. The aim was to consider both content and teaching, with regards to children's development and differences.	Chosen as it is the key report on the primary curriculum in the late 2000's
Independent inquiry in to post-14 mathematics (A. Smith, 2004)	This is a UK government sponsored independent review into mathematics post 14. The aim was to make recommendations (including curriculum and pedagogy) that would enable students to better meet the needs of further education and employment.	Chosen as it is the key report on post-14 mathematics in the early New Labour era. Though this report concerns older age pupils, it adds to the body of knowledge concerning mathematics education policy.

Although these documents are all affiliated to the government, they come from different sites of production. “However, while it is important to note distinctions in authorship (and audience), our concern here is with what it is possible to say and not the intentions of those saying it” (Llewellyn & Mendick, 2011, p. 52). I “selected the policy documents partly systematically and partly eclectically, borrowing from cultural studies approaches (see du Gay, Hall, Janes, Mackay, & Negus, 1997)” (Llewellyn & Mendick, 2011, p. 50). For instance, I looked at the main education White papers from the New Labour era, as they are key in providing the position of a government. Other documents were chosen as they gave a snap shot of those to which mathematics teachers and mathematics departmental managers would have had access; for example Mathematical challenges for able pupils in key stages 1 and 2 (DfES, 2000). Other documents, such as the Making Good Progress series, provided a more holistic description of the direction of the later New Labour government’s approach to mathematics education, which was the time when the student-teachers studied. Specific details are provided in the table. All documents were chosen because they ‘represented’ mathematics education, or primary education, within the New Labour era (1997-2010), which was also until the end of the participants’ course.

Using archived data was appropriate for a Foucauldian analysis (Silverman, 2006) as it allowed me to consider a genealogical approach to unpacking educational policy discourse. “The genealogical approach interrupts the taken-for-granted and isolates the contingent power relations which make it possible for particular assertions to operate as absolute truths” (S. J. Ball, 1994, p. 3). Furthermore it enables me to highlight the “profound influence of discourse on shaping everyday life in education” (Walshaw, 2007, p. 13).

In a wider sense policy texts can be viewed as ‘naturally’ occurring data, such that they are not ‘created’ by the researcher (Silverman, 2006), though it is authoritative data, as it is written by the government and/or ‘experts’. However it is important to consider the fluidity of the text in practice. Ball asks that we do not think of “policies as ‘things’; policies are also processes and outcomes” (S. J. Ball, 1994, p. 15). Instead “a policy is both contested and changing, always in a state of ‘becoming’, of ‘was’ and ‘never was’ and ‘not quite’ ‘for any text a plurality of readers must necessarily produce a plurality of readings’ (Codd, 1988, p. 239)” (S. J. Ball, 1994, p. 16). In this sense, what was meant by the policy authors is not necessarily what is taken up by the people who use them; the policies are lived and are thus constructed through webs of discourses. In addition, these written texts are often full of compromises in that they are “typically the

cannibalized products of multiple (but circumscribed) influences and agendas" (S. J. Ball, 1994, p. 16).

In terms of content, Ball (1994) notes that policies do not provide solutions or methods, instead they more commonly set objectives or outcomes. My analysis (in Act Two) shows that this is still evident in places, however New Labour did come to offer solutions in some documents as they became more supervisory during their tenure, most often these solutions are to the problems they define. What is still evident is that "educational policy these days is obsessed with clarity, certainty and 'transparency' – with forcing everything out into the open where it can be calibrated and assessed for value for money and 'quality'" (MacLure, 2003, p. 169). There is little space for grey areas, instead policies need to sound credible with their certainty (S. J. Ball, 1994); specifically these "texts work somewhat like lies … and they succeed when they *persuade* us that some state of affairs, proposition or argument is at it appears to be" (MacLure, 2003, p. 80); this is evident in both educational research and educational policy. In particular, MacLure argues that programmes such as the National Strategy and the National Curriculum are

> *fantasies of presence in a particularly blatant form* ... they construe the teacher as little more than a vehicle for conveying pre-constructed packages of knowledge into students' heads; and assume that the knowledge thus conveyed is assimilated unproblematically, without gap, delay or identification (cf. Strathern, 2000, p. 318). (MacLure, 2003, p. 169).

The uncompromising authority that is afforded by the status and text of policy documents provides a rich place of analysis. My aim was to examine whether aspects of educational policy documents were taken up or dismissed by student-teachers and how this was done.

Hence my analysis was based upon a comparative reading of interview data from the student-teachers over the period of their course and a selection of government educational policy documents from the New Labour era (1997- 2010). The use of interview data provides personal stories of current practice, whilst the policy documents allow my analysis to be set within the contemporary *regime of truth* (Foucault, 1984b).

4.4.7 Selection of mathematics education research

The mathematics education research I examined was largely done through reading widely and searching for dominant discourses. In part, this was achieved through my own experience and through being embedded in the field. In addition, and once the key themes of progress, understanding, confidence, and ability, were identified, there were occasions when I used a more systematic interrogation to explore certain themes. For instance, I loosely employed some aspects of systematic reviews, whilst bearing in mind the purpose of case studies. Specifically, I searched

Google Scholar for general citation value and the highly rated journal publications *Educational Studies in Mathematics* and *Journal of Research in Mathematics Education*, for access to the mathematics educational community. For example, in Chapter Five (on progress) I searched around the terms *mathematics, education and progress, whilst* in Chapter Seven I used broader combination of the terms *mathematics, education/teaching, anxiety/confidence, and children*. In Chapter Six, I largely relied on my own knowledge, as well as the summaries of others, whilst Chapter Eight was a combination of the above. In addition, I supplemented this by searching through my own mathematics education books. With these results I focused on a selection of research publications in more detail; here I was eclectic in my choices as the primary criteria was once again, the "opportunity to learn" (Stake, 2005). One aim was to ensure that I accessed articles and books that were prevalent, and hence helped establish truths about mathematics education research; in addition, I was concerned with articles that drew upon these leading sources. As the thesis developed around dominant branches of mathematics education research, I tended to focus on those articles and books that did similarly. Alongside this, I read widely throughout the thesis, hence I was open to adding more data where appropriate. Thus, I analyse discursive productions of these dominant themes within dominant discourses of mathematics education research.

In the next sections I discuss my methods of analysis in more detail. I begin by discussing the general types of analysis I employed before moving towards more specific details and processes.

4.5 Methods of Analysis

4.5.1 Genres and methods of analysis

Primarily my analysis is based around a poststructural interpretation of data (the themes) in relation to Foucauldian theories as explaining phenomenon. This was discussed thoroughly in chapter 2, where I explored various Foucauldian ideas such as: discourses; normalisation; governmentality; power and subjectivity. Thus in doing a Foucauldian style of analysis I aim to explore how subject and subjectivities are produced through discourses (Walshaw, 2007). Thus I discuss the conditions that make discourses possible, and instead of searching for meaning, I look for "external conditions of existence" (Threadgold, 2000, p. 4). Potter and Wetherell (2001) state that "when they are speaking or acting, people are taking some idea or object of interest and giving it a position in an evaluation hierarchy" (p. 201). This forms the basis of my analysis such that I examine text to look for evidence of this positioning and for the absolute power relations,

rather than look for characteristics of individuals or experience. In addition, I draw upon Walkerdine (1990) and say that these categories are "fictions linked to fantasies deeply embedded in the social world which can take on the status of fact when inscribed in the powerful practices, like schooling through which we are regulated" (p. xiii). Although Walkerdine was talking specifically about masculinities and femininities, the sentiment applies more generally. Overall my work is similar to other interpretative research in that the aim of my analysis is to "pull it apart and put it back together again more meaningfully" (Stake, 1995, p. 75). How I dealt with the data before reading it against Foucault, is discussed in detail in the next section 4.5.2.

However there are two other methods of analysis that supplemented (and complemented) my use of Foucault. The first is another aspect of poststructuralism, that builds on Foucault. Specifically MacLure's, reading of deconstruction, explored in section 2.10, which states that interrogating binary oppositions are a common way to disarticulate text, (for examples of use see Maclure, 1993, 2003; Mendick, 2006). Binaries in this thesis include: traditional pedagogy/progressive pedagogy; knowledge/understanding; structure/agency. "Each of these words locates the person it describes within a particular moral universe, and invests them with a particular identity" (MacLure, 2003, p. 9) these oppositions "are one of the key ways in which meaning and knowledge are produced" (MacLure, 2003, p. 10), furthermore they are common and potentially limiting (Alexander, 2010) within educational research; Alexander (2010) defines them as discourses of dichotomy. Thus deconstruction is found in places in the thesis however it is a minor method of disarticulation.

Another method of analysis was the writing, which was also a challenge in itself, particularly as "language installs the dimension of truth … even as it excludes all guarantee of truth" (Lacan quoted in Spivak, 1976, p. lxiii). Hence, the production of the written word is problematic. In addition, as much as I wished that I had planned the thesis in detail, and then written it up, this was far from the case. Instead writing was analysis, and also was my becoming as an academic. I read throughout, thus informing arguments that I could not possibly have made at the start of the thesis endeavour. Hence, like Richardson (2000), "I write because I want to find something out. I write in order to learn something that I did not know before I wrote it" (p. 924), I do not write to summarise what I already think I know. Thus the writing process became a site of analysis; hence there was fluidity between the collection of data, the analysis and the writing. More often than not, I sat with the words for a while, writing, deleting, writing some more and constructing arguments. Thus it is important to keep a sense of the iterative nature of the project. To expedite this process I was able to publish a few articles, (Llewellyn, 2009, 2012, 2013b;

Llewellyn & Mendick, 2011) and present at conferences (Llewellyn, 2008, 2010, 2013a). In particular much of the text of Llewellyn (2012, 2013b) forms Chapter Six of this thesis. The other articles were used to help formulate ideas. Going through those processes helped cultivate my thinking.

> I consider writing as a *method of inquiry*, a way of finding out about yourself and your topic. Although we usually think about writing as a mode of 'telling' about the social world, writing is not just a mopping-up activity at the end of a research project. Writing is also a way of 'knowing' – a method of discover and analysis. (Richardson, 2000, p. 923)

In this sense, "we experience 'language-in-use,' how we 'word the world' into existence (E. Rose, 1992)" (Richardson, 2000, p. 923), which suits poststructuralism.

Finally I wish to note that to invest in Foucault is not necessarily to make value judgements for our analysis. As Foucault states:

> A critique does not consist in saying that things aren't good the way they are. It consists in seeing on what type of assumptions, of familiar notions, of established, unexamined ways of thinking the accepted practices are based ... To do criticism is to make harder those acts which are now too easy. (Foucault, 2003d, p. 172)

However I am writing in the field of education thus judgement and solutions are often demanded, and alternative views are in the minority (for an example see Pais, Stentoft, & Valero, 2010). My concern is that judgement tends to offer quick fixes to situations that are incredibly complex, and this becomes an accepted pattern of education. It is a self-perpetuating cycle which could be viewed as akin to 'divide and rule'. Hence my judgement (and implications for practice) are kept to a minimum (see chapter 9). "I don't try to universalise what I say; conversely, what I don't say isn't meant to be thereby disqualified as being of no importance" (Foucault, 2003c, p. 246). Thus my analysis is tempered by being situated in the context, of the case and of the researcher, and moreover by the awareness of the choices I made throughout the process. Hence, throughout the process I remember that "the complexity and also the dynamic nature of the social world mean that a researcher can seldom make confident predictions about it" (Taylor, 2001, pp. 11-12). Though what I can do is add to a body of knowledge and offer a reworking that confronts the norm.

In the next section I talk through the process of working with the data, from the initial coding that developed the themes to the process of rereading and drawing on Foucault.

4.5.2 Themes and process of analysis

As mentioned, my approach to research is that it is fluid and always in production. This is shown through the process of the identification of the main themes for analysis, which are: understanding; confidence; ability and progress.

> Themes are abstract (and often fuzzy) constructs that investigators identify before, during and after data collection. Literature reviews are rich sources for themes, as are investigators' own experiences with subject matter. More often than not, however, researchers induce themes from the text itself. (Ryan & Russell Bernard, 2000, p. 780)

The themes in my thesis were shaped by all of these. My own personal experience certainly contributed to the discussion of confidence, whilst my role on the PGCE course contributed to the focus upon understanding and progress; understanding is a term that dominates talk at my institution, whilst progress dominates talk in schools. However I did not decide upon these themes by personal judgement alone. To find the themes, I initially performed inductive coding upon the policy documents and the student-teacher interviews. This follows Merriam (2009), who states that analysing qualitative data moves between a process of inductive and deductive coding. However, the dissection of data into codes or patterns is not unproblematic for poststructural researchers, where the homogenising of data to fit trends goes against the pursuit of difference and complexity. MacLure (2014) highlights several areas that could offend. She suggests that coding can keep the researcher removed from her data; "researchers code; others get coded" (p. 168), thus the analysis is the master's voice. In addition, coding assumes a hierarchy of data or events. Moreover, coding does not recognise difference or the significance or weight of relations or situations. It can forget cultural specificity and take you from the detail of the data. "Coding is an operation, then, that drags fixed, hierarchical structure from the proliferated surface of life, cutting its flows into 'limited and measured things', and hanging them in bunches under their ruling Ideas." (p. 169). These are previously the things that poststructuralism seeks to avoid and/or unpack. To avoid such complications MacLure suggests we should examine what is missed by the codes. Yet she recognises the value in coding as she states that "coding demands immersion in, and entanglement with, the minutiae of 'the data'" (p. 174). Both of these I did. In particular, I moved frequently between coded data and the overall data. Moreover, I often sat with the data for a long while, immersing myself in its detail and complexity. I was not seeking to recode or employ hierarchical classifications upon the data that I had, instead I was seeking to unpack the use of terms in common practice. Hence I was coding to deconstruct. As such, my codes were ways of enabling the discussion of wider dilemmas rather than the outcome being the code itself.

Thus, in fitting with poststructuralism, my interpretation of coding is far less formulaic than some. Specifically, I read through each document coding under singular or multiple themes, which were recorded in NVivo software. “Coding is the heart and soul of *whole-text analysis*. Coding forces the researcher to make judgements about the meanings of contiguous blocks of text” (Ryan & Russell Bernard, 2000, p. 780). In the process of identifying themes, I am aware that I was making judgements about whether or not the text concerned the theme, but as suggested above, the movement between the codes and the overall data counteracted this.

From this initial free thematic coding, I had over 20 potential themes, some of which were larger than others, and some of which could be combined. Thus next, I produced mental maps focused around three sites of production: discourses of student-teachers; discourses of educational policy and discourses of mathematics education research. Ryan and Russell Bernand (2000) state that “mental maps are visual displays of the similarities among items, whether or not those items are organized hierarchically” (p. 773). My maps were not hierarchical, and included both similarities and differences. As discussed above, the aim was to draw out cohesions and contradictions between discourses, rather than search for generalisable truths. I was particularly interested in the conflict of discourses and the disparity between each site of production of knowledge. Hence, throughout the process of analysis I thoroughly immersed myself in the data, and in the mathematics education research literature. From this, the themes of progress; understanding; confidence; and ability were identified. Additionally, and what made these themes quite interesting to discuss, is that they dominated different sites of production; thus conflict was already established through different priorities. For instance essentialising pupils in terms of ability and confidence dominated student-teacher talk, whilst some of the student-teachers were also concerned with understanding. The construct of ability was mostly absent from educational policy; instead educational policy had a particular way of talking about pupils that sought to mobilise yet also essentialise (Llewellyn & Mendick, 2011) through progress. In addition, discourses of confidence were also strong in mathematics educational policy. Conceptions of teaching and learning were also present, though teaching for understanding played a very minor, even apologetic role. This was in sharp contrast to mathematics education research which promotes ‘understanding’ as the ‘Holy Grail’ of mathematics education. Mathematics education research also had strong opinions on ability and confidence, which I felt would provide interesting discussions.

Once I had decided upon the dominant themes, I performed the analysis again but through a closer reading of the text. Hence my coding had moved from inductive to deductive

(Merriam, 2009), and also ensured that I was thoroughly immersing myself in the detail of the data. This involved firstly examining the selected themes and then the wider themes and text. However it was important to return to the wider text to look for other examples of the themes in use. In addition, it was important not to lose a sense of the document as a whole. I was wary that "the fragmentation implied in the coding strategy often leads researchers to overlook the form of their data" (Coffey & Atkinson, 1996, p. 22), and as discussed, disregards the context or the relations. In particular, it can be a "significant weakness in computer-assisted qualitative data analysis" (Hollway & Jefferson, 2000, p. 68). Thus to counteract this, I frequently moved between reading the coded data and rereading the corresponding whole documents. Specifically, I looked for evidence of cohesion and contradiction concerning the production of discourses within the specified themes. In addition I looked for subject positioning and for examples of normalisation, and governmentality.

"By the time he or she has identified the themes and refined them to the point where they can be applied to an entire corpus of texts, a lot of interpretative analysis has already been done" (Ryan & Russell Bernard, 2000, p. 781). In my experience this was true; coding was analysis (Miles & Huberman, 1994) - was thinking - was developing conjectures. To suggest the themes came along first and then I wrote about them is forcing a linearity that was/is not there. Instead, as already mentioned, the writing process became a method for analysis and a way of unpacking the data and discourses at work.

4.6 Chapter summary

In summary, in order to unpack dominant discourses of mathematics education, I designed a case study around six student-teachers. A series of data were collected through interviews during their three years on their primary education degree. Alongside this a series of educational policy documents were assembled and de-assembled. Specifically, these educational policy documents are a snapshot of the dominant discourses of the then current education polices in England. New Labour introduced many educational policies and teachers and teaching became reshaped by them (S. J. Ball, 2008). Both the interview data and the key educational policy documents (from 1997 – 2010) were analysed using a Foucauldian approach (Carabine, 2001; Foucault, 1980a) moving from open to selective coding (inductive to deductive). Although "these approaches become 'instruments of analyses' (Foucault, 1980c, p. 62) rather than *rigid sets of rules* for those analyses" (Cheek, 2000, p. 2). Throughout the process, the implementation of the design was iterative and reflexive and moved between immersion in the data and engagement in and the unpacking of wider reading. Subsequently, dominant themes emerged that were found to

be problematic in their discursive production. These themes were: progress; understanding; confidence; and ability. It is the results of the analysis that are explored in Act Two.

Act Two: Performance

Introduction to Act Two: the themes, analysis and discussion

Part Two is where the 'original' data are performed, the analysis is interrogated and the key arguments are made. By using the term 'performance' (Butler, 1999/1990) I am signalling that these interpretations are not 'natural' or indeed 'real', but instead are available subject positions within the regime of truth, hence within permitted discourses. In this introduction I outline the form Act Two will take. It largely summarises previous discussions in section 1.4, and Chapter Four. Readers who do not need this reminder, may want to skip ahead to Chapter Five.

As discussed, my research question is how is the mathematical child produced within the becoming of primary school student-teachers in England, and how does this include and exclude people within the mathematics classroom? The focus on the mathematical child rather than the becoming of the teacher (which was my initial area of study) was formed via analysis of the data. Specifically, I noticed that here were certain assumptions about the mathematical child that were taken-for-granted and were thus covertly implicated in productions of the mathematics classroom. In highlighting the child, I am arguing that it has been forgotten by many and thus static versions of the mathematical child are normalised into discourses. My aim is to expose the detail and stories that are not necessarily in the foreground. As such, I am building on the notion of discourses discussed in chapter two, as "practices that systematically form the objects of which they speak" (Foucault, 1972/2002, p. 54). Meaning is created through discourses (MacLure, 2003) and "power is constituted through discourses" (Carabine, 2001, p. 275). Hence, I do not describe the mathematical world, but instead I analyse how practices produce it and hence how this becomes. In particular, I am concerned with what is normalised; namely what becomes taken-for-granted as the 'normal' mathematics classroom and the 'normal' mathematical child. As discussed, the production of the normalised subject is a process of governance within a social system. However, within this it is important to remember that subjects may be able to embody a (constrained) agency.

To answer my research question I focus on deconstructing different dominant sites of production, namely mathematics education research and New Labour educational policy in relation to the student-teachers' talk. Each of these sites produces their own 'truths' and discourses concerning mathematics education that are bound by time and context. I have termed my querying of this 'troubling' (Butler, 1999/1990), in that my analysis is more than unpacking, it is interrogating many of the norms and assumptions on which mathematics education is based.

Moreover, it asks some difficult questions, around what work is done by these norms and assumptions. In particular, I explore how New Labour government educational policy constructs the mathematical child as a 'functional automaton', and influential psychological mathematics education research constructs the child as 'natural' and 'romantic'. I then examine how these constructions are performed in practice via the student-teachers' talk.

Structurally, I present these data via four different themed chapters. I view this as akin to different directors telling stories using the same footage; they are each choosing to bring a particular aspect to the forefront. The themes I examine are: progress; understanding; confidence, and ability. All of these dominated the content of the analysis of the student-teachers' data, in terms of how much talk there was about them. In addition, they were also found to be problematic in their discursive production across sites. Furthermore, they carried stories of common-sense interpretations which pervaded their construction and use. Thus these taken-for-granted themes allow the interpretation of my argument through seemingly familiar lenses.

There are two purposes of each themed chapter in Act Two: firstly, to establish the construction of the theme of the chapter within mathematics education (research, policy and student-teacher talk), and secondly, to establish the production of the mathematical child within this. Hence, other stories that could have been told from the data are ignored or brushed over. All of the chapters are structured similarly in that each tackles the different sites of production in turn: mathematics education research, educational policy and student-teachers' talk, before drawing these together to discuss problematic aspects of the theme and productions of the child. Moreover, all of the chapters are interwoven and appear in each other's. As such, I take the position that everything is entwined, and nothing exists in a vacuum. So, as much as I have chosen to focus on one theme (or lens) over the other for each chapter there should be echoes of the other themes throughout.

In Chapter Five I begin by exploring a notion that is dominating education - progress. Here I show that notions of progress are embedded in all sites of mathematics education, often drawing on Western notions of improvement. Within this, I show how progress produces different versions of the mathematical child, in mathematics education research that is a natural progressively-developing inquirer and in educational policy that is a functional automaton, progressing smoothly along a conveyor belt. Specifically, I argue that the fascination with a functional linear temporality is misguided and confusing for student-teachers. However, there is a group of pupils who are allowed to progress at an accelerated rate.

In Chapter Six, I develop the ideas of the mathematical child (both romantic and functional) by exploring them in relation to a (cognitive) norm of the mathematics classroom - 'teaching for understanding'. The focus on understanding comes from a tension between mathematics education research and student-teachers' talk. I argue that this can be traced to the version of 'understanding' produced in educational policy documents, which is functional and concerned with applications. This very much contrasts to the romanticised version of the child produced in mathematics education research which values the cognitive mathematical child. Moreover, it can limit the possession of mathematical understanding to the 'naturally able', confining others to achieving (more limited) success at mathematics via 'hard-work'.

Chapter Seven explores the notion of another 'norm' of mathematics education – confidence. For many student-teachers, and in some educational policy documents, confidence is seen as a key to success in mathematics. However, this norm differs to that in the previous chapter as on first glance, confidence appears to be an affective trait. Although I argue this is not the case in dominant education research and educational policy. Dominant research constructs it as a by-product of cognition, whilst policy constructs it as functional, automatic process. Thus, drawing on Hardy (2007, 2009) I examine how confidence is often conflated with competence and/or supersedes it to justify performance in mathematics. This again limits mathematics to those who act 'naturally able', via performing as confident.

My final thematic chapter (eight) draws together the three previous chapters by tackling the discursive construction of ability. 'Ability' dominated the student-teachers' talk and as such demanded deconstruction. In addition, and as above, it circulates in the themes of the previous three chapters, though this is often not in the foreground. Specifically, I argue that for everyone to succeed in a neoliberal mathematics classroom notions of different ability are problematic; as such ability is often constructed in policy as fluid not fixed. However, educational policy also posits a more 'able' group who are given special privileges and are constructed as naturally talented. I argue that this confusing message from educational policy and the natural inquiring mathematical child of mathematics education research inadvertently reify the concept of the 'naturally able' mathematical child. This is evident in the student-teachers' talk who most often favour the notion that there are those who can achieve at mathematics and those who cannot. This again includes some into mathematics and excludes others.

5 Chapter 5: Troubling progress

5.1 Introduction

"Our three core principles are: Inclusion, Progression and Excellence" (Consett Academy, 2014)

A few years ago I sat in a secondary school reception waiting to meet a student-teacher. I picked up a thick glossy brochure that heralded its transformation to an academy. As well as photographs of smiling children and the school logo, the front cover displayed three words: inclusion, progression and excellence. Within the last decade progress has become a buzzword in education, and perhaps the main indicator of 'success' for schools and the teachers and children within them. For the school mentioned above, progression was one of the key ways it was constructing itself; it was how it wanted to be known. Indeed the idea of moving to an academy and the presence of glossy brochures could suggest the school has made progress. They certainly had the appearance of professionalism. This school is not unique; many other schools include progress in their vision statement, or at the very least have variations of progress maps on their walls. These progress markers specify what the mathematical child should be achieving, and hence what the mathematical child should be.

As I show in this chapter, this investment in progress is widespread in education. For instance one of the key Ofsted criteria for judgement is that pupils demonstrate a measurable version of progress in every lesson (Ofsted, 2008). However, an investment in progress is not unique to English education, nor to the mathematics classroom, notions of progress permeate almost all aspects of society and the world. For Nisbet "no single idea has been more important than, perhaps as important as, the idea of progress in Western civilisation for nearly three thousand years" (Nisbet, 1980, p. 4). In particular, modernity is constructed around "a notion of continual progress. A fundamental Enlightenment precept, the thesis that humanity is making steady, if uneven and ambivalent, progress toward greater freedom, equality, prosperity, rationality, or peace" (W. Brown, 2001, p. 6). As such contemporary political thought, and perceptions of history, tend to be bound by notions of continual progress. Within this, progress becomes a symbol of a prosperous nation, and the goal of most Western 'developed' societies. Hence, it is difficult to contest the pursuit of progress, something which every modern society strives to achieve. Moreover, it is very problematic to contest this in education, as, in the current regime of truth schools are the primary way of correcting and maintaining a good nation (Popkewitz, 1988). On the shoulders of education and schools, seem to rest correcting society's

ills. Hence, education always already evokes a relationship to progress; its emancipatory narrative being difficult to resist (Mendick, 2011). From this, we can attest that any nation, including the United Kingdom (and England), that positions itself as a key builder of both a 'modern' society and world, must invest in continual progress and hence in education.

More specifically, education is constructed as having responsibility for economic growth and progress. This maxim has international validity, such that "powerful supranational organizations, such as the OECD and the World Bank, view education primarily as a tool for improving economic performance" (Gilead, 2012, p. 113). This relates to New Labour's neoliberalism where,

> equity and enterprise, technological change and economic progress are tied together within the efforts, talents and qualities of individual people and the national collective – the 'us' and the 'we'. (S. J. Ball, 2008, p. 17)

Hence economic progress is constructed around the promise of benefiting both the individual and the national. As discussed in sections 2.7 and 3.3.3, this requires an investment in self-improvement via notions of the "productive self" (N. Rose, 1999a, p. 103), where people work towards a correct way of being. As I show in this chapter, progress is a key part of this production.

Building on the discussion above, and the discussions in Act One, progress is not universal, and it is not innocent, though it has social power and is an important part of the mathematical classroom. Hence what it does in the classroom, and how it constructs the mathematical child should be deconstructed.

5.2 Troubling progress in mathematics education research

This sections serves two purposes, to examine 'givens' concerning progress within dominant branches of mathematics education research and to critique these. From my analysis of mathematics education research, there are three particular trends to which I wish to draw attention. Firstly, that mathematics education research is unequivocally committed to progress. Next, that this progress is allied to certain 'progressive' pedagogies and/or concerns for equity. Finally, these pedagogies rely on a naturally inquiring and cognitive version of the mathematical child.

The commitment of mathematics education to progress is a dominant narrative of mathematics education research. Many in mathematics education research routinely base their studies around making progress (for example Battista, 1999) and/or examining impediments to progress (for example, Goos & Galbraith, 1996). These declarations can appear innocent and straightforward, yet as discussed throughout the thesis, language is never so. One illustrative

example is found in the abstract on the back cover of the *Handbook of International Research in Mathematics Education;* a book that would be seen to provide an overview of mathematics education research. It states: "[This book] brings together important mathematics education research that … anticipates problems and needed knowledge before they become impediments to progress [and] interprets future-orientated problems into researchable issues." (English, 2002 abstract/back cover). It is unclear what or whose progress is referred to, however the succeeding line suggests that the future can be predictable. As such, we may assume that progress is steady and foreseeable. Thus, this extract conveys certainty, and a non-problematic relationship between mathematics education and development. My concern is that mathematics education research does not trouble the narratives or context within which it invokes progress; indeed, its role is to disappear these and to make progress appear relatively straightforward. This is discussed by Mendick, (who similarly questions progress in mathematics education). She draws on Dale (2001) to point out that the nature of sociology of education research is concerned with improvement and this is different to other research from other areas.

> My own and others' readings of mathematics/education policy, practice and research indicates the persistence here of the anchoring narrative of progress, as speaker after speaker 'straightforwardly invokes the premise of progress' [(W. Brown, 2001, p. 6)] ... As Dale points out, this is very different from researchers in sociology of religion or the family where the research agenda operates independently of their personal views on the social roles of religion or family. In contrast, in the sociology of education, education is treated less an object of study than as a resource. (Mendick, 2011, pp. 50-51)

Thus the majority of educationalists seek to improve education, rather than study it for its own sake. Hence progress, is always already present. It is something we accept and do not question. Furthermore, Mendick argues that for mathematics education research this is amplified with its foundations in science, reason and rationality.

Whilst investing in progress may appear inevitable, it can, like anything, be problematic. Specifically for mathematics education research, other 'non progressive' analysis and research are foreclosed. In this instance, we must know what the preferred version of mathematics education is (which I have troubled throughout), and we must always already know the preferred the mathematical child. Both of these I explore below.

As discussed previously, this thesis is concerned with dominant branches of mathematics, rather than generalisations of mathematics education research. From a Foucauldian perspective, this concerns what is allowed to be said and heard within mathematics education research. Brown and Clarke (2013), note that "there is a common assumption that research in mathematics

education is about informing movement towards some improved conception of teaching" (p. 463). This phrasing acknowledges that this norm of mathematics education is not factual, but instead is, like all norms, constructed within discursive practices. As such, we can state that "research participates in constructing the boundaries of its own practice" (T. Brown & Clarke, 2013, p. 469). In this instance, mathematics education research always already seeks improved teaching and learning, moreover mathematics education research defines what counts as improvement.

This pursuit of improvement is particularly evident within the dominant branches of teaching and learning in mathematics education research in England. As discussed in Chapter Three, these models of teaching and learning predominantly draw from 'constructivism' and are typically labelled 'reform' or 'progressive' in opposition to so-called 'traditional' forms of education, and as such the pursuit of progress is always already assumed in their naming. The preference of mathematics education research to progressive pedagogies can be seen in various mathematics research books content pages. For example, in the book *International Perspectives on Learning and Teaching Mathematics* (Clarke, et al., 2004) half of the chapters are geared towards reform education, with titles such as "building children's understanding"; "problem solving and modelling"; and "towards learner centred teaching"; whilst the other half look at wider contexts, and not other pedagogical models. "These studies centred their analyses on individuals shaping their practice in response to the perceived reform agenda (Remillard & Kaye, 2002; Van Zoest & Bohl, 2002). Many of the authors identified and openly subscribed to this agenda" (T. Brown & Clarke, 2013, p. 464). As such, other versions of events are excluded. Moreover, 'progressive' pedagogy maintains its place at the top of mathematics education research hierarchies, as it is the knowledge that is given value and allowed to circulate. Furthermore, it is often allowed to circulate unproblematically and without acknowledgement of mathematics education research's role in its production

Specifically, publications that align themselves to 'reform' agendas and/or to constructivism, and/or cognitive development, seem to produce progress as dependent upon the development of "meaningful learning" (Battista, 1999). This is shown through titles such as *Teachers' Mathematical Knowledge, Cognitive Activation in the Classroom, and Student Progress* (Baumert, et al., 2010) or constructs such as "conceptual progress" (Battista, 1999). Typically, as in the Battista article, the focus is on the strategies employed by the pupils to solve problems, which is the mathematical performance that is sought by constructivist research. This has the appearance of acknowledging the pupils' perspective. However, the specificities of mathematical thinking are clearly defined at the outset of the article, and referenced throughout; for example

Battista frequently refers to “proper mental models”. This suggests a correct and natural way of doing mathematics, which the pupil is measured against, or a ‘normal mathematical child’. Hence, in this, and many other cases, success with problem solving is the predetermined measure of progress and other versions are foreclosed. However, this is part of the circulatory discursive production of research, for “research is judged by its perceived capacity to deliver success in the prescribed terms” (T. Brown & Clarke, 2013, p. 460). Thus some researchers are always already setting out the model of progress that they intend to corroborate. In the above case, progress is evident by pupils’ demonstrating prescribed models of activity of the ‘natural’ ‘active’ subject who is the ‘centre’ of the activity. As Valero states in her critique,

> Most mathematics education research is based on the assumption of the centrality of learners in the processes of mathematical learning. This assumption views learners as active cognitive subjects at the ‘centre’ of the development of mathematical thinking in classrooms. (Valero, 2002, pp. 542 - abstract)

As explored in Chapter Three, this assumption very much draws on Rousseauian (1763/1884) romantic constructions of the past and the privileging of developmental psychology in education, and mathematics education. As such, the discursive construction of the mathematical child produced is both determined and defined by hierarchical developmental stages that privilege the “up the hill” progressive (Rorty, 1980) model of science, reason, and logic. Thus, the mathematical child is constructed as naturally, linearly, developing and autonomous. As established in Chapter Three, this version of the mathematical child is not natural, but is instead a production of discourses of developmental education (Burman, 1992, 2008a; Burman & Parker, 1993; Henriques, et al., 1998; Walkerdine, 1997, 1998a).

However, in spite of the inclusion of linear developmental stages and progress, the nod to dated works such as Rousseau and Piaget (Piaget & Inhelder, 1969/2000), troubles this linear narrative. Specifically, there are illusions of images of the past as a fictional “Golden Age” (W. Brown, 2001, p. 6), just as there were with the scholars that worried about the death of childhood (see section 3.2.2). It is a curious narrative, as it suggests a better time, by drawing on past images that never were; moreover, it invokes a concept of the ‘natural’ child that already was. However, even this is always already caught up in the overriding narrative of forward movement and something better. As such, there is a confusing relationship with temporality.

Of course mathematics education research is not a homogenous mass, as a few articles/books seek markers of both short and long term development. One example of such is the Realistic Mathematics Education (RME) project based in the Netherlands, who specify a micro-

didactic (short-term) and a macro-didactic (long term) perspective of students' "growth" (Van den Heuvel-Panhuizen, 2002). RME has similarities to constructivism, for instance they also expect pupils to "apply a natural strategy" (p. 6). This is reiterated by their use of the word growth, which suggests something innate, biological and unidirectional. As such, they also have a commitment to the 'natural' mathematical child as discussed above.

My search found few examples of individual progress that defined progress as anything more than cognitive. One example is from Watson and de Geest (2005) who refer to "deep progress". This is defined in broad statements such as, the students "learn more mathematics, get better at learning mathematics, feel better about themselves as mathematics students" (p. 227). This is an interesting quotation in that it suggests that progress is quantifiable – the more mathematics, the better. In addition, it infers that developing cognitively in mathematics leads to development of the self. Thus, I contend that, as before, it is this prescribed activity of reform mathematics that becomes a marker of progress and pupils' "cognitive activity is central to the whole educational enterprise" (Valero, 2002, p. 453). This is explored more in Chapter Seven, where I argue that the development of effective traits is seen as a by-product to the development of cognition, and as such becomes cognitised. I contend that this is a 'romantic' construction of the mathematical child, allied to Rousseauian principle of the 'development' of man. As such, I suggest that dominant productions of individual progress are based upon the cognitive 'natural' pupil, which is caught up in romantic productions of the past. It is this that leads to development of the self, which is a key aspect of neoliberalism. Moreover, progress within progressivism, and hence mathematics education, very much depends upon comparison to the normal, and to the extremes, and towards a correct way of being; it evokes a concept of the 'natural', of the advanced and of the backwards.

In the next section, I move on to examine how progress is constructed through New Labour's educational policy documents and how the mathematical child is constructed within this. As may be expected, this production largely takes on a more homogenous account than mathematics education research. Specifically, I suggest that within educational policy, progress is constructed as functional, which both produces and is a production of the measurable, neoliberal education system. Within this, the mathematical child becomes machine-like. In policy the complexities around notions of progress are written out of the discourse, and instead the 'normal' mathematical child is expected and linear temporality is assumed.

5.3 Troubling progress in educational policy documents

In this section, I begin by discussing New Labour's commitment to progress, and how this is always already part of government discourses, before moving on to explore how New Labour constructs narratives of progress within the mathematics classroom.

New Labour's neoliberal version of education, was based upon the production of a complete transformation; one such that "the 'depth, breadth and pace of change' and 'level of government activity' in education is 'unprecedented' (Coffield, 2006, p. 2)" (S. J. Ball, 2008, p. 2). Within this, the past is used as a point of reference to the previous government's failures often through "discourses of derision" (S. J. Ball, 2006; Kenway, 1990) (see sections 1.1, 2.6, and 3.3.3). Specifically, the government justify their policies through a production and assumption of linear temporality and progress. Government officials routinely attest, that their development is, for example, a "major step forward in the transformation of our education system" (Ruth Kelly, the secretary of state for education DfES, 2005a, p. 5). Hence, I suggest that as with mathematics education research, progress is always already evident within government policy discourses, they cannot say anything else.

Education was fundamental in this narrative of New Labour's progress. From the outset, progress of the nation was constructed around education. As already mentioned in section 1.3 and 4.3, New Labour positioned "education, education, education" (Blair, 1996) as a key symbol of their government and of a modern and prosperous society. Indeed their very first white paper, discursively constructed education at "the heart of government" (DfEE, 1997, p. 5). As such, education became a means by which New Labour could demonstrate their progress in government. Specifically their educational policies relied upon the link between individual and national progress. This is clarified by Mendick (2011):

> Within their [New Labour's] policies, progress figures as an unproblematic good … we see the conflation of national and individual progress, and the binding of these to discourses of economic competition and individual potential … there is an explicit linking of these discourses to a concept of history as linear and teleological. (Mendick, 2011, p. 50)

As such individual progress needs to be both visible and measurable. This accountability is part of the wider shift in education towards a neoliberal managerial discourse (S. J. Ball, 1994, 2008), explored throughout the thesis. Hence, from the first New Labour white paper for education (DfEE, 1997), language such as targets, performance management and appraisal entered the world of teacher discourse, as education became increasingly influenced by marketisation and business (S. J. Ball, 2008). As such, education is constructed around a system where pupils, teachers and

schools are accountable, where parents (and wider society) became the consumers and the governors, and where pupils are products fit for conversion (Llewellyn & Mendick, 2011). Furthermore, success is justified through conversion to these measurable targets, data and constructed levels of progress. This intent was signalled in the first New Labour's white paper. For instance, New Labour state that during their administration "school performance tables will be more useful, showing the rate of progress pupils have made as well as their absolute levels of achievement" (DfEE, 1997, p. 6). Specifically, they will "focus more on the progress made between different stages" (DfEE, 1997, p. 26). For this model to work, and for progress and learning between schools and pupils to be comparable, progress is constructed as both measurable and uniform; hence, progress must be the same for every child and for every school. As well as this uniformity, there are implications concerning speed. The use of "rate of progress" suggests a quick speed is preferred, and that progress can (and should) be constant. This is also shown with the assertion that "a pupil taught by one of the most effective teachers will typically learn at twice the speed of one taught by one of the least effective" (H. M. Government, 2009, p. 51). Hence, good teachers are constructed as fast teachers and good pupils similarly so. Moreover, progress is a measurable uniform concept (construct).

The rest of this section is focused on exploring how New Labour discursively constructed individual progress in mathematics, and how in this way the mathematical child became a functional product fit for conversion.

In the first instance, linearity is given validity in mathematics education through the objective-driven structure of the mathematics curriculum for England and Wales. During the New Labour era, this use of objectives was further enforced through the National Numeracy Strategy (NNS) (DfEE, 1999), where curriculum objectives were broken down into more specific piecemeal targets. Indeed, the Mathematics Curriculum (2000 and 2008) was structured around separate topic areas, each with constructed levels of achievement. In particular, progress within New Labour neoliberal mathematics educational policy is concerned with attainment levels and prescribed targets. In a recent piece of work, written with Heather Mendick, we argued:

> 'Levelling' captures even more clearly the compulsion to progress. Levelling, like quality, blurs several meanings, including: making flat, knocking down, and placing on the same level. To understand it in this context, it is helpful to know something about the organisation of compulsory schooling in England. Since 1988 this has been structured around four Key Stages (KS):
>
> KS1: ages 5-7

KS2: ages 7-11

KS3: ages 11-14

KS4: ages 14-16

> KS1 and KS2 constitute primary schooling, and KS3 and KS4 secondary schooling. Each KS ends with compulsory national tests in mathematics and English, the results of which are widely published in national and local newspapers, websites etc. National expectations are set for each KS. Pupils are expected to reach level 2 of the National Curriculum at KS1 and level 4 at KS2. Time-demarcated targets are set for the proportion of pupils attaining the expected levels. In addition, expectations are set around the quantity of progress (two levels) required across each KS. As indicated in the Ofsted [(2008)] report, this can be micromanaged to produce expected levels of 'progress' in every lesson. (Llewellyn & Mendick, 2011, pp. 52-53)

Many schools have broken down each level into three sub-levels, adding even more structure and measurement. Hence levelling is authenticated by overt surveillance on a micro and macro level, by Ofsted (mentioned above) and with the publication of school results and league tables. By comparison, progress within mathematics education research is covertly managed through illusions of 'natural' development and the development of 'understanding' (see Chapter Six). New Labour's justification is that "the rigorous use of target-setting has led to high standards and consistent year-on-year increases in the proportion of pupils who reach or exceed national expectations" (DfES, 2001, p. 10). However, this is a cause and effect assumption that is contestable. An alternative argument is that pupils are better at achieving targets as teachers are better at test preparation (M. Brown, Askew, Millet, & Rhodes, 2003). Teachers are part of the marketization of education, as discussed in Chapter Three (section 3.3.3); they are accountable and they have a role in the production of progress. Hence, this is a demonstration of how power relations are realised, through rationality, surveillance and governmentality. It also shows how an overtly mechanistic construct of progress – levels, becomes the conception of the mathematical child's learning, which is very different to the 'romantic' inquirer of mathematics education research.

Thus, for this version of progress to be possible a particular version of the mathematical child is required. Specifically teachers are to "ensure that children progress through the levels expected for their age" (DCSF, 2009b). Hence, like machines, pupils are constructed as capable of moving at uniform and continuous rates. Furthermore, pupils need to be fit for conversion to these measurable targets and as such are positioned as functional automata that can be programmed to move through these predetermined levels (Llewellyn & Mendick, 2011) at the

optimum speed. This is further reiterated within publications such as *Increasing pupils' rates of progress in mathematics* (DfES, 2004) and *Making Good Progress* series of publications (DCSF, 2007b; DfES, 2007a, 2007b, 2009). In the former document "the focus … is to increase rates of progress for pupils in mathematics by refining and developing planning, teaching and learning" (DfES, 2004, p. 5). These documents contain advice on preferred teaching that resembles many other teaching documents, though this is of course framed around the key marker of progress and that the speed of this should increase for all. They state:

> In many schools pupils improve on average by one and a half levels in mathematics through Key Stage 3. In some schools pupils improve on average by two levels through Key Stage 3. Nationally we need to ensure that this becomes more commonly the case in all schools. (DfES, 2004, p. 5)

Thus the message is that pupils should behave similarly, and they should conform to this 'normal/average' functional mathematical child. Within this construct of normalisation, it is hard to see alternatives. By New Labour's third term this message, and the subsequent surveillance, had become even more explicit, which is shown in the *Making Good Progress* series of publications. For instance, the documents are explicit about level transitions, giving a specific set of rules for each. In addition, there are sections entitled, "obstacles to progress in KS2 for all slow moving pupils starting at Levels 2 & 3", "obstacles hindering progression from level 2 to 4" (DCFS, 2008b, p. 2) and "actions to support progression from Level 3 to Level 5" (DCFS, 2008b, p. 3), for example. These titles suggest that difficulties can and should be overcome, and that progress is a relatively straightforward track which deviant pupils can be managed onto. However, the very existence of these progress-specific documents problematises this.

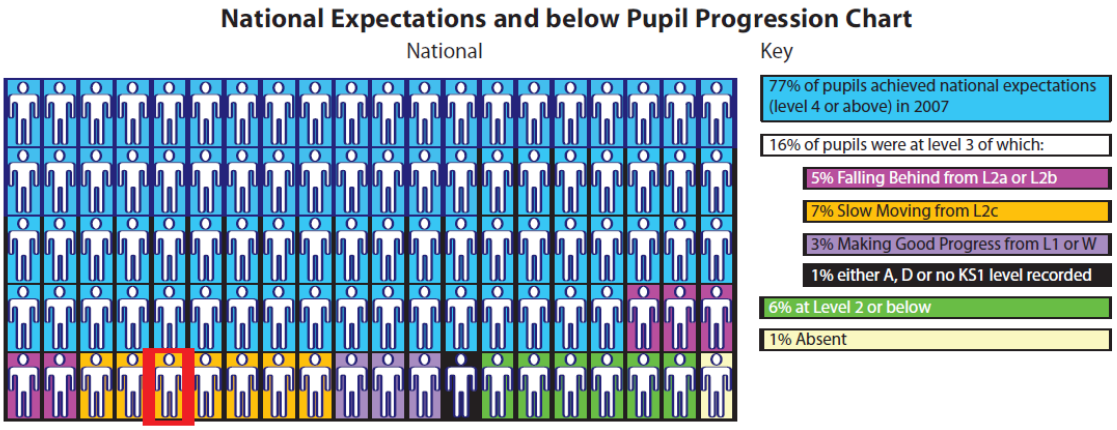
The surveilling and the governing of this 'normal functional progress' in pursuit of the 'normal functional mathematical' child is further demonstrated through micro managing the pupils outside their presence. This is discussed in the extract below:

> Holding pupil progress meetings can help to maintain and sustain improvement. These meetings allow children's progress to be discussed and ways of helping children to overcome existing barriers can be planned … The meetings also provide opportunity to identify children whose progress has recently stalled or slowed, and those children who no longer require support – a time to review membership of the focus groups. Schools are increasingly holding pupil progress meetings for the class teacher and senior leadership team, including the mathematics subject leader. (DCSF, 2009b, p. 24)

Above the pupil/mathematical child is capable of “stalling” as a car, or a similar machine would; a product that fits, or not, into the projected production line. The mathematical child is a “target” to be prodded and probed by authorities, without their presence or opinion. There are many more extracts which exemplify this positioning of the mathematical child as functional machine. For instance “the progress of … pupils needs to be tracked on a regular basis and obstacles to progress identified and addressed” (DCSF, 2009a, p. 26) and teachers are asked to “track progress and to tell pupils how they can do better” (DCSF, 2007a, p. 64). Here, the responsibility of monitoring seems to be placed upon both the teacher, with the pupils as passive responsive; the teacher is mostly charged with keeping normalisation on track, which again is produced as unsophisticated. Simple unequivocal suppositions such as this are a trait of government policy documents (Curtis, 2006) and again evoke authority through rationalisation.

The pursuit of the ‘normal’ is further demonstrated by “droid diagrams” (figure 1) that appear in the *Making Good Progress* series of documents (as discussed in Llewellyn & Mendick, 2011). This is a pictogram type illustration which uses colour-coded icons as a representation of national progress in comparison to expected levels.

Figure 1: Example of Pupils' Progression Chart "droid diagram"



> [in these diagrams] the normal is defined in comparison to the other as the eye is drawn away from the majority light blue towards the minority, abnormal failures … These icons are pseudo-children with stylised blank bodies; they resemble automata, droids, or another science fiction invention. (Llewellyn & Mendick, 2011, p. 54),

This establishes difference as unacceptable. This message is continued throughout other New Labour documents, as pupils are instructed to keep up with the ‘normal’ trajectory, through titles such as *Keeping up – pupils who fall behind in Key Stage 2* (DCSF, 2009a) and *Getting there – Able pupils who lose momentum in English and mathematics in Key Stage 2* (DCFS, 2007b). “Getting

there" also implies an end point and a predestined potential to fulfil, which follows an essentialist view of learning and development and one that has a ceiling. Furthermore, the rate of this progress is always already determined from educational policy and the set targets. Hence, this discursively constructs barriers around what is possible, but also what is restricted. Overall "this framework of expected levels and conversions, construct a 'normal' child, which purports to be, but is not, universal. Any moves away from normal connote danger/risk, and compel intervention to reconstitute the child within the normal" (Llewellyn & Mendick, 2011, p. 53). There is one exception explored in the next section.

5.3.1 The exception to the rule: 'Gifted and Talented' Pupils

There is one group of pupils who are allowed and encouraged to be different to the norm - those who are labelled *Gifted and Talented.* These are a designated group of pupils in each school that are determined to be able to develop significantly above the year group. This group is explored in more depth in Chapter Eight of this thesis; their different treatment with regards to progress is set out below.

Specifically, the *gifted and talented*, are encouraged to move at a faster rate than the norm. The government state that "it will be easier for young people to accelerate through the system - early achievement at Key Stage 3 or AS levels [a post 16 qualification] will be recognised in the achievement and attainment tables" (DfES, 2005a, p. 57). Other New Labour educational policy documents contain praise for schools that do this, thus validating this position (DfES, 2005a). In addition, to support such schemes further, the government offered financial incentives (DCFS, 2007a). Thus for this special group of people, who are positioned as having innate gifts, early achievement and acceleration are viewed as appropriate. This is a special kind of difference that is permitted, even celebrated. This has similarities to the 'natural' mathematical child found in mathematics educational research, in that it relies on ability, potential and the inner self (DCSF, 2008a; DfES, 2006a), rather than attainment. Although the manner with which these pupils demonstrate their potential is by converting at a faster rate. This would suggest there is still the requirement for the *Gifted and Talented* mathematical child of New Labour educational policy to perform functionally. This conjecture is explored in more depth and detail in Chapter Eight of this thesis, where the focus is ability.

Overall, there is a huge investment in progress at both a national and an individual level; the proposition is that the latter feeds the former. In the majority of government educational policy documents, I suggest that the discourse of individual progress is one of neoliberal functionality. Within policy, this consistent and unified approach affords authority and suggests

the statements are almost factual, and that the new always improves the previous; progress should be teleological for our pupils, and we should enable this. This is a much more overt and homogenous message than mathematics education research. Through governmentality, educational policy's message is presented as the only 'normal' option. These 'truths' of educational policy produce progress in mathematics as linear and uniform, and the mathematical child as a functional automaton moulded for conversion. Apart from for the chosen few, who are allowed to display 'romantic' constructions of the 'natural' pupil, more often found in mathematics education research; so long as they convert as functional automatons. This potentially excludes many from mathematics who cannot perform in these predetermined ways.

In the next section, I demonstrate how these conflicting discourses are lived by the student-teachers. I show that the student-teachers are aware of the need for progress. It is produced as the marker and hence dominant version of learning in the classroom. Hence, there are expectations of the mathematical child. However, the student-teachers find it difficult to reconcile these 'romantic' and 'functional' productions with messy 'real' practice. As such there is tension and confusion, which can lead to frustration and blame, and the positioning of teachers and/or pupils as deviant.

I construct this argument in phases. I begin by exploring how the talk reproduces educational policy discourses of the mathematical child as a functional automaton. I examine how this is problematic for the student-teachers, by focusing on their relation to others and to their selves. To finish, I explore the student-teachers' alternative ways of negotiating progress, albeit ones that still that evoke a narrative of linear progress.

5.4 Troubling progress in student-teachers' talk

5.4.1 The construction of the mathematical child as a functional automaton: the 'shoulds'

Throughout the interviews, all of the student-teachers discursively produce progress as a key concept in the mathematics classroom. Specifically, there seems to be a push for linear progress for all, such that everyone achieves at the same rate, regardless of other internal or external factors. This very much fits the functional production of progress within New Labour educational policy. This construction is shown in Nicola's interviews where the completion of the work is produced as the goal, as in the extract below. (The pupils choose their own names for their 'ability' group, suggesting a knowing and subversive subject positioning – a constrained agency)

Nicola: The other day I had four kids that did the Comets work [lower group] and the Spoons work [higher group] in the same amount of time the Spoons did their own work. And the rest of the Comets did their work. And it was like they should really be working with Spoons

The extract demonstrates how the mathematics classroom can be constructed around normalcy and comparison, of what pupils "should really be" doing. Pupils are assumed to move at predetermined rates and this is the construction favoured by the teacher. In addition, it demonstrates how the pupil's position can be fixed within this, in accordance with markers of ability/attainment that suit normal trajectories, explored in more depth in Chapter Eight. These constructions are very similar to the ones given by Nicola and Sophie, in the extract below, which is indicative of the wider data and taken from a group discussion.

Anna: What do you think of having targets?

Nicola: I think there's too many of them. Because you are changing, like sometimes you're changing topic like do one week on it and then you're on to the next thing and by the end of the second week they've forgotten what you did the first week because you haven't got the time to go back over.

Sophie: I think you do need some targets set but there's so much to do in the year, some kids you can go and do it one week, they'll be perfect at it, go and do a couple of weeks of other work and then you come back and they'll have completely forgotten it. So you can't win ... because you were trying to meet all the targets and all the strands, you had to skimp on certain weeks and certain bits and pieces.

Again, there is an expectation of what should happen in the mathematics classroom – what is "perfect" and demonstrating this within the lesson. There is an expectation of normalcy and pupils behaving as machines, to maintain their progress from lesson to lesson. The mathematical child is constructed as objects or "target groups" that "need to be pushed that little bit further".

There are several debates that follow from the above: firstly, for forward movement to be maintained, forgetting things, or making mistakes, becomes problematic - an illegitimate mathematical discourse. Secondly, as targets surveil the classroom, and the push for progress becomes the push to move at a fast pace and cover the objectives of the mathematics curriculum, progress can be measured by, or conflated with, speed and/or quantity and coverage. Both of these suggest particular connotations for mathematics pedagogy, for the mathematics teacher and of course, for the mathematical child. The teacher (and the system) could be read as exerting an external force upon the mathematical child, as they are processed through the production line

at a predetermined speed, regardless of who they are. They are machines that have to keep up with this production line.

This is particularly evident where pupils do not fit normal trajectories. There is an attempt to reconstitute deviant groups within the normal, within what we should do, as demonstrated (in the indicative extracts) below, which are from separate interviews.

> Nicola: the lower ability are pushed and they will be helped to the point where they will catch up with the other kids.
>
> Louise: if I say I'm working with a target group I need to work with that group 'cos I need to push them on

However, as shown in all of the extracts above, the push for progress is not as straightforward as discourses constructed in educational policy. Accordingly, the student-teachers express difficulties taking the construction fully on-board. For instance, the extract from Nicola and Sophie demonstrates that tension is evident between the pressure to obtain targets and the perceived needs of their pupils. Both student-teachers seem be uneasy about moving through fictional targets at a regulated speed and they express some desire to work more flexibly. Within this, they criticise the system (the number of objectives in the curriculum), however it also becomes acceptable for them to criticise their pupils when they fall short of these expectations. The pupils take the brunt of the blame, and are positioned as deviant. As such, the child, rather than the system, becomes defective. These sentiments are shown throughout the interviews above, and in Kate's interviews. The extract below is indicative of her other statements.

> Kate: they're second to bottom set so um, so I had to make sure I targeted my lesson at that, but they tended to get it one minute and it was over their head the next ... Wednesday I think it was, they'd not got estimation even though we'd done it two weeks ago, they could not get it, so we had to spend all of today doing estimation and they finally got it but if I asked them again on Monday they wouldn't be able to do it

The label (and perceived level) of the 'ability' group (or set) seems to dictate the teacher's assumptions about the targets and levels, thus it dictates the curriculum and pedagogy. Moreover, there is an expectation of linear temporality and any child who cannot meet these criteria is deemed deviant. 'Blame' is 'easily' placed with the abnormal pupil, and they become malfunctioning functional automata. However, there is another option, for those who do not fit the functional, linear system of progress. Instead of blaming the pupil, you can of course blame yourself – the teacher, which is discussed, through Jane, in the section below.

5.4.2 The frustration of the mathematical child as functional automaton: the constitution of blame around the self

Jane also has an expectation of what pupils 'should' do, and she also conflates speed and progress. This is shown throughout her interviews, for instance:

> Jane: See I've got to keep moving on for the higher ones and the ones that get it because there's no point keep doing that because they're just going to get bored, but what do I do with those ones who don't get it? Do I just move, you know, it's difficult weighing it up because this was supposed to be a consolidation lesson for those children who still didn't get it.

She is aware that she needs to keep all pupils moving forward but she is also mindful that everyone should be progressing at the same linear rate. Thus the fuzzy experiences of the classroom do not match the linear functional expectations of educational policy. Moreover, similarly to Kate, Jane positions the pupils who "still didn't get it" as abnormal. Again there is comparison to the normal mathematical child through the expected temporality and functionality. Thus for Kate, Nicola, Sophie and Jane there is tension concerning the functional expectations of educational policy in relation to their fuzzy classroom experiences. Jane also feels the need to consolidate the work and possibly to make mathematics comfortable. She may be caught up in the discursive production of teacher as carer, explored in section 3.3.3, and hence does not want children to struggle.

However, Jane is different to the other student-teachers discussed previously, such that she places some of the blame for her pupils' lack of progress onto herself. This is shown throughout her interviews; one example is used as an illustration below:

> Jane: but he still can't work it out in the way that we were working it out and that worries me because I don't know where to go with him now ... He just still doesn't understand … Not that they should all understand. I don't think it's anything, I never think it's anything to do with them. I always immediately think that I should have done something different with those children and I just worry that I don't know what else to do because I've had them sat on the carpet yesterday doing it. They could do it yesterday but when they go to the tables something happens and they just can't do it and I'm not sure why

Jane seems to be aware that she should be ensuring that her pupils make progress, as easily and as homogeneously as New Labour educational policy documents indicate, and/or possibly as intrinsic to the natural development of the 'romantic' inquiring mathematical child of mathematics education research (her use of 'understanding' is unpacked in the next chapter). However, in

practice the pupils do not behave as functional automata, or romantic natural inquirers. As she states, “when they go to the tables something happens”, something that Jane cannot explain or she cannot find an educational discourse to fit. Hence, the space that is available is one of deviance, that something must be wrong with the pupils or with Jane. In Jane’s case she seems to take the majority of responsibility for the ‘lack of progress’ onto herself, and positions herself as abnormal, and as an unsuccessful teacher. There is tension around ‘impossible’ discourses of progress and of the mathematical child.

There are ways of working with these targets, and by the final year of their interviews some of the student-teachers had begun to do this. There seemed to be two distinct ways of managing functional progress within the student-teachers’ interviews - driving the pupils through the targets as machines or expanding the depth of the subject, which alludes to more romanticised, mathematics education research versions of progress. These are explored in the next section using indicative examples of data.

5.4.3 The mathematical child as romantic inquirer – for the more ‘able’ only

By the final year of her practice, Leah seems to be able to find a way of halting the curriculum content led objective constructions of progress she does this by broadening the mathematics for those she designates as of high ‘ability’.

> Leah: I feel frustrated because I wish I had more time to spend and I feel like pressurised because of the way you’re expected to teach so much ... I think as long as you focus on one thing and you bring it up to the level of that, the high ability children by expanding on it, it’s okay that they do that or even just throwing in other elements and things I’ve done over the year.

Leah seems to be constructing (some of her) pupils as something more than functioning automatons, as they are capable of both practical tasks and higher order thinking. This is similar to mathematics education research constructions of the romantic naturally inquisitive mathematics child, though mathematics education research would suggest this is the mathematics that all pupils should be doing. However, in Leah’s production it is only the ‘able’ pupils that are allowed this mathematics, which sets up a pedagogical division where some types of mathematics are only suitable for some types of pupils (this line of argument is continued in the next chapter and in Chapter Eight). In addition, it is different to the advice from educational policy documents that advocate early entry and continuous movement through curriculum content levels.

By year three of the course, Nicola similarly widens the mathematics, rather than moving pupils onto the next objective. Similarly to Leah, this seems to be restricted to those she ascribes

as more ‘able’. Hence the task becomes one of herding the pupils onto similar trajectories, rather than pushing for objective specified progress.

> Nicola: So instead of pushing them on to another objective I try and give them a more challenging way of doing it, like with multiplication, while I’m doing basic multiplication, like for what is two times two days, I give them a grid that’s got like five numbers in it.

Hence, there are tensions around the various productions of progress, and we can ask if progress is about the completion of content-based objectives of educational policy or is it about “meaningful learning” (Battista, 1999), more akin to mathematics education research. These false dichotomies are further interrogated in the next chapter of the thesis. Here, I suggest that conceptions of progress should not be viewed narrowly; that progress can mean different things to different people. One concern, which I develop in Chapter Eight, is that it creates a division in mathematics between the functional mathematical child and the romantic mathematical child and limits the latter to those who are classified as ‘able’.

5.4.4 Pupils producing themselves as machines or as autonomous learners

Of all the student-teachers, Louise enacts the most ‘policy friendly’ discourse concerning the functional educational policy production of progress. Her discussion, of her lesson, in year three, is firmly based around specified targets. For example,

> Louise: when I started that I thought I don’t want to go into too much detail because I didn’t want to confuse red group, but reds is specifically to do half and a quarter of a different shape, whereas purple was just numbers and yellow was in-between here, so we're moving them from here to there.

As for the student-teachers already discussed, the targets seem to dominate her construction of the lesson over other conceptions of learning. She talks of instilling width (curriculum content) and not depth (for example, higher order thinking). Hence, the pupils have become the functional mathematical child, fit for conversion. Louise justifies this position by stating that the pupils use targets to take ownership of their learning and they enjoy this. Thus the pupils are positioned as enabled, autonomous actors within the production line.

> Louise: that's what these targets relate to and they're responsible for them themselves and have to colour in and put the date if they achieve it and one is 'I am trying to do this' and two 'I can do this with help' and three 'I can do this independently' so it's kind of like their own assessment, self-assessment they're responsible for doing those themselves.

The positive phrasing of the pupils' targets mirrors the enabling discourse of educational policy, demonstrating how self-improvement becomes possible within neoliberalism; although the privileging of independence also follows discourses of mathematics education research. Hence, this may be a case where discourses from educational policy and mathematics education research coalesce. Specifically, within each content-based levelled target, there is a separate, possibly 'romanticised' target that is supported by discourses of neoliberal reflexivity and self-actualisation; the more 'independent' you are, the more successful you are.

Of all the student-teachers, by year three, Louise is the most aware of the appropriate business discourses that have permeated education and teaching, she mentions targets, levels, target groups and differentiation.

> Louise: At first I was like ooh, you know, but after working with Year 6 last year and they were doing their SATS, so it was all levelling. Level, level, level, and it was just constantly levelling everything. And the children wanted to do better, they wanted to reach level 5, and we had like the levels going across the top of the door on the wall. And they used to, they used to be like, oh right, so I'm like a 4C now, how can I get to a 4A? And, you know, they'd look at it and yeah children really, really like it. Um, more than I do.

Here, the functional levelling discourse is negotiated through a broader production of the mathematical child as autonomous individual. And like the majority of the student-teachers, this functional discourse is supported by the positioning of their pupils (with and between) levels as homogenous groups built on comparison; something which is always already part of constructions of progress. The pupils become targets and learning mathematics becomes moving through levels as on a production line. Moreover, in Louise's case the pupils view their learning in relation to these targets; they are constructing themselves in relation to the norm. They are possibly constructing themselves as functional automatons, or as autonomous learners, as they are programming themselves to move through the levels. This positioning is not done without some acknowledgment of doubt from Louise, for instance she states that "the children seemed to like it which I did not; I thought it was a bit like labelling". However her overall 'positive' position and her placing as pupils as central allow her to dismiss any concerns, similarly to unambiguous educational policy.

5.5 Chapter summary and concluding remarks

In this chapter, I have shown that there is a commitment to progress in mathematics education, and that this investment is realised through the mapping of national and individual progress. Specifically, I argue that mathematics educational policy fictions a functional version of

progress, and this becomes a driver of mathematical learning in the student-teachers' talk. Particularly, I contend that the anodised and linear policy view of progress is most evident in student-teachers' productions of progress. Though the romantic, 'natural' mathematics education view of progress is also present, but in a more minor role. However, neither are able to be taken fully on board, resulting in conflict and disillusionment. Pupils (and teachers) are neither functional nor romantic; instead they are a complex hybrid of identities. Moreover, the emphasis on progress results in comparison becoming a key part of the mathematics classroom and part of student-teachers' constructions of the mathematical child and of themselves. There is the pursuit of the norm and stable discursive productions of the mathematical child are given authenticity and authority. Furthermore, there are problems when teachers work with the messy 'real' situations that they find themselves in. As Jane states, "I always immediately think that I should have done something different with those children and I just worry that I don't know what to do"; "those children", being anyone that does not conform.

This analysis has established that progress is a fundamental part of the production of the mathematics classroom and of the mathematical child. It sets up the rest of the analysis in this thesis, where I examine how the romantic production of the mathematical child in mathematics education research and the functional automaton of educational policy are enacted through other norms of the mathematics classroom. The next two chapters (Six and Seven) specifically demonstrate this through a typically cognitive aspect of the child (understanding), followed by a typically affective trait (confidence). Chapter Eight continues the deconstruction of the notion of ability that has been introduced in this chapter as another fundamental aspect of the production of the mathematical child within the messy mathematics classroom.

6 Chapter 6: Troubling Understanding

(the majority of this chapter has been published in Llewellyn (2012) or Llewellyn (2013b); the front pages of which are found in appendix 1)

6.1 Introduction

> I know that you believe you understand what you think I said, but I'm not sure you realise that what you heard is not what I meant
>
> (Robert McCloskey) [1]

What does the above quotation mean to you? For me it reminds me of the frequently heard question in the classroom 'do you understand?' Whilst looking rather innocent, this can be a problematic question in many regards, for instance how valid is the answer? If you ask this of a school pupil and they answer 'yes', what have you learnt? That they are compliant? That they have heard you? Or that they think they understand you? Perhaps the question you are really asking is 'do you understand in the manner that I understand?' or 'do you understand in the manner that I want you to understand?' but of course the pupil may not always know if they do. Even if you can establish that they have understood in the way you intended, what do you mean by understanding? Do you mean that you want them to understand how to do the work or are you hoping for something else mathematically; a spark that suggests something 'deeper'?

By asking these questions I have begun to problematise the concept of understanding, and I have questioned the amount it is used and the way it is used. These questions of course, derive from my poststructural frame developed throughout this thesis, since they assume that language is not transparent, meaning is subjective and created in context (MacLure, 2003). They set the scene for this chapter which is focused upon unpacking teaching for understanding, which, like progress, is another taken-for-granted good of the mathematics classroom. In addition, it is a good which further authenticates mathematics education's preoccupation with the normal cognitive subject, which was introduced in the previous chapter. Hence, it builds on Chapter Five by further interrogating the norms of the mathematical child; specifically that of the romantic inquiring

[1] This quote is attributed to many people. According to many internet pages the first recorded reference is by Marvin Kalb, a CBS reporter in the TV Guide 1984 citing a press briefing, with Robert McCloskey, the US State Department spokesperson, during the Vietnam War. http://en.wikiquote.org/wiki/Alan_Greenspan

mathematical child of mathematics education research and the functional mathematical child of educational policy. These, I argue, are evident when we consider the norm of teaching for 'understanding'.

Indeed, in the field of mathematics education the quest for understanding is akin to the (re)search for the Holy Grail. But why is this? Do we believe this creates better mathematicians or people, or do we believe this is the correct, and only, way to learn mathematics? If we do suppose these things, what happens when a teacher states that they want to understand or that they wish to teach for understanding? What is it they want, what work does this do, and what does this mean for the mathematical child they are producing?

Thus instead of blindly pursuing teaching for understanding and assuming that there are only good consequences for all, I follow the Foucauldian epistemology developed through the proceeding chapters, and interrogate understanding.

The structure of the chapter is similar to the previous one in that I start by analysing discourses of understanding with/in mathematics education research before moving on to show how understanding is constructed with/in New Labour mathematics education policy. Finally, in a slight departure from the last chapter, the analysis of discourses of understanding with/in mathematics education research and neoliberal policy provide a context for examining a case study of a particular student-teacher called Jane. Understanding appeared strongly in all of the student-teachers' talk, but above all in Jane's. I supplement this with short extracts from Sophie and Nicola's interviews to demonstrate alternative perspectives and resistance to dominant positions.

6.2 Troubling understanding in mathematics education research

In this first section I argue that the preoccupation of mathematics education with cognitive activity and with promoting particular forms of understanding forecloses other stories. Specifically, and building on the work of the previous chapter, I show how mathematics education promotes a 'romantic' discourse of mathematical understanding which draws on a normalised developing child as self-governing and free-thinking. I begin by showing how pervasive this romantic discourse of understanding is in mathematics education and then look in detail at one paradigmatic example, Boaler's (1996, 1997a, 1997b, 1997c, 1997d, 1998a, 1998b, 1998c, 2002) "quest for understanding" which has huge influence both for the mathematics education community and for the student-teachers with whom I spoke.

As established in the previous chapter "cognitive activity is central to the whole educational enterprise" (Valero, 2002, p. 453) and in particular to mathematics education. Caught

up in this production is a hierarchy of pedagogy, and at the peak is teaching that promotes understanding. Particularly, in mathematics education research, understanding is typically positioned as something mathematics teachers or learners cannot function without (Hossain, Mendick, & Adler, 2013). For instance, Ball, who has written extensively about the 'correct' kind of understanding states that "a teacher cannot explain to her students the principles underlying the multiplication algorithm if she does not explicitly understand them herself" (D. L. Ball, 1988, p.36). Moreover, many student-teacher text books clearly promote the principle, having titles such as *Primary Mathematics: Teaching for Understanding* (Barmby, Harries, Higgins, & Suggate, 2009) and *Understanding mathematics for young children* (Haylock & Cockburn, 2008). Hardy (2009) similarly notes that another popular text book states that many student-teachers "'have the wrong kind of understanding of their subject' (Suggate, Davis, & Goulding, 2006 preface)" (p. 387). As such, a position is constructed of a right kind of mathematics, a right kind of understanding, and by implication a right kind of mathematical child.

In addition, understanding is often ascribed as one-dimensional and cognitive such that the nature, superiority and good of understanding are all taken-for-granted and assumed. However, within academic literature there are actually several versions of understanding that circulate. A useful guide is provided by Kilpatrick (2009) who cites Sierpinska (1994) with identification of four main categories in academic research. These are: hierarchical levels of processes, for example, Bloom's taxonomy (1956) which has six ranked levels of which knowledge is the lowest and understanding is in the middle; cognitive structures or mental models, such as Barmby, Harries, Higgins and Suggate (2009) who examine understanding as a process of connections and representations; dialectic models such as Skemp (1976) who positions a value-laden opposition between instrumental and relational understanding and finally historico-empirical concept analysis, for example Piaget and Garcia's (1989) psychogenesis of concepts. These classifications are particularly pertinent as all have influenced mathematics education. Kilpatrick (2009) suggests that the dialectic model has been particularly influential whilst Newton (2000) argues that cognitive mental models are prevalent with mathematics education. In addition, Piaget's logical reasoning has been used to support initiatives such as the Cognitive Acceleration Through Mathematics Education (CAME) project (Adhami, Johnson, & Shayer, 1998). In the first instance, this appears to demonstrate that diverse versions of understanding circulate within mathematics education. However, for my argument, what is important is what these classifications have in common - the notion of the normal cognitive mathematical child. That this child can produce 'real' or 'authentic' mathematical understanding, and that it is such an

understanding which causes 'real' mathematical attainment or 'real' progress (Walkerdine, 1988, 1998a).

Building on the discussions from Chapter Three, and in the previous chapter, this privileging of understanding often relies on a romantic Rousseauian version of the child as a "state of nature" (Rousseau, 1755/2007/1910; 1763/1884), and psychological development models, where understanding naturally develops from experience. In addition, this version of understanding is complicit in the production of a specific version of progress, which I have argued, is both a marker and driver of Western mathematics education. As discussed in Chapters Three and Five, this fictional version of the child is very seductive and, as Walkerdine (1997) argues this naturalistic view has become common sense.

> Modern theories of cognition have taken their central plank to be that reasoning is a centralized process, occurring on the basis of a naturalistic path of development, itself guaranteed by a structural model of thinking and of the world. This view taking some of its impetus from Descartes and some from Kant, has become an almost common sense wisdom. (p. 57)

Following Walkerdine, the child is always already a normalised developing child, one that is self-governing and free-thinking, which fits the preference of autonomy within neoliberalism. Furthermore, 'the child' and 'understanding' (alongside progress) both produce, and are a production of, discourses of education that venerate 'natural' development.

In the ensuing paragraphs I deconstruct this romantic notion of understanding through a detailed reading against Boaler (1996, 1997a, 1997b, 1997c, 1997d, 1998a, 1998b, 1998c, 2002). By focusing on one of Boaler's influential studies, I show how one example can be very persuasive, when it confirms already held romantic beliefs. In order to do this deconstruction, I continue to draw upon the work of Walkerdine (Henriques, et al., 1998; Walkerdine, 1988, 1989a, 1989b, 1990, 1997, 1998a, 1999), who also uses Foucault to critique notions of understanding.

Boaler's study (1996, 1997a, 1997b, 1997c, 1997d, 1998a, 1998b, 1998c, 2002) has already been mentioned in Chapter Three as an example of one that explored both 'traditional' and 'progressive' teaching. I argued this positioning was a false binary that created unhelpful divisions. Here, I build on this, and the discussions in Chapter Three that relate teaching pedagogies and constructions of the mathematical child. Boaler carried out a comparative ethnography of two secondary schools. In over-simplistic terms, one taught mathematics in an 'open' or 'progressive' manner, and the other taught mathematics in a 'closed' or a more 'traditional' fashion; in the US version of her work (Boaler, 2002) the division is called reform and traditional. Boaler argued that

the open classrooms gave better and more equitable results, particularly with regards to social class and gender. She claimed that 'girls' were disproportionately alienated from mathematics as a result of the dominance of rote learning in the classroom; thus if they were denied progressive classrooms, they were denied progress. Furthermore, she identified that pupils, primarily girls, had a "quest for understanding". Indeed, she has recently reasserted this in the UK newspaper, the *Daily Telegraph* (Boaler, 2014).

I begin my deconstruction by examining the context within which Boaler's research took place, and by asking what can be said. Using the theories explored in Chapter Two, I argue that it is this "regime of truth … that is, the types of discourse which it accepts and makes function as true" (Foucault, 1980c, p. 131) that authorises a romantic notion of understanding. I then move on to show how Boaler's notion of understanding in relation to the mathematical child, helps to construct the romantic discourse of understanding. Finally, I unpack Boaler's "quest for understanding", by arguing that this quest may not be a quest for understanding but instead may be a reproduction of the fantasy of mathematics educationalists.

As discussed in Chapter Three, Boaler's (1996, 1997a, 1997b, 1997c, 1997d, 1998a, 1998b, 1998c, 2002) research occurred in a setting where child-centred education was in decline. In a political backlash against progressive education, the UK's Conservative government of the 1990's implemented a 'back-to-basics' agenda that would aim to transform British education. Consequently by the time Boaler was writing about girls' "quest for understanding" (1997b, p. 111), "order, control, rule-following, 'transmission' teaching … [were] easy to locate with a mathematical domain and [were] ... commonplace" (Boaler, 1997b, p. 1). Thus arguably as educational practices had shifted towards the right, the scene was primed for a version of mathematics education that foregrounded progressive education and equity, which Boaler's study did.

She argued that only open/progressive classrooms can produce 'real' understanding, 'real' knowledge/attainment and hence 'real' progress. This argument remains a constant throughout Boaler's work: "real mathematics … the whole subject that involves problem solving, creating ideas, and representations, exploring puzzles, discussing methods and many different ways of working" (Boaler, 2009, p. 2). Indeed, she recently returned to the participants of the study to demonstrate that the 'real' mathematics of the 'open' classroom, had enabled the pupils as 'real' citizens, with highly skilled or professional jobs (Boaler, 2009), in comparison to the 'deficit' model of pupils from the 'closed' mathematics classroom. However, like Walkerdine I question "why is there such remorseless and unrelenting pressure to 'prove' that real understanding causes real

attainment" (Walkerdine, 1998a, p. 39). In addition I argue that Boaler's comparative approach constructs an unnecessary and an untenable division between situations and between knowledge and understanding despite counter-discourses that argue that "for many people the acquisition of information both excites and liberates" (Alexander, 2010, p.247). As discussed previously, whilst it is acknowledged that "discourses of dichotomy" (Alexander, 2010, p. 21) or the use of these binaries are widespread within our language this does not mean that these oppositions are 'natural' nor that they should not be interrogated (MacLure, 2003). Moreover, these constructions are not helpful as they serve to position events and people into conflicting boxes that hold hierarchical values that tend to favour people of privilege. These specific divisions of traditional/non-traditional and knowledge/understanding are examples of value-laden positions. Furthermore they produce and are produced by a version of the mathematical child that, in progressive classrooms, is deemed superior.

Within Boaler's open classroom, the mathematical child that is valued is one who 'naturally' develops mathematical understanding and it is this which causes 'real' progress. This occurs by permitting the child to work 'freely' on mathematical activities, within constructed social groups. Accordingly the child 'controls' themselves and 'chooses' the mathematics. This supposes that the mathematical child is naturally inquisitive and predisposed to develop mathematical enquiry. Thus it assumes that the romantic account of the mathematical child as natural inquirer (Dewey, 1916; Rousseau, 1763/1884) and social (Dewey, 1916) is real and ignores the productive power of these pedagogies to bring such mathematical children into being. Moreover, it disregards the mathematics educator's role in this construction, and as such, discounts governmentality (as discussed in section 2.9). However, this discourse can be unpacked.

Boaler uses Lave and Wenger's (1991) "situated cognition" and "communities of practice" to argue that pupils taught in an open manner can more easily transfer mathematical techniques since "notions of knowing should be replaced with notions of doing" (Boaler, 1997b, p. 92). In simple terms, situated cognition relies on the principle that learning is relational to the context, whilst communities of practice refer to a group of people with a shared interest whose development relies on learning from each other (Boaler, 1997b; Lave & Wenger, 1991). However, Lave and Boaler can both be critiqued similarly such they do not "really theorise how subjects are produced – practices" (Walkerdine, 1997, p. 59). Even the apparently free are products of discourse, and under neoliberalism, governmentality is ubiquitous; thus the freedom that we believe we have, is instead a form of governance (N. Rose, 1999a). Hence Boaler's classroom is not the open and liberating experience she claims; instead pupils are discursively produced as specific

types of the mathematical child in a specific environment. They are subjects that are products of normalisation and surveillance, yet worryingly this masquerades under a discursive construction of liberation and romantic ideals of the child. I argue that these positions feed the educationalists' dream of the autonomous pupil and the autonomous teacher (S. J. Ball, 1994) and this is a fiction which succeeds because of its attraction (Walkerdine, 1990).

The romanticisation of understanding is furthered by Boaler's advocating of a "quest for understanding". One of her main conclusions is that girls are disproportionately alienated from mathematics as a result of the dominance of rote learning in the classroom. She argues that most girls (and some boys) sought the understanding that was absent and thus excluded themselves from the mathematics classroom.

> Throughout my 3-year case study, students, in conversations noted during lessons and in interviews, expressed concern for their lack of understanding of the rules they were learning. This was particularly acute for the girls, not because they understood less than the boys, but because they appeared to be less willing to relinquish their desire for understanding and play the `school mathematics game' …
>
> *J* : He'll write it on the board and you end up thinking, well how comes this and this?, how did you get that answer? why did you do that?, but...
>
> *M* : You don't really know because he's gone through it on the board so fast and...
>
> *J* : Because he understands it he thinks we all do and we don' t. (Jane and Mary, year 11, set 1)
>
> Here the students contrast `learning' and `understanding', with the need to `get things done', set against the demands of a fixed pace of coverage of topics. (Boaler, 1997c, pp. 292-293)

The above representative extract illustrates how the romantic discourse is perpetuated. Boaler views understanding as mutually exclusive to a 'fast' pace. Thus the child is constructed as unhurried and contemplative, which is aligned to Rousseauian philosophy (Rousseau, 1763/1884). However, there are issues here. Firstly, Boaler essentialises women and girls; this is particularly evident in her recent book, *Elephant in the Classroom* (Boaler, 2009), and also in her recent *Daily Telegraph* article, where even the commenters attest to the concern. As one of them points out, if you change the comparison to race, you can see how dangerous the essentialising argument becomes. Oddly, Boaler states that the "science of the brain shows that anyone can do well in maths, and there is no such thing as a 'maths person'" (Boaler, 2014 para. 8); yet reiterates the argument, that girls prefer learning in certain ways. This is an incongruent message - that we are born a certain way, but we are not; everyone can do mathematics, but certain mathematics

excludes some people. Secondly, I contend that Boaler's misconstruction was to take the girls' proclamations literally. For instance she states that "the girls were clear that their mathematical understanding would have been enhanced if they had been given more opportunity to work in an open way" (Boaler, 1997b, pp. 144-145). She does not question how the girls can know this if they have not been taught in a progressive way. We cannot know from such extracts that the girls interpret understanding similarly to Boaler. It is also problematic to suggest that, even if they do, understanding is what the girls wanted. Instead, there are a number of alternative readings that could be applied. Below, I offer a few examples which illustrate how what we say is part of a complex web of negotiated subject positioning, within a wider system of power and discourses.

In the first instance, the production of desire involves "a complex subject investment in … subject-positions" (Walkerdine, 1990, p. 30). Indeed, if we are to invest in psychoanalysis, Lacan's version of desire is "about the quest for a secure identity" (Walshaw, 2004b, p. 130). Alternatively the girls' proclamation could have been the socially acceptable response to give, the "trick of knowledge/power (Foucault, 1972/2002) masquerading as common sense leaves us unaware of the effects of our practices on ourselves and others" (Hardy, 2009, p. 192). Boys quest not for understanding (and instead for speed) would be the converse and would align to a masculine identity. Additionally, it could be that Boaler's boys are more easily afforded understanding (without academic evidence) usually through the presence, or absence, of other attributes, such as activity and rule-breaking (Walkerdine, 1988, 1989a, 1989b). Walkerdine argues that "the discursive production of femininity [is] antithetical to masculine rationality to such an extent that femininity is *equated* to poor performance, even when the girl or woman is performing well" (Walkerdine, 1989b, p. 268). Her position, and mine, is that progressive classrooms can covertly encourage girls to be passive as they "threaten[ed] the smooth running of the child-centred classroom for they [girls] seem to learn in ways which have been outlawed for leading to authoritarianism and producing the wrong kind of development" (Walkerdine, 1998a, p. 33). This is in direct contrast to Boaler and her advocating of understanding as girls' mathematical liberation. Thus, conceivably, the quest for understanding is a mask for something else. This argument is expanded in the student-teacher interview section of this chapter.

Summing up, I have argued that dominant discourses of understanding within mathematics education research rely on and perpetuate romantic notions of the child as an autonomous, developing individual. Pedagogy must use 'his' natural curiosity as the basis for developing real understanding rather than focussing on the imposition of discipline and knowledge. Even when the child is understood within their social context as in Boaler's work, the

context is assessed in relation to how it supports this romantic image of the child and is limited to the classroom. This romantic discourse of understanding perpetuates unnecessary and untenable hierarchies and restricts discussion around education. Furthermore, it excludes those who cannot access these privileged pedagogies as they are not the 'real' mathematical child.

In the next section, I move on to examine the construction of 'understanding' within educational policy. I argue that the version of understanding that is produced in policy is different to the version produced in mathematics education research. Instead of romantic discourses, policy produces functional discourses of understanding, such that it is concerned with doing rather than being. Building on the argument in the previous chapter, it follows that the mathematical child is also produced as functional. However, both educational policy and mathematics education research have similarities in that they rely on versions of a normalised, developing mathematical child, albeit different versions.

6.3 Troubling understanding in educational policy documents

To begin my deconstruction of understanding in the context of policy, it is important to remember the regime of truth in which the production of understanding circulates. This builds upon the discussions of Chapter Three, and of the previous chapter. Specifically that during New Labour era (1997-2010), educational policy and initiatives were vast and intense, particularly with regards to mathematics education. It is with this governance in mind that I examine policy from the era.

With regards to the analysis, the first thing to note is that the popularity afforded understanding in mathematics education research is not found in government educational policy documents; instead the word understanding is rarely mentioned. In the *White papers* (DCFS, 2009a; DfEE, 1997; DfES, 2001, 2005a) it sometimes appears alongside skills and knowledge, but these are included far more frequently. Understanding is mentioned in the National Strategies documents. However here, the romantic discourse of mathematics education research is not evident, and instead I demonstrate that the discourse of understanding in policy is more concerned with functionality and efficiency.

For instance, the *Core Position Papers on Literacy and Numeracy* (DfES, 2006c) contain two sections related to mathematics, one on calculation and one on "using and applying" mathematics. In the former understanding is largely absent, and where it is mentioned, it is constructed as knowing.

> Children need to understand when and why the decimal point can disappear and can move about in the display. When £0.50 is entered, the number displayed is likely to be 0.5 as trailing zeros are not shown in decimal numbers. (DfES, 2006c, p. 59)

In the above extract, the pupil is required to 'understand' that calculators do not show trailing zeros, which is a functional task that does not reflect the ideas of 'deep' and 'underlying' understanding that pervade the mathematics education research discussed earlier. Thus this performative discourse of understanding does not match romantic mathematics education discourses.

Further on in the text, the document states that children must "have a secure knowledge of number facts and a good understanding of the four operations" (DfES, 2006c, pp. 40, 57). This is followed by the assertion that "work must ensure that children recognise how the operations relate to one another" (DfES, 2006c, p. 40). Thus one interpretation is that this version of understanding is related to Barmby et al's (2009) interpretation of understanding as connected processes, however the specificity of it bears little relation to Boaler's open approaches. This is indicative of the wider discourse of New Labour's neoliberal policies that rely on short term achievable progress targets and as such, focus on specific, functional details (Curtis, 2006). Indeed, this is the only mention within the document of something which is loosely related to romantic discourses of understanding; even then understanding is produced as having specificity and functionality.

In the *Making Good Progress* series there is one positive proclamation of understanding:

> These [outstanding] schools place a great emphasis on children understanding the key concepts attached to each subject. They do not, however, shy away from teaching vital standard practices, for example, punctuation and grammar and mathematical algorithms. But the point here is that they make sure that children understand why these procedures are efficient and are fit for purpose. (DfES, 2007b, p. 21)

In the above extract it appears that successful schools attach importance to understanding alongside "standard practices". However, understanding is discursively produced as an efficient and appropriate method; this is again far from Boaler's romantic conception of freedom. Thus as before, understanding is constructed through a functional rather than a romantic mathematics education research discourse. This is in keeping with a measurable education system that both produces and is produced by neoliberalism.

As I stated earlier, the inclusion of the word 'understanding' in the texts is rare. In effect, the discourse of understanding is largely absent from educational policy documents and instead skills are more dominant. This emphasis on the application of hierarchical skills seems to be the

"fashionable educational antidote to knowledge" (Alexander, 2010, p. 249) and understanding. This is shown in the following extract, with the praising of particular pedagogic approaches: "A common belief shared by all these schools is that skills are learned for a purpose and not out of context … Skills are methodically built up, practiced and refined so that more challenging and complex work can be attempted" (DfES, 2007b, p. 21). "The belief here is that skills combine contemporary relevance, future flexibility and hands-on experience: that is, those attributes which knowledge is presumed to lack" (Alexander, 2010, p. 249). These valued traits are in keeping with a neoliberal society as they support the vision of autonomy, flexibility and the capitalist market. The replacing of knowledge and understanding with skills further substantiates my argument that educational policy documents create a functional discourse of mathematics education and of the mathematical child, which is tied to neoliberalism, the market and the economy.

For the functional discourse to be convincing, learning and understanding must be discursively produced as unproblematic and universal. This is shown in the following representative extract: "As children begin to understand the underlying ideas they develop ways of recording to support their thinking and calculation methods, use particular methods that apply to special cases, and learn to interpret and use the signs and symbols involved" (DfES, 2006c, p. 40). For example, the suggestion of "underlying ideas" is not only excessively prescriptive but suggests an overtly rational, Platonic or Euclidean view of mathematics; one that searches for timeless, unquestionable, truths (Ernest, 1991). Furthermore, the use of rigid phrasing, such as "use particular methods" and "as children begin to understand" implies that there is an expectation of certain cognitive and social behaviour, fitting with the idea of the child as an automaton - a normalised product of a factory line. These statements are indicative of the tone of the documents. For instance methods are often "efficient, reliable and compact" and "particular strategies" are habitually advocated. The mathematical child may need to be similarly so.

This promotes a very precise, functional way of doing mathematics and of being mathematical. Consequently, there is little space in the National Strategies documents for children who fail to follow linear and rational views of learning mathematics, and little space for them with/in neoliberalism more generally. This adds to my argument that the Primary National Strategy encourages a specific version of the mathematical child and as such mathematics classrooms become vehicles of this normalisation (Curtis, 2006). Anything or anyone that does not conform are positioned as deviant.

This is one feature that New Labour educational policy and mathematics education research discourses have in common. Thus 'what can be said' about understanding in educational

policy and mathematics education research relies on the normal mathematical child and the accepted truths of mathematics as linear, rational and reasoned (Walkerdine, 1989a, 1990). Both productions rely on normal prescribed cognitive expectations, albeit different ones.

Thus, reinforcing the arguments established in the previous chapter, so far I have argued that mathematics education research constructs a romantic discourse of understanding whilst educational policy constructs a more specific and functional version. Both discourses common feature is the unquestioning utilisation of their version of a normalised, cognitive, mathematical child, and 'his' development demonstrates progress (Chapter Five). In the next section, I use talk with student-teachers to explore the tension between the romantic and functional discourses. As before, I argue that this tension leads to inequity and exclusion for some. I explore both the different discourses that the student-teachers are exposed to (Walshaw, 2007) and how they are discursively produced within the contemporary 'regime of truth.'

6.4 Troubling understanding in student-teachers' talk

By predominantly using one student-teacher, Jane, in this chapter I aim to show how these discourses affect an individual as both a teacher and learner of mathematics. In addition, I demonstrate how this can potentially affect the pupils in her class. Thus I am seeking to tell a particular story in order to explore an issue in depth and detail. I supplement this with references to two other student-teachers, Sophie and Nicola, to further develop the analysis and narrative. However I begin with Jane, who offers a particularly powerful story that demonstrates the tension between competing discourses. Jane's story is an explicit and intensified version of stories that are alluded to by some of the other student-teachers. I start by discussing how she produces understanding in practice – as powerful and functional, before discussing what this means for the mathematical child.

6.4.1 Jane's story: the functionality of understanding

At first it can appear that Jane constructs a romantic vision of understanding, particularly with regards to Boaler's (1997b) assertion that girls have a "quest for understanding". There are many examples of this in her interviews; one is shown through her discussion of her experiences of studying mathematics education at university. Here the mathematical child is one who understands.

> Jane: I found it really hard to start with, really really hard. I didn't know what I was doing and I couldn't get it. Everyone else was understanding it and I wasn't.

Earlier I argued that there are alternative ways to read such a quest for understanding and as such Jane's quest may be a search for something else. For instance she believes (possibly drawing from mathematics education research discourses) that she should understand, yet looking back, she thinks she did not; this positions her past self as different, and as lacking. Thus Jane's desire could be about constructing her identity, as stemming from difference. Without difference, we have no basis to compare or construct ourselves. In this case, Jane sees herself as inferior, as it is in contrast to a difference that is privileged. In addition, she could be storying herself through progress, such that the new Jane is preferable to the old. These emotions are echoed in her memories of school:

> Jane: Because I always remember at school thinking every time we did anything in maths 'why are we doing this? I don't get it, why are we doing this? Why do we have to do it this way? I don't understand.' And it was never explained so when I was doing my maths teaching I always made a point of saying 'we're doing it this way because it's easier', and I don't often say it but' if we did it the other way it involves four steps where this way you only have to remember two.'

In this extract, it is more evident that Jane's production of understanding is comparable to functional policy discourses rather than mathematics education research ones. She wants pupils to know that they are doing the work in the most efficient way; this is what she means by understanding - why they are using a particular method. Moreover, she constructs understanding as knowing the "little steps" in order to make mathematics accessible and doable. Thus she produces understanding as functional, and akin to skills. The required mathematical child would be similarly compliant.

Below, Jane shares more memories of failed schooling, where she again produces not understanding as not accessing the work:

> Jane: You never got taught anything, you just worked through a workbook and the workbook was supposed to explain how to do things but I quite often never understood what the workbook meant because there was not very often any example.

She states, "that's why I really enjoyed the lectures about rote learning because it made sense to me that that's the way I'd learned." Hence the university lectures may have given Jane a rationale for why she is not 'good' at mathematics. It is a powerful story and one which she may have been seeking. It helps her reposition her 'failure' and redistribute blame to circumstances that are beyond her control. Thus the romantic discourses of research and the functional discourses of

policy collide and give Jane a valid and logical story that is permitted with/in a neoliberal society; moreover, Jane has never had the chance to be a mathematical child.

Below is an example, where Jane makes the link explicit and perpetuates the powerful myth that everything would be okay if only she understood.

> Jane: I just used to think well surely if I had an embedded understanding it must have come back somehow and then I realised that in some areas I didn't have an embedded understanding, I just rote learned stuff and even though I did understand that, this is what I've realised in the past few months that even though I did a lot better in year 10 and 11, I think it was still all rote learning… I don't think there was any understanding towards it, because you know I still don't understand things, and sometimes I wonder how I got a B, because in the things I got a B in I don't understand how to do it.

However, the conversation below, shows that that Jane is not interested in or in a position to consider mathematics education conceptions of understanding (such as Barmby, et al., 2009), or at least she rejects them in the following extract.

> Jane: Yeah, and you have to put a three down and a one up so you add another one to the tens column, they said 'why' and I was, just like,' well just so you know where it's going' and they were like, 'why, why do you put it there? Why can't you just put it somewhere else?' 'Well that's just the way we do it'.
>
> Anna: Where else did she want to put it?
>
> Jane: Underneath.
>
> Anna: Oh, right, ok. In the same column though because it's the column that's the important bit.
>
> Jane: Yeah, I know that but it was still like, well, you know.
>
> Anna: It was ((inaudible)) question really.
>
> Jane: ((laughter)) I know, you're a maths person ((laughter)). It was a question that just completely threw me because I never thought that.
>
> Anna: Some people do put it underneath.
>
> Jane: Do they?

One interpretation of this exchange could be that I, out of habit, have taken on the role of the teacher. This excludes Jane from the conversation as I become the 'maths person' and she becomes the Other. Jane positions herself as the norm and, as such, within a functional discourse. Whilst a romantic discourse of mathematics is reserved for people like me - mathematical people. Moreover, Jane excludes herself from this romantic discourse of understanding when it is offered,

which is a very different story to Boaler's mathematical liberation. Conversely to Boaler, I argue that a place without understanding may be the most desirable place to be, it may be that this position offers comfort and security. Even though it can appear that this is a passive place of least resistance, as discussed in Chapter Three, subject positions are both constraining and enabling (Foucault, 1980a, 1989i). It is perhaps a form of self-protection from the failure that romantic discourses bring. Thus maybe, everyone does not want to be an inquiring, curious mathematical child. Hence, rather than accepting language as literal, we should consider what people mean when they ask for understanding and what subsequent work this does.

This hierarchical division in mathematics is substantiated by Jane's construction of understanding mathematics as desirable and as the pinnacle of mathematics success. For instance, she deems herself a failure, despite having achieved an above average grade B in her GCSE mathematics. Thus she is positioning those who achieve results by rote learning as non-mathematical (Walkerdine, 1998a). Accordingly, understanding belongs to a select group of mathematical people. Specifically, the mathematical child is a naturally inquisitive child who is capable of performing understanding. For Jane, this is possible only for those who, unlike her, are deemed naturally able. This is further shown below where she restricts thinking and choice to the "higher achievers."

> Jane: Because, if like, the higher achievers find a different way of doing it then that's fine, but just for the lower achievers to know that, you know, that first thing it should circle the lowest number, and then they need to find out how low it is, and those were the key bits I wanted them to realise ... But I think it's important for them to understand what they're doing, and why they're doing it, you know, to know that they are finding the smallest number.

However, again her description of understanding is to do with access and functionality. This functionality provides a contrast to Jane's description of her ideal mathematics teaching situation which recalls Boaler's (1997b) conception of understanding.

> Jane: I think the main thing is to let children explore maths, to not, you know not let it just be abstract, let it be concrete by them exploring it and looking at examples and things and to know that it's not just me that struggles with maths, everybody does to a certain extent and I think the biggest thing I've learnt is that you have to work through it yourself and explore it yourself, you know, just because you don't get the answer right the first time doesn't matter I think. But I think there will always be that ingrained thing with me that it's either right or wrong.

Jane's final line hints that her romantic ideals of mathematics belong to a privileged, perhaps mythical, few - the perfect cognitive, naturally curious 'real' mathematical child. Furthermore, this ideal does not supersede the practicality of the binaries of understanding and rote learning explored earlier in the chapter and the absolutism of mathematics discussed in Chapter Three. Thus this position of mathematical child is not available to everyone.

Perhaps Jane is caught between the discourses of romanticism and functionality, between mathematics education research and educational policy. From this, I conjecture that the tension Jane experiences comes from her expectations and the expectations of others that she actively positions herself within. She knows what she should think, yet she struggles with this in relation to her experiences. She also struggles with it in relation to her emotions. "Teachers and their work calls for a massive investment of their 'selves'" (Nias, 1989, p. 2), which is ignored by educational policy and by the majority of mathematics education research who are preoccupied with the normal "active cognitive subject" (Valero, 2002). Similarly, tension is also evident between this oversimplified normal cognitive mathematical child (present in both policy and research) and the emotion and complexity of the 'real' children with which she works (Llewellyn & Mendick, 2011).

In summary, Jane struggles to advocate or comprehend academic versions of understanding. Instead, as in educational policy, understanding is more often constructed as a functional 'ability to do'. I suggest that this is easier to see and thus measure, and hence suits a neoliberal education, and the expectations of progress explored in the previous chapter. Her "quest for understanding" draws on functionality, and not academic discourses. However, in common with academia and accepted discourses of mathematics education research, she produces 'understanding' as superior, and the pinnacle of mathematics achievement, thus leaving the position of 'real mathematician' out of reach to the majority and out of reach to herself. As such, Jane positions herself outside of mathematics, but she is able to use the taken-for-granted discourse of understanding to remove herself of responsibility for this. Absent from these discussions, are the acknowledgement that neither pupils nor teachers behave as the active cognitive subjects presented by educational policy or mathematics education research. They are discourses constructed on a fantasy.

Jane's is a particularly strong story which demonstrates the tension between the various discourses of 'understanding'. Below I explore differences and similarities between Jane's and two other student-teachers, Sophie and Nicola. Particularly, both stories highlight how understanding is reserved for the most able, which limits mathematics to certain pupils and excludes others. This is a more common story from the student-teachers and is explored further in Chapter Eight.

6.4.2 Sophie's story: understanding and the most able

Sophie's discursive positioning is similar to Jane's in that she also produces understanding as important to the mathematical child and as something that was absent from her own education. The following extract is typical of Sophie's interviews.

> Sophie: That is all I remember from year 6 was those multiplication grids. I hated them … Then at the end of GCSE's it was the case again, the same thing just recalling facts over and over again. Still not understanding but learning the multiplications or learning the actual formula and things like that without understanding them

She states that she believes that rote learning is wrong "I didn't like that way of teaching at all, just teaching by rote". In addition, she pronounces that you should "try and get the understanding, that's what you need to have initially, you've to have understanding there before you can develop it all". Thus Sophie, may seek understanding, or indeed, this could be the acceptable discourses that are available to Sophie; as they are the ones permitted by mathematics education research and hence by her university.

Thus similarly to Jane, she presents as frustrated with the rote learning she has experienced in mathematics. In addition, and like Jane, she seems to have difficulties dealing with situations where 'understanding' (such as Barmby, et al., 2009) could arise. For instance, when it comes to her own teaching Sophie seems to be utilising these rote methods, and replicating her own experience.

> Sophie: The class chanting works good. The first time they did that really quite well. They used to be so slow and they'd die down between the 7 times 4 and the 9 times 4 but they have improved quite a bit with taking tables home and things like that.

Academic conceptions of understanding are missing from the exchanges above; instead the emphasis is on practice, speed, and being able to do/recall. Thus like Jane, there is a disconnect between a desired outcome and the realisation of that outcome. Or perhaps, like Jane, understanding is similarly concerned with a functionality and being able to do. This is clearer in the next extract; it has much in common with my exchange with Jane (discussed previously). Specifically, when faced with developing her mathematics, Sophie expresses fear for the process (or the connections) or for what some (Barmby, et al., 2009; Skemp, 1976) might term understanding. She expects mathematics to come to her naturally, which is a familiar and constricting story (Mendick, 2006) and one that is developed throughout the remaining chapters of this thesis.

Sophie: That's my worst one! I hate the tables. 7s and 8s. 9s, I know the trick with your hand so that's not a problem. 5s and 10s and 3s are fine. 4s are fine. It's just 7s and 8s.

Anna: Would you be happier, would you just like to know them and be able to recall them or work them out?

Sophie: I would love to be able to know them by rote and just be able to say '7 8s are … whatever it is' and know it, off hand, but I just can't. I haven't got that in my head. Whereas some people are more- they can visualize numbers so easily and I just can't do that. I need to sit down and go through them all one by one and get to the answer.

Anna: Right, so you know your 4s?

Sophie: Yeah.

Anna: You could double your 4s to get your 8s.

Sophie: I can't do that because that's doing too much of a process so I could probably try that. I just think it's going to complicate it more.

Anna: I do it.

Sophie: I'll give it a try but …

Anna: Some people wouldn't know them all but would calculate to get each individual one.

Sophie: Yeah.

Anna: Or if you know 8 8s is 64, use that to get back to 7.

Sophie: Mmm. But it's all working out your long methods isn't it?

Anna: Yeah.

Sophie: I'm not good at that sort of thing of working out how to do things and making it complicated. I'd rather it just came to me naturally. But I'm never going to be that one! (laughter) Unfortunately.

As with my conversation with Jane, this exchange may be a rejection of me as a teacher or as a mathematical person, with Sophie taking up the position as non-mathematical person. It is perhaps a comfortable position for Sophie to choose, however it is not a position that is allowed in neoliberal educational policy, or in mathematics education research, where everyone is constructed as being able to achieve. However, Sophie takes the positions that 'real' mathematics comes naturally to a lucky few; which contrasts to the extract where she ask her pupils to practice times-tables. This also complicates the relationship to understanding, suggesting that those without it see it as a natural gift. Thus it does follow the hierarchical view of mathematics where the 'real' mathematical child is naturally able. As such, this positions those who achieve results by

hard work as not (authentically) mathematical (Walkerdine, 1998a), which excludes many from the subject.

6.4.3 Nicola's story: the person who identifies as mathematical

Nicola's story has similarities and differences to the two described above. In the first instance Nicola is different in that she self identifies with mathematics. In addition, perhaps she is more aware of the position from some of mathematics education research that mathematical progress is concerned with connectivity (for example Barmby, et al., 2009). This is shown in the following extract.

> Nicola: I had two kids in my class last year; they didn't have the basic understanding.
>
> Anna: So what do you think they missed out on that stopped them getting access to the Year 5 Maths or the Year 4, whichever it was?
>
> Nicola: The basic concept of a number really … because they can tell you the numbers from 1 to 100 in order quite easily… But understanding, giving them multiplication tables and things it was all learnt by rote, there was no concept of the fact that five times four is five lots of four.

Although here, and similarly to most mathematics education research, Nicola positions understanding against rote learning, perpetuating reductive binaries. However, rather than viewing understanding as part of a stage of development, in practice she seems to construct the mathematical child as a fixed category, and hence this position is only available to some.

> Anna: Could you see yourself ever teaching by these sort of rote ways that you don't particularly like?
>
> Nicola: To be honest I think it's beneficial for certain kids. You're always going to have the odd kid in your class that just can't cope with like abstract ways of learning and needs to learn by rote.

Thus, where for 'low achievers', 'failure' would be seen as an opportunity for correction in neoliberal educational policy texts, here the pupils' 'abnormality' is constructed as static (discussed more in Chapter Eight). The concern is that these lower achievers (rote-learners) are positioned as non-mathematical children and are no longer asked to understand (Bibby, 2001). This message runs throughout Nicola's interviews and is also shown below. Here, she reiterates these divisions by restricting using and applying, the strand of the curriculum which many (including Boaler, 1997b; J. Rose, 2006; Williams, 2008) associate with 'understanding', to the most able.

Nicola: My Highers can do fractions, equivalent fractions everything. The Lowers don't even understand basic fractions. The Highers are very good with their times-tables. Or one boy, you can ask him anything in his zero to twelve times-tables, he's like that ((clicking of fingers)), you get it back. He understands it perfectly. It's like using and applying is, I find more important for them [the Highers].

Her assumption that true mathematics comes inherently or instinctively seems to validate the perspective that teaching for understanding should be directed to the naturally able mathematical child. This is perhaps validated with reference to herself. For instance, discussing her sister she states that "she was good at maths, she wasn't naturally as good as I always [was]" (this is typical of her comments throughout her interviews; her 'ability' talk is discussed in depth in Chapter Eight). Thus like Sophie she views the mathematical child as innately and naturally mathematical.

However, in the above extract, the version of understanding is more aligned to the recall of knowledge and speed, which is very different to Boaler's romantic child, and different from her previous statements. An alternative reading is that these are more performed and noticeable traits of cognitive ability, or from a poststructural perspective they could be viewed as social markers presented as understanding. This is just one case, though her interview also exemplifies Walkerdine's (1990) point that boys are more easily afforded the luxury of the appearance of understanding even when it is not apparent in their attainment. What is clear, is that the version of understanding described above is not primarily concerned with connections or with Boaler's romantic curious child, in spite of previous concerns that it should be.

From this, I suggest that the student-teachers experience tension between the expectations of the functional mathematical child and being able to do, and the romantic attraction of the naturally curious mathematical child from mathematics education research. However, they do not find many of these children in their classroom practice, or within themselves. Thus each student-teacher takes on the discourse of understanding as all important to varying degrees; however within that, how they interpret understanding is not straightforward. It is particularly complex in a neoliberal climate where pupils are subjects to be measured and are required to demonstrate progress (Chapter Five). As such, it may be that understanding, and/or the mathematical child, need to take on aspects of performativity. However, this performance of understanding is not equally available to everyone. This can be dangerous from the point of excluding and including only certain people into mathematics. In this case 'real' mathematics is reserved for the most able (Walkerdine, 1998a) and is possibly monitored through measurable,

social markers such as speed. Within this the mathematical child is mostly constructed as naturally able, in spite of the awareness of neoliberal counter discourses that everyone can achieve.

6.5 Chapter summary and concluding remarks

In this chapter I am continuing my questioning of some of the apparent truths that circulate within mathematics education. I am not saying that there is something wrong with teaching for understanding, but instead I suggest that its value should not be seen as a common-sense truth, something which is, inherently good and always the best case scenario. It should not be the Holy Grail of mathematics education. Instead of being an undisputed force for good, understanding can be divisive. It can position doers of mathematics as non-mathematical, creating and maintaining inequalities (Walkerdine, 1989a, 1990). Furthermore, to suggest that girls have a "quest for understanding" draws on this fiction. It assumes a romantic assumption that fits the illusion of mathematics education research and their preferred discourse of the active cognitive subject. This positioning adds to the tension created between the functional discourse of understanding (from New Labour educational policy) and the romantic discourse of understanding (from mathematics education research).

In the next two chapters, I continue to trace New Labour educational policy and mathematics education research constructions of the mathematical child to see how they are realised within dominant themes of mathematics classrooms within the student-teachers' talk. In contrast to the archetypal cognitive topic of this chapter, the next chapter looks at an archetypal affective notion – confidence, which drawing on Hardy (2007, 2009), I argue can be conflated with competence as it takes on a functional meaning in New Labour educational policy. In addition, there is also an oversimplification of confidence in dominant mathematics education research, as it is primarily constructed around the cognitive subject. This is actualised in the classroom, where it is used as another barrier to engagement in mathematics.

7 Chapter 7: Troubling Confidence

7.1 Introduction

Beryl: Well you know looking back I know the exact time and place where I lost my confidence with maths. It was back in class 4C and I lost my ways with times-tables.

Teacher: Seven eights are fifty six, eight eights are sixty four.

Beryl: I was too scared to put my hand up and say it's all goobledegook to me. But I've just taken this free adult maths course at my local college. They start you at the point where you get lost and and build up your confidence from there. Now my fear of maths has just gone away. To get maths confident and get on call...

(Direct Gov, 2008)

In 2008, an advertisement appeared on UK Television; its aim was to encourage people to enrol on adult mathematics courses. The advertisement depicted a woman describing her 'difficult' experiences learning mathematics at school. She explained how taking the adult mathematics course helped improve her confidence. The woman is called Beryl – though this is not revealed in the advertisement but on the accompanying website. Above, I have quoted it in full because it is typical of how confidence, the theme of this chapter, is produced within mathematics.

Figure 2: Beryl from the DirectGov advert[2]

[2] The other voice in the advertisement is that of a male teacher who appears to chant times-tables. Instead of using videos of actual talking heads, the advert is artistically designed so that it uses sets of hands to portray the three characters in the short film; these characters are: Beryl today (portrayed with hair rollers, earrings and drinking tea); Beryl as a young girl (portrayed with bows in her hair) and the male school teacher (portrayed with a mortar board and bow tie).

From the text, confidence is written as the key attribute/possession that gives power back to the individual in mathematics. In a neoliberal manner, Beryl finds a way out, and regains control of the situation. This is possible, as the loss of confidence is not blamed on the student but on the mathematics and on other external factors such as 'teaching by rote'. The dialogue, mostly from Beryl's perspective, and the advertisement, epitomises a neoliberal fantasy, in which confidence and an inner belief is a key to success.

I have used this government television advert as a provocative entrance to 'confidence' - the theme explored in this chapter. It highlights assumptions concerning confidence which appear throughout the chapter. Moreover, the advert demonstrates how easy it is to be seduced by rhetoric that offers simple solutions for problems; in this case, confidence fixes problems with mathematics. Advertising, like government policy, constructs problems and proposes solutions to fix them. Hence, this is a stance that permeates education, and this thesis. However, it illustrates how confidence can exclude some from mathematics, by being part of the production of the mathematical child. As such, it demonstrates how Foucault's concepts of normalisation and governmentality circulate with contemporary discourses. In this instance, the person who is without confidence, and who needs to be empowered is female, white, and constructed as 'working class' and the person who dictates the regime is male, white and constructed as 'middle class'. This exemplifies essentialist notions that confidence is missing from women and girls, and as a consequence mathematics belongs elsewhere.

The advert above, and many mathematics education researchers (such as Boaler, 1997b; Santos & Barmby, 2010), also connect confidence to the common sense good I explored in the previous chapter - 'teaching for understanding'. Specifically, the advert implies that rote learning (the binary to understanding), and confidence are mutually exclusive for those, like Beryl, who are excluded from mathematics. My concern, is that this connection removes confidence of depth, complexity and emotion, and instead it becomes part of the "active cognitive subject" (Valero, 2002) which is the preferable mathematical child of mathematics education research, and within this confidence becomes performative.

Building upon the ideas established through analysing this advertisement, in this chapter I question the assumption made by much of mathematics education research, that people do not succeed mathematically, not because they cannot do mathematics, but because they are not 'confident' that they can (for example Kyraciou, 2005; Kyraciou & Goulding, 2004). Similarly to the previous chapter, the concern is that this discourse is then (re)produced without question by mathematics educators and student-teachers to make meaning in their classrooms, and as such it

becomes part of common sense wisdom. As highlighted in the analysis above, this can exclude some from the mathematics classroom as they are not the preferred 'mathematical child', who performs as confident.

As in the previous chapters, I look in turn at mathematics education research, education policy and student-teacher talk, to explore how confidence is essentialised, as external behaviours become read as signs of inner traits. Since the mathematical child (and teacher) of research and policy must possess confidence, mathematics becomes the province of those whose behaviours fit.

7.2 Troubling confidence in mathematics education research

There are two purposes of this section. In the first instance I explore the production of 'confidence' within mathematics education research. Specifically, I show that much of mathematics education research produces confidence as necessary for competence in mathematics and within that, a particular type of the mathematical child is constructed. As such, more 'traditional' conceptions of the emotional child (and nurturing teacher), both explored in Chapter Three, and of confidence are lost. The second purpose of the section is to challenge this production by drawing on the extensive work already done in mathematics, and wider education, specifically that of Burton (2004), Hardy (2007, 2009), Bibby (2002) and Chetcuti and Griffiths (2002). Thus, I question how confidence is constructed in the field of mathematics education, and what work this production does. Overall, I argue that pupils do not have equal opportunities to be(come) 'confident' and hence all pupils do not have equal access to success in mathematics. Within this, I draw on research that discusses confidence, affect, anxiety, self-esteem and self-efficacy. Whilst there are important differences between these words, (some of which are discussed in the next section) my concern is not with establishing their 'real' definitions but with how they are discursively produced within mathematics education. This is broadly similar in that they act "as a label for a confluence of feelings relating to beliefs about the self, and about one's efficacy to act within a social setting" (Burton, 2004, p. 360).

To explore how confidence is produced, I followed a similar process of searching to that used in chapters five and six, and discussed in detail in section 4.4.8. Whilst my results showed that confidence is used in various ways and research studies, there were some dominant threads that were problematic and as such, warrant unpacking. My results also found one particularly useful article, by Zan, Brown, Evans and Hannula (2006), that summarises the trends in research into 'affect' in mathematics education. Thus I have combined its conclusions with my own results.

Zan et al. argue that there are three distinct waves of research. The first was evident in the 1960s and 1970s, when affect was split into two fields - "mathematics anxiety" and "attitude

towards mathematics". These early studies were characterised by large scale data sets and by measuring participants via various 'attitude' scales. In response to this, the second wave of 'affect' research, championed by McLeod and Adams (1989), tended to use small scale qualitative research methodologies and clearer theoretical foundations. McLeod's (1988, 1989, 1992, 1994) work proved influential, particularly his categorization of affect into the three domains: beliefs, attitudes and emotions; here, emotion was viewed as variable, whilst attitude and belief were stable (1992). The third wave of research split into two directions, one that uses yet critiques the work of McLeod, and one that focuses on the increasingly-popular category of self-efficacy. Throughout this research, and in spite of McLeod's categorisation (of beliefs, attitudes and emotions), Zan et al. note that "emotion has been used less in mathematics education research – so far - despite being arguably the most fundamental concept" (p. 6).

Combining the above with the results of my own analysis, I argue that whilst there are complex stories of confidence within mathematics education research, (and much more difference and diversity than the topic of the previous chapter), I agree with Hannula (2006) that:

> there are two main traditions to examine affect in mathematics education. The first tradition is to measure relatively stable affective traits and their relation to achievement … Another research tradition has been looking at affect as an important aspect of mathematical problem solving. (p. 210).

In this chapter, I build on this to show that, within dominant constructions of confidence, there is the relentless pursuit of the essentialised individual cognitive subject. To demonstrate this, I examine it around four dominant points of production. Firstly, that confidence is most often constructed as measurable, secondly that the correlation between confidence and ability is normalised and constructed as 'real', thirdly, similarly the correlation between confidence and gender is normalised and constructed as 'real', and finally that there is a relationship between confidence and teaching methods; the third point specially builds on the arguments of the previous two chapters. I argue that this always already excludes some people from 'having' confidence, and consequently from being the mathematical child.

7.2.1 Confidence is measurable

As noted above, the majority of early research in mathematics education into affect concerned the use of large scale data sets. Indeed, the most cited articles on *Google Scholar* are from this field, with the works of Fennema and Sherman (1976, 1977) being the most prevalent. These articles refer to the much cited *Fennema-Sherman Mathematics Attitude Scale*, part of this being "The Confidence in Learning Mathematics Scale" and "The Mathematics Anxiety Scale". This

scale is not only used in older articles but has been used as an analytical tool more recently (see for example Frenzel, Pekrun, & Goetz, 2007). Thus, whilst I acknowledge that their age would add to the number of citations, this dominance and the recent referencing suggest that their influence is broader than the initial era. As such, the dominant discourse is of confidence, attitude, and anxiety as measurable and 'real'.

The classification of confidence by scale has continued in more recent well cited works that use the term self-efficacy; for example in the much referenced work of Betz and Hackett (1983; 1989) or Pajares and Miller (1994) or more recently with Pierce, Stacey and Barkastas (2007) "Mathematics and Technology Attitudes Scale" (MTAS). In their work, Pajares and Miller (1994) state that there is a relation between performance and belief of performance, and consequently suggest that there should be interventions for pupils to improve their self-efficacy. Hackett and Betz (1989) take this further, suggesting that "mathematics teachers should pay as much attention to [students'] self evaluations of competence as to actual performance" (p. 271). At first glance, this may appear innocent; however, the authors seem to be validating a particular version of the mathematical child, as requiring confidence. This is a powerful story that can become a self-fulfilling prophecy about mathematical performance. It can be proliferated by some teachers who spend more time 'correcting' self-efficacy/confidence rather than competence.

Corroborating this, Ma's (1999) meta-analysis shows that the correlation between anxiety and attainment is stronger when the assessment of anxiety is done by the teacher, rather than through a standardized test, suggesting that teacher perception is very important to the measurement of confidence. This is supported by Burton (2004) and Hardy (2009), who found that teachers connect confidence to accepted and measurable behaviours. They both identified that teachers viewed "willingness to 'have a go'" (Burton, 2004, p. 363); "speaking out …[and] taking risks" (Hardy, 2009, p. 193) as indicators of confidence. The concern is that this, alongside the high status of mathematics, result in the need to show that you are good at mathematics (Bibby, 2002) via 'confident' displays. Specifically, "'passing' oneself off as an active, successful school mathematician and member of the class might be achieved by mimicking the behaviour of those engaged with the lesson" (Bibby, 2002, p. 715). Alternatively the performative behaviour of confidence could constitute, what Miller (1967) calls, "conditional love" such that the child must be (or act) good to feel valued.

This view of confidence as performance is perhaps unsurprising within the English neoliberal, education system, where teachers are encouraged to seek targets and demonstrate progress (discussed in Chapter Five). In addition, and as discussed, it follows the pattern of

measurement within mathematics education research. However, presenting as confident is easier for some than others. Specifically, the confident traits mentioned above are more easily associated with masculinity (Mendick, 2006; Walkerdine, 1988, 1998a). This exclusionary practice sits in contrast to many educationalists position that improving confidence can help 'disadvantaged' groups (for example women and girls). As Chetcuti and Griffiths (2002), who query the role of self-esteem, state,

> Many of them [researchers] suggest that enhancing self-esteem will improve achievement (or *vice-versa*) especially for disadvantaged groups, and that improving it is always a good thing ... This orthodoxy in the theoretical literature is highly significant because it is congruent with the orthodoxy to be found in practice. (p. 532).

To show specifically how confidence can favour the advantaged, I next connect it to 'ability' and then to gender. I argue that the dominant production of confidence within mathematics education can benefit these already privileged groups.

7.2.2 Confidence and ability/attainment

From the above, we can see how discourses that construct confidence as a measurable variable enable the idea that confidence is intrinsically connected to both attainment and ability, making it difficult for other stories to be told. Indeed, there are many examples of mathematics education research that specifically link confidence and competence (or anxiety and attainment) (for example Coben, 2003; Dorman, Adams, & Ferguson, 2003; Jones & Smart, 1995; Karimi & Venkatesan, 2009; Kyraciou, 2005; Kyraciou & Goulding, 2004; Ma, 1999; Tobias, 1985). Within these works, statements of correlation, and of cause and effect, are often evoked as common sense wisdom. This is particularly evident in work that draws upon the 'normal' psychological subject. Here, you find statements that present as the truth, for example: "the correlation between mathematics anxiety and academic performance is negatively significant" (Karimi & Venkatesan, 2009, p. 33) or "self-efficacy is a strong predictor of related academic outcomes" (Pajares, 1996, p. 5). Much of this work ignores or misunderstands the wider structural relations that set out what is possible for people studying mathematics, and of course, this work essentialises the mathematical child.

It is the connection to 'ability' that is particularly concerning as it can position the mathematical child as natural, and confidence as restricted to pupils who fit, particularly as I discussed in the previous section, confidence is more easily found in some bodies than others.

One such example is provided by Kyraciou:

> The link between confidence and competence is an important one, because attainment is always normative - some pupils must inevitably do less well than others, and it is this sense of doing less well than one's peers that can all too easily lead to disaffection and anxiety in mathematics, and create a vicious circle of low self-confidence and underachievement. (Kyraciou, 2005, p. 168)

He is suggesting that since a spectrum of achievement is unavoidable, the correlating spectrum of levels of confidence is similarly so. Even if this does occur, my issue is with its acceptance as 'inevitable'. Moreover, the statement ignores any structural elements that facilitate it. In particular, it accepts the link between low achievement/ability and low confidence as 'real' and as causal. As such, the mathematical child is bound by the connection between confidence and competence, and more often than not this is fixed. This reduces the development of confidence, and leads it primarily to be concerned with the development of cognition, leaving complexity and emotion as secondary concerns. As such, the mathematical child becomes a developed cognitive one who displays models of confidence as discussed previously. This does not take into account that, "assessed ability is socially constructed ... rather than an attribute of the person" (Erickson, 1986, p. 125) (explored more in Chapter Eight).

Burton argues that if we accept this correlation then "persistently, a link is made with 'confidence' in ways that can affect a pupil's self-image and consequent choices" (Burton, 2004, p. 357). In "confidence is [constructed as] everything" she highlights the problems associated with labelling pupils, in particular she questions the idea that confidence stems from individuals, which is a common position in mathematics education research (Jones & Smart, 1995). This is similar to Chetcuti and Griffiths (2002), who examine self-esteem in relation to social justice. They contend that this commonly held view of the individualistic notion of self-esteem (and, I would argue, confidence) ignores the wider conceptions of power relations that lead to the marginalisation of some pupils.

The "situation that many people feel powerless in the presence of mathematical ideas has been systematically reinforced by our culture, which sees mathematics as accessible to a talented few" (Willis, 1990, p. 206), which is already evident in the student-teacher interviews of Chapter Five and six. However, I argue that "power resides not in the mathematics but in the myth of mathematics – in the meritocratic prestige of mathematics as an intellectual discipline" (Willis, 1990, p. 205). Additionally, I suggest that confidence acts similarly, that the power of confidence is in its fictitious status and the power to create the normal and ideal mathematical child. The salient point is that those "talented few" are often dominant groups, such as the middle-class male (Walkerdine, 1998a).

7.2.3 Confidence and gender

Establishing a correlating, causal relationship between confidence and gender is well documented (M. S Hannula, Maijala, & Pehkonen, 2004), with Fenemma and Sherman (1977) being one of the earlier and more influential works to validate the assertion that confidence is found less with girls and women. As mentioned earlier in the chapter, this is one of the most cited articles on the topic of affect. Indeed the negativity of this relation is enhanced via its relation to attainment; specifically, some studies indicate that the relationship between self-confidence and achievement is intrinsically part of gender (for example M. S Hannula, et al., 2004). Thus in spite of counter arguments (for example found in Burton, 2004; Walkerdine, 1998a) and in spite of many researchers arguing that confidence and gender norms are facilitated by the teacher, classroom and deeper sociological relations, this powerful story is still being reproduced within mathematics education research, in ways that posit these relations and these genders as real. This is shown in an example below, where discourses are inscribed into common sense practice. In this extract, the authors measure attitude and confidence via scales. They view confidence as being different at various points during the problem solving process.

> *After* having worked on one of the problems (problem 4) boys also showed more confidence than girls. … The results at this level confirm that boys and girls tune in differently when processing mathematical problems. For boys a relevant aspect of the mathematical learning environment is the challenge and competition it elicits. Their constructive attribution beliefs call for favourable scenarios which generate confidence rather than doubt. Girls may more than boys believe that doing math is applying a set of rules. When they are not sure that they know 'the' necessary rule they may want to protect their ego by lowering their affects and expectations (Boekaerts, Seegers, & Vermeer, 1995, p. 259)

Thus whilst they acknowledge that confidence is not one-dimensional, their simplistic classification of boys and girls negates this work and fixes it to an essentialised performance. Moreover, the authors invalidate girls' ways of experiencing mathematics; I would argue that doubt need not be seen as inferior to confidence, it is only that it is positioned as such. In addition, they discredit the expectations they have of 'girls'' 'ways of doing mathematics', by positioning rule following as inferior, which is the same point that Walkerdine (1989a) made in the 1980s.

Of course confidence was mentioned in Boaler's (1997b) work examined in the previous chapter, where it was again judged to be absent from girls. As discussed there, what is missing from this is an acknowledgement of how girls are products of the practices that make it more difficult for them to be viewed as confident. Or that

> we also have a set of expectations about the way we expect people of different sexes to behave. A man who freely expresses his emotions or freely discusses emotional issues is considered remarkable or out of the ordinary. A woman who behaves in a very confident way is considered extra-ordinary. (Jones & Smart, 1995, p. 161)

As discussed, Boaler suggested it was 'traditional' teaching methods that supported this, but I would contest this.

7.2.4 Confidence and teaching methods

Building on the arguments discussed in the previous chapters, confidence, like understanding, functions in the research literature to privilege 'progressive' pedagogies. If we assume that there is a right way to do mathematics, that produces the right behaviour, then different ways of being and acting are excluded. Once again, teaching methods are reduced to a binary of transmission versus problem solving. This position is (re)produced and perpetuated by many in mathematics education research. For instance Santos and Barmby (2010) state that

> pupils manifested improved attitudes towards mathematics inside and outside the classroom, such as positive attitude while working, pride in their work, had fun and built confidence in their own abilities to tackle the tasks. (p. 203)

In the above, mathematics is constructed as something that should be positive and fun, and confidence is produced as a natural product of this. What is absent, are spaces for doubt, confusion, negativity or emotion.

Another example is provided by Lijedahl (2005, 2011/2006). He states, that as a result of changing pedagogy, "the majority of the participants [student-teachers] demonstrate significant changes in their beliefs and attitudes about mathematics, as well as their beliefs and attitudes about their own ability to do mathematics" (2005, p. 232). He quotes a student-teacher Melanie:

> Of all the problems that we worked on my favourite was definitely the pentominoe problem. We worked so hard on it, and it took forever to get the final answer. But I never felt like giving up, I always had confidence that we would get through it. Every time we got stuck we would just keep at it and suddenly one of us would make a discovery and we would be off to the races again. That's how it was the whole time – get stuck, work hard, make a discovery – over and over again. It was great. I actually began to look forward to our group sessions working on the problem. I have never felt this way about mathematics before – NEVER! I now feel like this is ok, I'm ok, I'll BE ok. I can do mathematics, and I definitely want my students to feel this way when I teach mathematics. (2005, p. 232, 2011/2006, p. 168)

Whilst, I agree with Hannula (2006) that "these examples show that both relatively stable emotional traits as well as rapidly changing emotional states have an important role in mathematical thinking and learning" (p. 211), I am concerned that it has to come from a romantic vision of problem solving and that this is causally connected to developing 'understanding'. There is no reason that 'never giving up' cannot be connected to other ways of doing mathematics. The concern is that the teacher in question (Melanie) becomes concerned with a correct version of mathematics and of the mathematical child. There are many more examples that corroborate this romantic view, for instance Duffin and Simpson (2002) whose works is entitled "the tension between the cognitive and the affective" state that confidence (alongside comfort) is "the internal characteristics of understanding" (p. 90). The concern with this is that the affective side merely becomes a by-product of cognition. Within this, confidence becomes a 'natural' and required part of child 'development' and of the mathematical child.

7.2.5 Summarising mathematics education research

There are complex considerations of confidence within mathematics education research, many of which I have not had space to mention here; indeed, the 'theme' allows for much more diverse research positions than the themes of the previous two chapters (progress and understanding). However, my issue is with the simplistic invoking of a complex emotion such as confidence within dominant productions, thus potentially rendering confidence 'emotionless'. In summary, I argue that confidence is not as innocent as it may appear. Instead, it can accentuate the already inequitable education system that privileges certain groups, such as the 'able' and boys. In particular, I contend that the fixation with confidence as measurable, and connected to attainment, and particular pedagogical styles is problematic. This limits who is confident, by making confidence more easily available to some and not to others. Hence, the mathematical child of mathematics education research becomes primarily concerned with cognition and 'natural' development, where emotional experiences are rectified in line with a specified outcome. As such 'he' becomes the romantic mathematical child discussed in the two previous chapters.

Although some of the researchers I have used to formulate my arguments look at confidence within neoliberal regimes none focuses on how traditional ideas of confidence are inscribed within neoliberal policy discourses and the impact of this for practice. This is my focus in the rest of this chapter. Specifically I show that neoliberal educational policy, fitting with its purposeful and economistic drive, constructs confidence as a trait that can be acquired by all (pupils and teachers) through appropriate training. For this, both teachers and pupils are required to be functional automata, moving through the system without divergence. However, the tensions

between these functional discourses, and the emotional discourses of primary student-teachers, mean that rather than opening up access to confidence, and so to success in mathematics more widely, neoliberal policy leads to even greater exclusions.

7.3 Troubling confidence in educational policy documents

In this section, I deconstruct several educational policy documents examining them for the production of confidence. I show how educational policy documents produce confidence as a concrete noun - something that is functional, objective and measurable. In educational policy, this production is so explicit it reproduces the mathematical child as a functional automaton, as in the previous two chapters. I begin by exploring how confidence is the word de jour within educational policy (Llewellyn, 2009).

In a search of all of the New Labour educational policy documents (referenced in Chapter Four), there were over 200 mentions of the word confidence or confident, 13 for self-esteem, and none for self-concept or self-efficacy; there were six mentions of anxiety or anxious. Thus, the preferred option for educational policy, to describe both pupils and teachers' affective responses to mathematics, is confidence (Llewellyn, 2009); however this choice is not innocent. Why prefer confidence when anxiety is perhaps more commonly found in mathematics education research? I suggest that anxiety is often found in mathematics education research as its authority stems from a psychological gaze. However, the word anxiety is uncomfortable for educational policy documents. Anxiety can be conceptualised as a state, a trait or a process (Spielberger, 1972) or it can be a disorder, and thus it can suggest something which is abnormal, which is not permitted within neoliberal New Labour policy documents (Llewellyn and Mendick 2011); confidence is viewed as aspirational - something we want, whereas anxiety is something we do not want. Moreover, using anxiety would suggest an inner psyche, again something not permitted within policy documents or neoliberalism. Above all, it is harder to imagine it being eliminated by rational and functional means, than it is to imagine confidence being instilled through them. Thus, confidence is chosen as it fits more comfortably with neoliberal discourses, such that it is something positive and enabling that in theory, can be achieved by anyone; accordingly, it is not only energising but equitable. Confidence as equalizer and liberator is a powerful and attractive fantasy, in part as it relies on the illusion of the neoliberal autonomous self for whom anything is possible (du Gay, 1996; N. Rose, 1999a). Moreover it fits with New Labour, who construct equity through opportunity (Llewellyn & Mendick, 2011), which is explored more in Chapter Eight.

In the rest of this section, I breakdown educational policy discourses of confidence into three areas: the conflation of confidence with competence (Hardy, 2007, 2009); the naturalisation

of confidence (some have it and some do not) (which links to confidence as an individual trait discussed previously); and the setting up of confidence as a prerequisite for successful mathematics learning and teaching (as in some educational research - discussed earlier). Specifically, I elaborate each of these and show that in educational policy documents confidence is overwhelmingly produced as performative and this has implications of functionality for the mathematical child, which I have elaborated and established in the previous two chapters.

Mirroring Hardy's (2007, 2009) analysis of educational policy, I also found that in educational policy documents confidence is conflated with competence. This is particularly prevalent within *National Strategy* documents which, as part of the flagship government education strategy, are the key manufacturers of knowledge concerning mathematics pedagogy. They clearly state that "practitioners must provide opportunities for practice to develop children's confidence and competence" (DfES, 2006b, p. 105) however, as I argue below, these become one and the same.

To show this conflation, I use selected extracts from policy, though these are indicative of the wider patterns in the documents.

> The aim is that by the end of Key Stage 2, the great majority of children should be able to use an efficient written method for each operation with confidence and understanding. (DfES, 2006c, p. 41)

In the above statement from the *Primary National Strategy (PNS)* (DfES, 2006c), confidence is included alongside understanding, and this combination is taken to imply competence. Though as discussed in the previous chapter 'understanding' is produced as functional. I argue that confidence has a similar functionality through its conflation with competence. The next few incidences are more explicit:

> As children become more confident users of the calculator they can be taught how to use the calculator's memory. (DfES, 2006c, p. 58)

> The challenge for teachers is determining when their children should move on to a refinement in the method and become confident and more efficient at written calculation. (DfES, 2006c, p. 41)

> The aim is that children use mental methods when appropriate, but for calculations that they cannot do in their heads they use an efficient written method accurately and with confidence. (DfES, 2006c, pp. 43, 45, 47, 50)

In the first quotation confidence is constructed as a necessary feature of mathematical achievement before someone can be given access to more knowledge, thus it serves as a barrier to learning. In the other two extracts efficiency and accuracy have become indicators of mathematical success, and confidence becomes entwined with these performative traits, (that are not dissimilar to those noted by Burton (2004) and Hardy (2009)). This is reiterated in *Making Good Progress*, where an aim for pupils is to "become more confident at 'reading' calculations and deciding on the most efficient method to use" (DCFS, 2008b, p. 5). It is difficult to know how someone can be confident at reading calculations or why this should be valued. In the extracts above confidence has taken on neoliberal discourses, and has become functional and performative.

In this next example, similarly, there is a conflation of confidence with competence, however confidence is tied to neoliberalism through the illusion of control over your choices (Llewellyn, 2009); as such, confidence legitimises neoliberal discourses.

> Children should be equipped to decide when it is best to use a mental, written or calculator method based on the knowledge that they are in control of this choice as they are able to carry out all three methods with confidence. (DfES, 2006c, p. 41)

This conflation is also found in documents that bridge educational policy and education research. In his government sponsored independent review Williams (2008), demonstrates the importance attached to confidence, shown in the extract below:

> The high standards achieved in mathematics in recent years can be maintained and improved further only by addressing the unique needs of this subject, a discipline which is not always embraced with enthusiasm and confidence. (Williams, 2008, p. 1)

Above, Williams constructs mathematics as unique, he also constructs confidence as not the norm. Reading the wider text, it is not clear if he is referring to teachers or pupils, the message may apply to both. In other references he states that "confidence and dexterity in the classroom are essential prerequisites for the successful teacher of mathematics" (Williams, 2008, p. 3), conflating confidence and competence in teaching. He further perpetuates commonplace discourses of mathematics as absolute by stating that "children are perhaps the most acutely sensitive barometer of any uncertainty" (Williams, 2008, p. 3), suggesting that there is little place for doubt within mathematics, teaching or learning. This puts considerable pressure on the individual (teacher) to conform and responsiblises their failure when they do not, as discussed in the

previous chapter. Here, Williams is constructing confident teaching of mathematics as vital to the confident learning of pupils.

Hence, similarly to mathematics education research, educational policy documents produce confidence as a valuable and individualised trait and as coupled with competence. As such, it can appear that affective qualities are present. However, as I have shown neoliberal educational policy discourse of confidence removes emotions and/or doubt, and instead discursively aligns it to functionality and objectivity. Hence, confidence is constructed through its replacement of competence and through its links to the neoliberal subject. In this sense, it is a stronger and more coherent construction than the one found in mathematics education research. In addition, and as in the previous chapter, the mathematical child of educational policy is produced as a functional automaton. However, part of the neoliberal illusion of confidence is that it appears to be equitable, and thus achievable by everyone. In the next section, I contend that this is not the case, and instead confidence is naturalised within educational policy documents, such that only some can achieve. This is similar to mathematics education research, where they similarly produce confidence as more easily found in some bodies than others.

This 'naturalisation' is (re)produced through the *Making Good Progress* series of the *National Strategy* documents that describe "slow moving pupils" as "lack[ing] self confidence" and as "often girls" (DCSF, 2008b, p. 1), whilst underachieving pupils are "tentative and cautious when starting a new topic, particularly the girls" (DCFS, 2007b, p. 12). Thus in a significant section of a major government education strategy, it is implied that you cannot be slow and confident in doing mathematics. Furthermore, that this is embodied by girls and women is reiterated throughout; for example, able pupils who "lose momentum" are described as confident in English yet not in mathematics: "'these girls are really confident, but they are different when they are doing mathematics. They seem anxious about getting it right' (Year 6 teacher)" (DCFS, 2007b, p. 15).

As mentioned in the previous chapter, the removing of confidence from women and girls is also found in some mathematics education research. Though in research there is more awareness of the structural elements that create this position. In New Labour educational policy documents the tendency is more clearly to place the problem with the girls. This 'victim blaming' has been much criticised, for instance in mathematics education by Walkerdine (1998a) and Boaler (1997b). Building on this, I argue that it is difficult for pupils (and girls especially) to break out of these cyclic deviant categories, partly as it is difficult for pupils to appreciate their ability if it positions them as slow-moving and/or under-attaining and thus as outside of a normalised version of mathematical success (Llewellyn & Mendick, 2011). Therefore, speed and confidence are

naturalised to the more able, and mathematics is done by those who can more easily perform these traits (Mendick, 2006). Moreover, confidence is naturalised within masculine identities (Bibby, 2002; Burton, 2004; Hardy, 2009). Hence girls or women can too easily be constructed as under-confident and withdraw from mathematics citing lack of confidence as the reason, as they are caught up in discursive productions of femininity (Mendick, 2006; Walkerdine, 1990, 1998a). This leaves the majority of women in an impossible position, they are seen as weak for not having confidence, but it is also a position that they cannot comfortably inhabit because of their investment in femininity; conversely 'real' men have to show confidence. Thus confidence is discursively produced as an inner state (Llewellyn, 2009). This restricts the number of people who can be good at mathematics and perpetuates the myth of 'real' (born) mathematicians (Walkerdine, 1988).

Overall, I suggest that within government educational policy documents confidence has become a neoliberal chimera. It is produced as a gatekeeper for success in mathematics through its conflation with competence; moreover, it is a gatekeeper that is potentially achievable by everyone. However this is an illusion, instead confidence is discursively produced as concrete, and as performance which is more easily taken on by certain groups. Thus confidence becomes a measurable piece of data that is easier for some to achieve. Here, and as in the previous two chapters, neoliberal educational policy produces the mathematical child as a functional automaton. This is similar to constructions in mathematics education research, discussed in the previous section, where the mathematical child is again restricted to certain privileged groups. However, the mathematical child of research is a more romantic production, in that they are naturally curious and confident, whereas the mathematical child of policy is functional, mechanistic and a product of the classroom.

These arguments are continued in the student-teachers' talk section, where I show that the student-teachers further essentialise confidence, when the romantic and functional discourses meet the emotional discourses of student-teachers' talk.

7.4 Troubling confidence in student–teachers' talk

In her critique of confidence, Burton (2004) found that, whilst teachers construct confidence as a measurable trait, pupils' view confidence as multi-faceted, often tied to their emotions. Specifically, pupils talk of confidence as a ''can do'' approach to the mathematics classroom; this suggests confusion between the function and emotion of confidence. In this section, I suggest that similarly to the pupils in Burton's (2004) study, the student-teachers produce confidence as an emotion when discussing their own experiences with mathematics.

However, when describing their pupils they are caught between emotional discourses of confidence and those quantifying confidence as a measurable performance and as such, as an inner state. This situation is only possible as confidence is written as a gatekeeper to success in mathematics, which, in the classroom, can supersede cognition. I speculate that within neoliberalism – where everyone can achieve – a confidence deficit is an easier barrier to envisage overcoming than a cognition deficit. To show this, I use extracts from the interviews with all of the student-teachers. The quotations I have included appear as detached statements though they are usually indicative of wider patterns in the interviews, and where this is not the case it is indicated.

7.4.1 "Maths is able to give you a confidence boost or to do the complete opposite"

For five of the student-teachers - Jane, Nicola, Kate, Leah, and Louise - there seemed to be cohesion around the 'truth' of confidence and the production of the mathematical child. Specifically, that doing mathematics and being confident are 'intrinsically' connected, or as Nicola puts it "maths is able to give you a confidence boost or to do the complete opposite". Maths is almost 'magically' responsible for an inner state, similarly to the advertisement discussed in the introduction to this chapter. Jane and Louise (in separate interviews) also make this relationship explicit.

> Louise: So maybe if she can do it with shape she'll start building up her confidence and maybe that'll help her confidence in numbers too, so ... I think it's [confidence] huge. That's why I like to give a lot of praise.
>
> Jane: I think knowledge can only take you so far and if you haven't got the confidence then you haven't got the ability to absorb the knowledge really because you've got this presumption that you can't do it ... The average achievers because they weren't very confident in maths were quite happy to sit back and let the higher achiever do all the work and everything

This construction permeates much of the student-teachers' talk, which results in particular classroom behaviours, for example Louise's use of praise, or Jane's assumptions about why groups of pupils behave the way they do. Again, and similarly to educational policy, there is a sliding between confidence and competence. For example, if you replace confidence with competence in the quotations above and/or below, most still makes pedagogical and linguistic sense.

> Jane: That's what I think I need, more confidence, that if we do get pulled off in a completely different direction if I know it's of educational benefit that it's OK to go with that

However, there is a subtle difference in construction between the educational policy and the student-teachers' versions of confidence. Specifically, instead of producing confidence as

performative (as in New Labour educational policy) the student-teachers are also learners of mathematics who typically construct confidence as emotive, as Burton's (2004) pupils did. More examples of this are shown below:

Leah: A lot of the time the children for who it is a confidence issue and it looks like they can't be bothered but actually they really would like to be able to do it

Nicola: They can do stuff like that and it makes them feel good about maths

Kate: I know one of the girls is terrified of fractions, really hates them

Above, Nicola, Kate and Leah (in separate interviews) link feelings directly to mathematics. Kate talks of pupils being "terrified" and "hating" fractions, whilst Nicola talks of "feel[ing] good" about mathematics, which are emotional statements. In addition, Leah talks of "giv[ing] up" on mathematics, even though pupils may "look like they can't be bothered", showing how a student-teacher can construct emotional stories to explain the results of a teacher's surveillance for expected performance. These extracts also demonstrate how pupils and teachers are not simply cognitive beings.

7.4.2 A neoliberal "can-do" approach to mathematics

I suggest that this fabrication of confidence as curative is a prominent discourse in the mathematics classroom, as it is permitted within neoliberalism. Specifically, confidence is perceived as alterable and is thus aligned to neoliberal characteristics such as self-improvement. This is in contrast to a pupil's competence or cognition which in the classroom is often viewed as fixed (Chapter Eight) and as an inner state, and so as less easily influenced. Confidence is the preference of neoliberal self-improvement, and as such it should create opportunities for the mathematical child. Consequently the pupils are asked to adopt a "can do" attitude, where emotion is constructed as the driver of cognition.

Leah: They've given up on it because they just don't have the confidence to say I can do it or they just don't want to do it because they don't feel like they can.

Nicola: When the shutters come down it's about convincing them they can do it

Kate: It is self-esteem, a bit more confidence with their work. They can do it but they don't believe that they can do it I think.

All three student-teachers above talk (in separate interviews) of the need to instil into pupils the attitude that "they can do it", which is very similar to Burton's (2004) observations of pupils' conceptions of confidence as a 'can-do' approach. This is also shown where Louise constructs her own approach to mathematics:

Louise: I've got the maximum, I stormed it! Stormed the GCSE and got a B 'cos I did the intermediate paper, erm, but I wish I'd gone in for the higher one because I felt, felt it was a bit tedious to be honest ... I just picked it up really, really, quickly

This is not an uncommon statement for Louise. She acts as 'confident' in relation to mathematics, and constructs this as integral to her performance as someone who is naturally good at mathematics. She constructs confidence as from within and belonging to her – which is the case of some of the student-teachers. These constructions are notably different to academic conceptions where building confidence comes alongside competence and through specific teaching methodologies. Similarly, but more explicitly in educational policy, confidence is viewed as an end result and a by-product of successful doers of mathematics.

7.4.3 Confidence is easier for some than for others

However just as in neoliberal educational policy, I suggest that confidence as a barrier is a far more attractive proposition than cognition as a barrier (explored in the previous chapter and in Chapter Eight). Though for confidence to become measurable it can easily become essentialised as an innate quality in mathematics education research, and the student-teachers' emotional discourses suggest that they essentialise it further. In Jane's case, it becomes a reason to keep her as a non-mathematical person. She states:

Jane: I'm not very confident teaching maths, I'm not very confident at maths … If I'm not confident I can't pretend to be confident

She reiterates this by making the mathematical person confident.

Jane: but you know like when I was saying how that girl tried to like knock my confidence at the same time, because she was very good at maths.

Consequently, as mentioned in the previous section, it restricts mathematics to certain groups, as Jane states in an earlier interview there are "those who can, do it [mathematics] and those who can't". These binary oppositions position people/groups into mutually exclusive boxes giving some pupils access to mathematics, and keeping others without (Mendick, 2006), as confidence, and mathematics, are positioned as an inner state (Hardy, 2009). As discussed, the concern is that this causal assumption is too easily made, and the importance of confidence can supersede competence resulting in exclusion based upon behaviour. This is demonstrated by Nicola's extract below:

Nicola: One of the biggest problems is their [low attaining pupils] confidence. That plays more of a part than anything.

As before, confidence is required for competence, in addition confidence is restricted to the more 'able', and as elsewhere (and Chapter Eight) there is homogenising around an 'ability' group. The restricting of confidence is broader than towards the mathematically 'able', instead, it is towards pupils that can do confidence as performance. For example, Leah assigns confidence more easily to boys - "I would say that probably in maths, boys are more confident on this table" - which is a common stereotypical generalization (Walkerdine, 1998a) discussed in the previous section of this chapter. Leah is not saying that all boys are more confident than girls but she is making assumptions based upon an abstract rather than a concrete notion, one that is not equitably measurable. Another example is shown below:

> Nicola: I knew she'd be hesitant about it because she's one of those people who doesn't have the confidence. She can do it ... She's a really clever girl. She can do anything you put in front of her; she just hasn't got the confidence to believe in herself.

Here Nicola talks of a female pupil that has competence ("she can do it") but denies her confidence ("she just hasn't got" it). This suggests it is more complicated than simply conflating competence and competence. As here, despite being academically successful at mathematics, the female pupil is constructed as lacking something and as not belonging to the group of 'real mathematicians' (Walkerdine, 1988). Attainment must be based on performances of 'understanding' and 'confidence' to fit the idealised mathematical child.

7.4.4 Confidence and the loss of doubt

Additionally, from Nicola's quotation above, confidence is constructed in a manner that produces doubt or hesitancy as incompatible with mathematics, which was also found in some educational policy documents. This leads onto my final point that when particular versions of confidence are constructed as very important, doubt and uncertainty become problematic, and they may be written out of discourses of mathematics. This, I argue, perpetuates the myth of 'real' mathematicians and 'real' mathematics. Moreover, it adds to the fiction of confidence as key, whilst simultaneously keeping confidence as unachievable by most. It creates an impossible fantasy.

As Nicola has demonstrated in the example above, the mathematical child is not usually told it is okay to struggle at mathematics; they are not often permitted to get anxious, to express their emotions or seek doubt in their solutions (Damarin, 2000). The discussion of this in much of mathematics education research can also be lost, amongst the essentialising of the mathematical child. Instead, doers of mathematics are encouraged to view mathematics as the unquestionable,

absolute truth (discussed in Chapter Three) and their methods as definitive and incontestable. For instance, when Jane says that mathematics is "full of multiple steps and if you miss one you've lost the whole thing", she is discursively producing mathematics as something you must get right, where you must know what you are doing. Even in problem solving, or teaching for understanding, there is a correct way to do it (explored in the previous chapter) and a correct way to get things wrong or 'fail' (Halberstam, 2011). However, doubt can be conducive to learning mathematics (Burton, 2004); moreover Burton argues that when mathematicians do mathematics they are grappling with uncertainty. Although, doubt is not allowed in romantic inquirers, who tackle problems positively, and with the correct manner of 'failure' (Halberstam, 2011), or in functional automatons, who do not tackle problems at all; doubt is written out of mathematics as the indisputable view of the subject and the mathematical child prevails.

The conflict it can cause is shown through a teaching episode with a 'gifted and talented' pupil. The pupil spent the lesson crying because he could not do the work and as such he removed himself from it.

> Nicola: I don't know, I feel guilty for putting the work in front of him in the first place but at the same time I know he's just frustrated. That's the only reason he's crying because he's frustrated because he can't do it. He's not used to not being able to do anything because he is the one that always seems to be the one that can do everything.

Nicola is aware that his emotions come from his unusual position of not being able to do the mathematics; she is also emotional - upset and confused. She, and the pupil, view frustration with mathematics as wrong and incompatible to the preferred mathematical child. Furthermore, for Nicola, the conflicting discourses of teacher as carer and teacher as manager may be confusing (discussed in chapter section 3.3.3). Nicola removes the work, explains it was a mistake and offers to never put the pupil in the position again.

7.4.5 A counter discourse to dominant productions

Sophie is the one student-teacher who questions the role of confidence as imperative to success in mathematics.

> Sophie: There's a downside to being overly-confident because they'll work through them far too quickly. You've got an entire team who still do 10 questions in a minute, they can't explain to you why they've done it, or if they go wrong they come and say 'Oh, I don't know where I've gone wrong' and they've got to do them again. Because they get quicker they just get sloppy with their work. So I think you've got to keep them challenged if you can, and

keep their confidence down a little bit. Just keep them pushing on. That confidence needs to be worked on, but you can't ever be fully confident because otherwise you'll just start making mistakes.

In the text above, Sophie queries the elevated position of confidence as everything, and she queries doing mathematics fast. In addition, Sophie acknowledges that there are times when you may need to prevent a pupil's confidence growing. These stories contrast to Boaler's (and Jane's) opinion that confidence comes from understanding (discussed in the previous chapter). Sophie views understanding as the goal but does not connect it to confidence; she is able to unpack confidence and see it as more than wholly good.

By year three, Sophie identifies as more confident, and states this is different to how she felt earlier in the course.

Sophie: So I do think I have become more confident with it. I mean, when I came into uni thinking 'I hate maths I really hate it'.

Anna: You sound more confident

Sophie: I am a bit more confident. I feel much more confident, so I do think it has changed me. I still don't love it but I feel more confident teaching it. So I think that's a positive thing.

A possible reading is that Sophie subject positioning has changed. For instance, in the earlier texts she may be investing in the position as beginner teacher or as a non-mathematical person. Whereas by year three, she is sliding towards a subject position as both teacher and mathematical person, having been successful on the course. Or Sophie may be appealing to my preferences, as I fall into the normative trap of investing in performative measures of confidence. Hence both Sophie and I construct confidence as important, and as a sign of wider competence or contentment. Rather reductively, I identify confidence through outward performance.

Overall, I have argued that student-teachers' discourses of confidence are similar to both mathematics education research and New Labour educational policy in that they produce confidence as a barrier to mathematics. However they differ to those in educational policy documents, such that instead of producing confidence as functional linked to cognition the student-teachers tend to locate it in the affective domain. However they still make generalisations about confidence and look for examples of it as performance, thus it becomes essentialised as an inner state, which is perhaps permitted by both educational policy and by mathematics education research. This could suggest the student-teachers are caught between conflicting discourses of the current day teacher, that is between feminised discourses of the caring primary school teacher (Coffey & Delamont, 2000) and neoliberal discourses of the functional autonomous teacher

advocated by current policy, within the education market (S. J. Ball, 2008). Alternatively this conflict is indicative of the student-teachers' experiences as a teacher and as a student of mathematics (Burton, 2004) or it may be a combination of these contingencies.

7.5 Chapter summary and concluding remarks

Thus confidence, as understanding and progress in the previous two chapters, is not the innocent force for good common sense purports it to be. Confidence is most commonly produced as a gatekeeper to mathematics. However, it acts as an enabler of opportunities for some and as a disabler of opportunities for others. This is partly drawn from the conflict that the student-teachers' experience, between the expected functionality, essentialised performances and the forbidden emotion. In particular, and drawing on the work established in the previous two chapters, mathematics education research prefers the romanticised version of the mathematical child where confidence stems from the correct kind of pedagogy that encourages the 'natural' curiosity of the child. Educational policy documents however, produce confidence as functional and as part of the autonomous and meritocratic discourses of neoliberalism. Here, confidence is constructed as a concrete rather than an abstract noun and the mathematical child is produced as a functional automaton. However in the student-teachers' talk, mathematical pupils are a hybrid of performance and emotion, hence similarly, confidence is a hybrid of performance and emotion. This amalgam results in it becoming an individualised essentialised trait, which I argue is permitted by dominant mathematics education research. As such, confidence is bounded by the cognition of the individual rather than having any relation to the systems and structures that circulate.

Ability, the theme of the next chapter is somewhat different from those encountered so far, in that it is not an assumed good. Instead it is problematic in its production, and something that is often not discussed openly in mathematics education research; Boaler (2009) referred to it as "the elephant in the classroom". In fact, it came as a surprise to me that it was a dominant term found in the student-teachers' interviews.

8 Chapter 8: Troubling Ability

8.1 Introduction

Which of these statements is true? Everyone can achieve at mathematics, or mathematics is done by a special, gifted few. The difficulty some may experience in answering this question, their desire to agree with both parts of the statement, is indicative of a paradox that circulates in discourses of mathematics: that 'everyday' mathematics is for everyone, but 'real' mathematics is done by a talented, special few (Mendick, 2015 (forthcoming)). Referring back to the advertisement used to start the previous chapter, the notion of 'ability' is remarkable by its absence; instead, the acquisition of confidence, through the correct teaching methods, is seen as the route to success in mathematics. In contrast to this, the highly 'able' mathematical 'genius' is a well-worn trope of popular culture. From the film *Good Will Hunting* (Van Sant, 1997), to the television show *The Big Bang Theory* (Crendowski, 2007-ongoing), the socially-awkward inherently-brilliant mathematician abounds (Mendick, 2006, 2015 (forthcoming)). Thus we are left with a quandary - is mathematics for these special few or is it for everyone? Hence, and as I show in this chapter, mathematical 'ability' is a problematic construct, and whether it is constructed as 'natural' or 'developed', very much influences what is possible for the mathematical child.

Ability has already been discussed throughout Act Two of this thesis. In Chapter Five, I argued that ability was a fundamental part of the production of progress. Specifically, different kinds of progress were only available to the more 'able'; moreover, the pursuit of progress required the homogenising of pupils by 'ability' groups in the classroom. In chapters six and seven, I showed that the mathematical child was always already an 'able' child. I argued that performing signs of 'understanding' and 'confidence' are key means by which pupils are classified as 'able', and these signs are more easily found in some people than others. As such, my overall argument is that the constructions of the mathematical child found in educational policy, mathematics education research and student-teachers' talk, are always already bounded by notions of 'natural' 'ability', this is in spite of counter discourses that propose that everyone can do mathematics. My assertion is similar to Gillborn and Youdell's (2001), who state that "the view of 'ability' that currently dominates education, from the heart of government through to individual classrooms, represents a victory for the hereditarian position, without debate and without conscience" (p. 97). My thesis supports and builds on this argument by unpacking the practice and power around 'ability' in mathematics education. Moreover, it offers a critique of mathematics education

research as an implicit producer of this problematic dis/abling discourse, even as it explicitly advocates the universal accessibility of mathematics.

Specifically in this chapter, I contend that mathematical ability is a fundamental yet problematic concept in the classroom which creates tension for student-teachers of primary mathematics. Moreover, I show that this tension is particular to a neoliberal society, where equity is constructed as opportunity (Llewellyn & Mendick, 2011, p. 20), and mathematical 'ability' discourses of educational policy are incoherent. For mobility and productivity to be possible, 'ability' is ignored in the majority of educational policy documents. However, mobility is always already present in the 'Gifted and Talented' child of educational policy, which is made 'real' by its alignment to the romantic inquirer of mathematics education research. This tension ultimately legitimates mathematical ability as a modern day method of permitted discrimination.

I set out this argument, by following a similar chapter structure to the previous three, by unpacking ability in the domains of mathematics education research, educational policy, and student-teachers' talk.

8.2 Troubling ability in mathematics education research

Throughout part two of this thesis, I have argued that within dominant productions of mathematics education research, the mathematical child is always already the "active cognitive subject" (Valero, 2002, p. 542). And within this, hierarchies are found in the romantic construction of the natural mathematical child. I begin this section by showing how the romantic, inquiring child of mathematics education research, that is connected to the hierarchies found in psychological definitions of child development, is always already bounded by notions of 'natural' 'ability'. I examine this with both overt and covert examples from mathematics education research. Specifically, I show how notions of 'natural ability' are transmitted through the privileging of particular pedagogies and the acknowledgement of inherent traits of mathematical 'ability'. This argument sits in contrast to the explicit discourses of mathematics education research which advocate the opposite - that everyone can think mathematically (for example, Mason, Burton, & Stacey, 1982) and everyone can achieve. I foreground the discussion, by acknowledging the links between intelligence, 'ability' and constructions of the mathematical child.

8.2.1 Innate constructions of 'ability'

Common mathematical discourses suggest, as Orton does, that "overall intellectual capacity is the most dominant influence on mathematical ability … however, some pupils clearly show more aptitude for mathematics than others" (Orton, 2004, p. 114). Hence, the debate

surrounding ability in mathematics education seems to have relations to classical (non-mathematical) definitions of intelligence (Gillborn & Youdell, 2001). 'Intelligence' is of course not the same as 'ability', however Gillborn and Youdell convincingly argue that in the current regime of truth "talk of 'ability' replaces (and encodes) previous talk of intelligence" (Gillborn & Youdell, 2001, p. 65). Sternberg summarises the history and current position succinctly:

> Although many different definitions of intelligence have been proposed over the years (see, e.g., 'Intelligence and Its Measurement,' (1921); Sternberg and Detterman (1986)) the conventional notion of intelligence is built around a loosely consensual definition of intelligence in terms of generalized adaptation to the environment. Theories of intelligence extend this definition by suggesting that there is a general factor of intelligence, often labeled *g,* that underlies all adaptive behaviour. As just mentioned, in many theories, including the theories most widely accepted today (e.g. Carroll, 1993; Gustafsson, 1994; Horn, 1994), other mental abilities are hierarchically nested under this general factor at successively greater levels of specificity. (Sternberg, 1999, p. 292)

As such, the dominant construction of ability/intelligence has similar conceptions and constraints to 'IQ' or "generalized academic potential" (Gillborn & Youdell, 2001, p. 79).

As has been argued in the previous chapters, the hierarchies which Sternberg refers to are evident in some concepts of mathematical understanding, progress and within the romantic, inquiring mathematical child of mathematics education research. Specifically, and as established in Chapter Three (and Act Two) these hierarchies draw from Rousseauian and Piagetian notions of 'natural' child development, where the active child 'naturally' develops from experience. For Piaget, the child inevitably moves through stages, with the pinnacle of intelligence being reasoning (Piaget, 1953; Piaget & Inhelder, 1969/2000). However, Piaget suggests that this highpoint is not achievable by everyone, thus it is not an inclusive model. Moreover, this Piagetian child is very much based upon Western conventions and ignores subjectivity, and cultural context (Burman, 2008a). As such,

> there is a corresponding danger than children's 'needs' become some kind of inviolable category that is treated as self-evident rather than as informed by and reflecting the socio-political preoccupations of particular cultures and times (Woodhead, 1990). (Burman, 2008a, p. 73)

Similarly, the notion of normal 'development', and hence a 'normal ability' is taken-for-granted. Anything different to this is naturally abnormal, hence we have the construct of naturalised difference, and of high and low 'ability' pupils that are statically positioned for all of their mathematics study.

> The view that differences in the cognitive potential and achievement of individual pupils are broadly consistent across a subject area, and persistent over time, is characteristic of the influential psychological tradition centred on the concept of intelligence or mental ability. (Ruthven, 1987, p. 245)

Thus in this particular case - within mathematics education research that draws on developmental psychology - anyone that is not 'naturally' active and inquisitive is Othered, and viewed as non-mathematical (Walkerdine, 1998a). This creates divisions based upon innate and inherent traits. And the 'able' mathematical child is one bounded by cognition and hierarchical discourses, such as 'understanding' (Chapter Six) and problem solving. Below, I discuss how this is actualised in mathematics education research.

8.2.2 The 'natural' problem solver

Building on the last section, my concern is that the 'natural' problem solver is always already part of mathematics education research, and furthermore, this is part of a deeply embedded hierarchy that constructs the mathematical child as special. The first illustration is from the mathematician Polya, who applied heuristics to problem solving. In an influential, and well-referenced text, within mathematics education research (with over 6000 citations on google scholar), Polya (1945/2014) talks of both the 'natural' problem solver, and the use of common sense. He also talks of the expedition of these:

> All the questions and suggestions of our list are natural, simple, obvious, just plain common sense; but they state plain common sense in general terms. They suggest a certain conduct which comes naturally to any person who is seriously concerned with his [sic] problem and has some common sense ... If the teacher wishes to develop in his students the mental operations which correspond to the questions and suggestions of our list, he puts these questions and suggestions to the students as often as he can do so naturally. (pp. 3-5)

Thus here, there is an appreciation of the 'natural' reasoned 'man', through "natural, simple, obvious, just plain common sense". The tone of the language is factual and the use of "common sense" constructs the doing of mathematics and the mathematical child as inherent and innate. However, what Polya refers to as 'natural', or common sense, is of course dependent upon cultural and socio-political context; it constructs the 'common sense' of the time. In spite of this 'inborn' 'ability' to see and do mathematics, there is also an acknowledgement of the facilitation of this, as the teacher governs the classroom. Hence, it is clear that the teacher is complicit in this production, of commonality and 'natural' reason. As already stated, the work of Polya and others

in developmental psychology is very influential in mathematics education research; hence, they are constructing a story of 'natural' reason.

Similar messages are found in the more recent work in mathematics education research that draws upon developmental psychology. One typical example is offered below:

> Problem solving, a way to reach a goal that is not immediately attainable, is a hallmark of mathematical activity and an important means of developing mathematical knowledge. Problem solving is natural to young children because the world is new to them, and they exhibit curiosity, intelligence, and flexibility as they face new situations. (Tarim, 2009, p. 325)

Here, Tarim, like Polya, posits a natural mathematical problem solver, hence (re)producing natural and inherent mathematical ability as 'real'. Similarly to others in mathematics education research, she also expects pupils' mathematical ability to develop from experience, perhaps inevitably as Piaget or Rousseau did. Within this, the child is constructed as acultural and asocial, as a vessel who is already 'natural' and who continues to 'develop' in a 'natural' (predetermined) way. However, the 'natural' problem solver, whist appearing universal in Polya's statement, authenticates the mathematical genius discussed in the introduction; everyone does not confirm to this.

As I have shown in the previous chapters, dominant branches of mathematics education research are invested in problem solving; they are invested in progressive education and demonstrating that this is the only way to learn mathematics. However, there are a few counter examples to the connection between problem solving and mathematical achievement; one is provided by Schiefele and Csikszentmihalyi (1995). They note that "the majority of studies confirm that cognitive student characteristics explain a large part of the observed variance in [mathematical] achievement" (p. 163). The authors examine correlations between mathematical ability and motivation and conclude that:

> Quality of experience in mathematics class was mainly related to interest in mathematics and, to a lesser extent, to achievement motivation. Inconsistent with our hypothesis, ability was not at all correlated with experience. Even feelings of self-esteem, concentration, or skill seemed to be unaffected by ability. Achievement, however, was most strongly related to level of mathematical ability. (p. 176)

This contradicts the above, and the discourses of the mathematical child written about in earlier chapters; specifically that they are confident, and that they should experience mathematics in an 'active' way. However, by measuring mathematical ability and achievement as distinct, they

maintain the idea that aspects of mathematical ability are 'natural'. This sliding between ability and achievement/attainment is a problematic discourse which is explored throughout the rest of this chapter.

Discussions of ability are not found all over mathematics education research, especially in more recent publications; instead often mathematical ability is noticeable by its absence. Boaler (2009) called it "the elephant in the classroom"; something of which we dare not speak, but which is always there. Nunes and Bryant's (1997) edited collection, *Learning and Teaching Mathematics: an international perspective,* demonstrates the predicament with which academics are faced – trying to argue that 'ability' is inherent, whilst maintaining that everyone can do mathematics. Nunes and Bryant explicitly use Piaget's definition of intelligence, stating that, "intelligence (but note, one form of intelligence only!) and mathematical reasoning are the same because both are ways of solving problems in an adaptive, not arbitrary, and coherent fashion" (p. xiii). In addition, they are concerned with being able to think and reason, more than being able to do, or perform functionally. As such, they link success in mathematics to reasoning, to intelligence, and to ability, very much in line with Piaget. However, they contest the argument I have just made, that this produces mathematics 'ability'/understanding as innate. They do this by drawing on the idea of stages of development (also similar to Piaget):

> If mathematical understanding were innate, one would not expect children to have to go through a series of earlier stages in which their understanding of some mathematical idea is not just incomplete but rather takes a different form before they achieve a full understanding of the idea in the question. (Nunes & Bryant, 1997, p. 45)

Though as I argued earlier, someone who can 'develop naturally' is an always already 'able' child, though this is often through covert surveillance (discussed in the previous chapters of Act Two). This way of being is heavily entrenched in discourses of inherent 'ability'.

Thus, Nunes and Bryant are not circulating the discourses of an innate mathematical 'ability' explicitly; however there is a nod to the natural. Nunes and Bryant go broader than cognition and draw upon social and cultural context. Moreover, they are circulating the discourse of mathematical reasoning, as the pinnacle of a hierarchy of stages of development, and the meaning of intelligence. It is a correct way to be 'able'.

8.2.3 Covert productions of the always already 'able' mathematical child

Whilst these explicit discourses of 'natural mathematical ability' are not everywhere, mathematics education research does contain many other nuanced suggestions of the natural, the inevitable and the intuitive. Some of these works have great influence, for example Schoenfeld

(1992), who provides an overview and critique of trends in mathematics education, emphasises his own preference for orienting teaching towards "mathematical thinking". For this he draws on communities of practice, and states that "the person who thinks mathematically has a particular way of seeing the world, of representing it, of analysing it" (Schoenfeld, 1992, p. 363). Hence, in spite of Schoenfeld's broad conclusions, he advocates a particular way of doing mathematics and, within this, the mathematical child becomes special. Schoenfeld does not intentionally advocate a naturalised mathematical child, however his positioning invokes one.

Somewhat similarly, in a report on a review of mathematics education research, Watson states that, "it is well known that very young children develop intuitive ideas that form the foundations of later formal mathematics" (A. Watson, 2010, p. 1). Again, Watson is not stating that some people are good at mathematics and others are not, however she acknowledges that some of mathematics is intuitive and hence natural. In a sister paper/report, when discussing her preferred "bottom up" approach to mathematics pedagogy, she states:

> a complementary 'bottom up' view includes consideration of the development of students' natural ability to discern patterns and generalise them, and their growing competence in understanding and using symbols; however this would not take us very far in considering all the aspects of school algebra. (A. Watson, 2009, p. 8)

Watson is not stating that she uses "students' natural ability" or that it is important, however, by its inclusion, there is an implicit acknowledgement of its being. It is possible that 'natural ability' surreptitiously saturates documents, and hence discourses of mathematics education research.

8.2.4 Overt productions of the always already 'able' mathematical child

The most explicit positioning of a 'natural' 'ability' in mathematics education research comes from two places: projects that blur the boundaries between practice and research; and researchers that write about 'gifted' pupils/learners. For the former, mathematics ability is routinely ascribed as natural, and this 'ability' dictates what mathematics the pupils should do. Indeed, "stereotyped goals [by ability] can be found even in a document of such generous intentions as the Cockcroft (1982) report" (Ruthven, 1987, p. 250). A typical more recent example is found on the NRICH website (NRICH, n.d.) based at Cambridge University, which is generally held in high regard by both practitioners and researchers:

> Ability is usually described as a relative concept; we talk about the most able, least able, exceptionally able, and so on. If mathematical ability is similar to other physical differences between individuals then we might expect it to approximate to a normal distribution, with few individuals being at the extreme ends of the spectrum … A hard-

> working student prepared well for an assessment can succeed without being highly able. Conversely not all highly able mathematicians show their abilities in class, or do well in statutory assessments. (McClure, n.d. para.1, 10, 11)

In the brief article, McClure, the NRICH project director, suggests that ability is inherent but not always related to attainment. She draws on those that suggest various presentations of natural ability in mathematics: Krutetskii (1976), Bloom (1956) and Straker (1983), from over 30 years ago. Krutetskii's description of mathematical ability is similar to that of a problem solver (Orton, 2004). This is reiterated in this statement from McClure's article:

> The message here then is that in order to discover or confirm that a student is highly able, we need to offer opportunities for that student to grasp the structure of a problem, generalise, develop chains of reasoning. (McClure, n.d. para. 8)

Hence, as before, the 'natural ability' that is prescribed is a certain type of mathematical ability. Just as in Chapter Five on progress, it is the active reasoning one that is always already sought by mathematics education research.

Research articles that specify the 'gifted, natural learner' encompass broader fields and disciplines than mathematics education research – though they permeate its boundaries. Indeed, there are many journals that are specifically constructed around 'gifted'/'able' pupils. These include: *Gifted Child Quarterly*; the *Gifted Child Newsletter*; *Journal for the Education of the Gifted;* and *Gifted Education International.* Whilst none of these are specific to mathematics many of the articles are exclusively about mathematics, with titles such as *Gender Differences in Gifted and Average-Ability Students Comparing Girls' and Boys' Achievement, Self-Concept, Interest, and Motivation in Mathematics* (Preckel, Goetz, Pekrun, & Kleine, 2008). Within this, and other such articles and journals, natural ability is produced as 'real', with the choice of 'gifted' conjuring notions of innate qualities. In the article mentioned above, this essentialising is taken further by the analysis of gender. The discourses stemming from the articles are similar to those already discussed, specifically that, gifted pupils require opportunities to be active and be creative problem solvers. However, some clarify this around the suggestion of inclusive practice. One such example is from the journal, *Gifted Child Quarterly,* where Mann (2006) stresses that creativity is for all, but also suggests it is most important for the gifted. He states "teaching mathematics without providing for creativity denies all students, especially gifted and talented students, the opportunity to … fully develop his or her talents" (p. 236). As discussed previously, this both affirms a natural 'ability' and the discourse that creativity/problem solving/understanding is only or mainly relevant to the more mathematically 'able'.

The positioning of mathematical ability as innate, and 'real' mathematics as achieved through problem solving, is concerning. Firstly, even if you are successful at mathematics (via academic grades) you are only viewed as a 'real' mathematician if you have achieved this through 'natural' 'ability' and understanding, not through 'hard work' (Walkerdine, 1998a). Next, and as examined across Act Two, these social markers that signify ability are more easily identifiable in privileged groups (Walkerdine, 1998a). Thus, some pupils are more easily labelled as 'naturally able' and hence good at mathematics, which is inequitable. This was particularly evident within the previous chapter which unpacked discourses of confidence. As I argued in Chapter Five, the special rates of progress that are allowed for the 'able' mathematical child elevate this discourse, and in turn emphasises the deficit model of 'normal'.

8.2.5 Recognising our role in the production

Hence, the production of 'natural mathematical ability' as 'real' is probably not the intention of mathematics education research; instead, mathematics education research positions itself and progressive pedagogies as the route to equity in mathematics (for example Boaler, 1997b; Boylan & Povey, 2012). In addition, they fiercely advocate all 'ability' grouping as another route to this, although setting by 'ability' is endemic in mathematics classrooms (both primary and secondary).

Some researchers, such as Zevenbergen (2003), are aware of the psychological and hierarchical constructions of learning mathematics that facilitate this production of mathematical ability, and could enable grouping by 'ability'.

> In the current educational climate, there is a dominance of psychological discourses; views of social justice that focus on liberal, individualistic perspectives; and a view of mathematics being a hierarchical ontology. Within a field such as this, there is considerable influence for constructing a habitus that would legitimate practices associated with grouping students according to need and ability. (pp. 4, 5)

However, Zevenbergen stops short of specifically criticising or analysing mathematics education research's role in this production. Specifically, she stops short of critiquing the role of mathematics education research in producing inherent mathematical 'ability'. Hence, my final point in this section is that by not critiquing ourselves, not only are we not acknowledging our role in the production of mathematical ability, but we are removing and distinguishing ourselves from common discourse. We are defining ourselves as purveyors of untouchable knowledge; as such, we are complicit in the reproduction of power hierarchies. We are also setting ourselves as

impervious and power laden by refusing to engage with the norm of setting by 'ability', the common way of bring that circulates in UK mathematics classrooms.

Thus building on the analysis established in Act Two of this thesis, and irrespective of the intentions of mathematics education research and any counter discourses offered, the notion of a natural, inherent, mathematical ability is very persuasive in mathematics education and mathematics education research. This mathematical child is identified through signs of natural confidence (chapter seven and Hardy, 2007) and naturally curiosity, displaying real understanding (chapter six and Walkerdine, 1998a). Thus the romantic natural inquirer and the associated pedagogies essentialise the mathematical child, and mathematics education research is always already caught up in the production of natural mathematical ability as 'real'.

In the next section, I build on this argument by examining how ability works within New Labour educational policy documents. I argue that the discursive production of ability within mathematics educational policy is incoherent, in that it draws on both notions of fixed, and fluid abilities, without exploring how this/these can be actualised in practice, or where the complexities may lie. As a result, the always already 'able' group are allowed to be the romantic inquirers of mathematics education research, whereas everyone else is required to function without 'ability'; this is the only way to give both groups mobility, which is vital to neoliberalism.

8.3 Troubling ability in educational policy documents

In the latter parts of this section I discuss the construction of ability within neoliberalism. This is followed by analysis of the discursive production of different 'ability' groups, within New Labour educational policies. However, I begin by exploring the production of 'ability' grouping as the norm, arguing that this is done through the authority of government but through a neoliberal form of governmentality. I suggest that this normalises mathematical ability.

8.3.1 The production of ability grouping as the norm

As mentioned above and in Chapter Three, setting by 'ability' in mathematics has become commonplace in the majority of English schools, and is often viewed as normal and unproblematic. New Labour's educational policy documents construct a similar discourse. For instance, In the New Labour 1997 election manifesto setting is positioned as an obvious way to "maximise progress" (Labour Party, 1997, p. 7), and as established in Chapter Five, progress is one of, if not the, most important aim of education. This position is reiterated and maintained throughout their time in government, which is demonstrated in the four New Labour education White papers (DCFS, 2009a; DfEE, 1997; DfES, 2001, 2005a). For example, in his opening address

to the 2005 document *Higher standards better schools*, the then Prime Minister Tony Blair highlighted all-ability groups as a reason that many comprehensive schools had "failed to improve" (DfES, 2005a, p. 1), reiterating the previous point about the authority of progress. Hence a discourse is constructed which positions setting as the best option. However, as highlighted in the previous section, this contrasts to the majority position from within mathematics education research.

The policy documents quoted above draw upon neoliberal discourses of improvement and choice. This is made more explicit in other extracts where New Labour "encourage" the practice of setting.

> Since 1997 we have been encouraging schools to use 'setting' (teaching groups of pupils by *ability* in a particular subject rather than across a range of subjects) and other forms of pupil grouping, and we continue to encourage these practices. (DCFS, 2007a, p. 67)

An extract from the first education white paper in government is very similar, and relates setting specifically to the subjects of mathematics, languages and the sciences:

> Setting, particularly in science, maths and languages, is proving effective in many schools. We do not believe that any single model of grouping pupils should be imposed on secondary schools, but unless a school can demonstrate that it is getting better than expected results through a different approach, we do make the presumption that setting should be the norm in secondary schools. (DfEE, 1997, p. 38)

This passage combines neoliberal commitment to choice in rejecting an "imposed" and "single model of grouping pupils" with the language of presumption. The push to 'ability' grouping is justified on the grounds of its success in achieving results fitting with the mechanistic reduction of education noted throughout Act Two. Freedom from the presumption that a school follows the norm can only be gained by having a successful production line of results.

According to New Labour's educational policy documents, setting also maximises personalisation, a prominent term found within their documentation and within market driven neoliberal education systems. For instance, in the white paper *Higher standards better schools* there is a section entitled "education tailored to the individual" (DfES, 2005a, p. 9). One of the key aims of this section is that there needs to be "more grouping and setting by subject ability" (DfES, 2005a, p. 10). In a similar personalised learning section, "setting or grouping children of similar ability and attainment" (DfES, 2005a, p. 50) is given as a key principle. Thus, in New Labour educational policy documents, setting and grouping is not only produced as the best method, but

the method that best meets individuals' needs. Hence, the government have created a discursive position that setting leads to the modern neoliberal version of success.

Falling in-between educational research and educational policy is the Williams (2008) 'independent' review, whose position is more ambiguous towards 'ability' grouping. Williams states that "all forms of grouping appear to have limitations as well as strengths, so it is important for teachers and schools to be aware of the opportunity costs of how they choose to group children" (p. 67). It is interesting to note that a business and commodity discourse (of "opportunity costs") is present in an independent education review, and not just official policy. Despite this nod to government policy, Williams does highlight the problems that can stem from setting:

> An explicit stance is not adopted on the question of setting by this review – except that it appears best to leave decisions on such matters in the hands of head teachers and practitioners and their principled judgements of what is best for their children. The problem is that forms of grouping can easily be misinterpreted as categories of children, rather than tailored provision designed to aid all children's progress. (Williams, 2008, p. 67)

This caveat very much concurs with the mathematics education research discussed in the previous section, however such issues are absent from government policy documents, who instead present an uncomplicated picture, as in the previous chapters.

This section has established that setting is the norm within educational policy. Policy's assertion is that pupils who are placed in the appropriate group, learn at the appropriate pace and make appropriate progress. Before analysing the discursive production of these different 'ability' groups, I discuss the dilemmas faced by the concept of 'ability' within neoliberalism.

8.3.2 Troubling the construction of the mathematical child within New Labour's neoliberalism

At the beginning of this chapter I asked a question around what we mean by mathematical 'ability' – highlighting the tension between whether it is inherent or can it be learned. As discussed in the previous section, similar tensions can be found in mathematics education research discourses; however they are much more prominent within New Labour's educational policy documents. In particular, the 'very able/gifted and talented' children are constructed with fixed natural 'abilities' and as the acceptable version of special. However, the 'under-attaining/low ability' children are constructed as more fluid. In the following sections, I suggest that this difference is permitted within neoliberalism as both groups of children are given mobility or "equity as opportunity" (Llewellyn & Mendick, 2011); the more 'able' through their natural

'ability', and the less 'able' through a more functional production which ignores 'ability' and instead, constructs low achievement as something that can be corrected.

The discursive production of ability has not always been constructed around opportunity, New Labour's early educational policy agendas contained statements such as "children are not all of the same ability, nor do they learn at the same speed" (Labour Party, 1997, p. 7). This example supports Gillborn and Youdell, who argue that early New Labour policy "takes for granted a common sense view of 'ability' as unevenly distributed between individuals" (Gillborn & Youdell, 2001, p. 76). Similarly, the labelling of 'ability' groups was through a fixed, naturalised difference - "very able or less able" (DfES, 2000, p. 5). These are categories that are referenced to the norm, and more easily position pupils as superior and inferior. In addition, the markers of this appear to be fixed and internal, more so than if the categories had referenced fluid states such as high attaining and low attaining. This essentialises being good at mathematics which plays into familiar discourses of mathematics that maintain its privileged status. It also leaves some without mobility, and hence restricts opportunity, which as discussed is problematic within neoliberalism. Thus in 2000, these lower attaining groups needed to be repackaged. Below I analyse educational policy documents to show how this was achieved, however I start by discussing the 'more able' group.

8.3.3 High 'ability'/attaining pupils – the natural romantic mathematical child

Within New Labour's mathematics educational policy documents, high 'ability' pupils are discursively constructed as 'naturally' gifted. This essentialising is cemented by the assertion that there are certain characteristics associated with 'able' pupils, and moreover that there is a recommended pedagogy. For instance, this is shown in the DfES (2000) document *Mathematical Challenges for Able Pupils in Key Stage 1 and 2* (DfES, 2000). It states that mathematically 'able' pupils: "grasp new material quickly; are prepared to approach problems from different directions and persist in finding solutions; generalise patterns and relationships; use mathematical symbols confidently; and develop concise logical arguments" (p. 4). This extract constructs a version of the 'able' mathematical child, as one who works fast, is confident, who understands and is a reasoned, 'natural' inquirer. Thus rather than being concerned with 'normal' functionality as in the previous chapters, this version of the 'able' mathematical child is one bound by understanding (Chapter Six) and confidence (Chapter Seven); moreover it draws on discourses of the romantic mathematical child of mathematics education research; this child is allowed to be an 'individual'.

The document goes on to describe the appropriate pedagogy for working with able pupils. It talks of "extra challenges – including investigations using ICT – which they can do towards the end of a unit of work when other pupils are doing consolidation exercises" (DfES, 2000, p. 5).

Consequently, investigations and ICT are constructed as belonging to the 'able' whilst consolidation and practice exercises are positioned with those of lower 'ability'. The classroom is split between those who are functional and have to practise, and those who are too special to need to. This supports, and draws upon, familiar and exclusionary discourses of the gifted mathematician discussed in Chapter Three. This also supports the 'naturally able' romantic mathematical child of mathematics education research, discussed in the previous sections as throughout Act Two.

By 2006, if you were higher 'ability' in several subjects you were repackaged as "gifted and talented" (DfES, 2006a) stressing even more the specialness and the innate nature of these pupils' 'abilities'. Moreover, the documents made the distinction that it was 'ability', rather than attainment that conferred the classification (DCSF, 2008a; DfES, 2006a). This perpetuates the production of a mathematical child with a fixed, 'natural' ability. By 2008, characteristics of the 'gifted and talented' pupil (who had been repackaged as a more neoliberal, managerial gifted and talented 'learner') include:

> be[ing] very articulate or verbally fluent for their age; learn[ing] quickly; show[ing] unusual and original responses to problem-solving activities; prefer[ing] verbal to written activities; be[ing] logical; be[ing] self-taught in his/her own interest areas; hav[ing] an ability to work things out in his/her head very quickly; hav[ing] a good memory that s/he can access easily. (DCFS, 2008a, p. 4)

as well as behavioural traits such as "be[ing] easily bored by what they perceive as routine tasks; not necessarily appear[ing] to be well-behaved or well-liked by others" (DCFS, 2008a, p. 4). This appears to be a subset of traits of the high 'ability' mathematical child from 2000 already discussed. I argue that there is also an attachment to the 'able' mathematical child as frustrated and impetuous genius or indeed, and again, to the romantic mathematical child of mathematics education. It is also interesting to note what characteristics are absent, that may be found in high achieving people in society. For example: creativity, team-work, self-awareness, diligence, reliability, and organisation.

This production of a 'natural' mathematical child is normalised by New Labour's educational policy position, when progress/attainment is below expected levels. As discussed in Chapter Five, when pupils do not fit their projected trajectories they are labelled as deviant. They are "able pupils who lose momentum" or "able pupils who make slow progress" (DCFS, 2007b) or 'able' pupils who make "less than expected progress" (DCFS, 2007b, p. 12). This keeps them as

special but also draws on functional discourses of expected progress. Furthermore it allows them to remain within the bounds of the 'natural' mathematical child.

8.3.4 Lower ability/attaining pupils – the functional mathematics child

The discursive production of low 'ability/attaining' groups is very different. As mentioned earlier, it was similar at the beginning of the New Labour era when pupils when labelled as "very able or less able" (DfES, 2000, p. 5). However in later New Labour years, the language applied to and the discursive production of the "less able" pupils was repackaged to be more mobilising and more neoliberal. For instance, in educational policy documents lower 'ability' pupils are constructed as "under attaining" (DCFS, 2007a) or "underachieving" (DCFS, 2009b) or "slow moving" (DCFS, 2008b). The implication is that they have mobility and hence opportunity - their state is transient, and hence can be improved. The language is maintained more generally by other New Labour educational policy documents that talk of "moving on in mathematics" or "narrowing the gap" (DCFS, 2009b). The inference is that lower 'ability' pupils are not fixed in their place but they can move to a 'normal' state. This mobilising language provides a contrast to the 'gifted and talented' who can be fixed by language as they always already have mobility through their status as 'naturally able': they are a desirable kind of different. This message is reiterated by Williams, in his independent review (2008), who similarly uses "high ability" and "low attaining". This could encourage pupils and teachers to construct high achievement as internal and belonging to themselves, and low achievement as external and somebody else's fault. This is problematic for many reasons, particularly as it sets up a division between groups of pupils in mathematics, and labels some as 'real' mathematicians.

Another difference between treatments of 'ability' groups occurs in the version of support offered to low 'ability' pupils. Specifically, the lower 'ability' groups are commonly assigned catch up classes, through various interventions, either supporting the pupils in the class, or removing the pupils from the class and supporting them in a separate environment. However, we can question the nature of this support, such that more time and support creates dependence (Llewellyn & Mendick, 2011), particularly in contrast to the preferable always already independent self-taught inquiring 'able' mathematical child discussed in the previous section. Williams (2008) advocates intervention, but does query the setting up of it as the principal aim. He states, "it is the position of this review that quality first ('wave 1') teaching for **all** children, over the long term, is the major determining factor in adult numeracy, not intervention" (Williams, 2008, pp. 30-31, original emphasis). This does hint at the concern that that it is too easy to use intervention as a crux, a catch-all to support ineffective practice. The practice of intervention also means that some pupils

are more easily positioned as non-mathematical through structural school norms, and deficit models of 'ability' and of the mathematical child.

8.3.5 Different discursive productions of the mathematical child – an incoherent message.

As with the notion of extra support, it is easy to see that there are good reasons to construct low 'ability' pupils as having moveable ability. However, when this is positioned against the static, natural high 'ability' the message is incoherent and confusing. If we examine a trait, such as 'potential', that appears in much of New Labour documentation it is problematic. For instance, "all children and young people with outstanding academic ability or with particular sporting or artistic talent should be able to achieve their potential" (DfES, 2001, p. 20). The statement, from New Labour's second education white paper, is written for "all children", and thus there is a nod to equity, which is common within New Labour's policies. However, the statement is found in a section for "gifted and talent children" and it specifically refers to those with "outstanding academic ability", thus this group is privileged as these are pupils that have greater potential. These pupils have inner qualities that are aligned to the inquiring, romantic child. This is problematic in relation to some of New Labour's promise of "narrowing the gap" (DCFS, 2009b) and the associated statements such as - "[we must make] sure that all children benefit from rising standards and closing achievement gaps by bringing those who struggle up to the standards of those who achieve the most" (DfES, 2001, p. 12).

This tension is accentuated by the sliding between ability, attainment and progress. As I have shown, within educational policy, ability is ignored in low 'ability' groups, and progress/attainment can be overlooked when classifying high 'ability' groups, hence it is easy to mix the terms. The mathematics education policy documents *Making Good Progress* (DCFS, 2008b) and *Keeping up – pupils who fall behind in Key Stage 2* (DfES, 2007a) warn against this. They state "in many schools the children who were making slow progress were placed in the lowest ability group and the planned teaching programme was unlikely to secure their progress to level 4 by the end of the key stage". However, this does contradict other statements from the documents, namely that speed is a marker of ability. Hence, the sliding is also done by New Labour educational policy documents, it is always already in government discourses.

Thus overall, I argue that New Labour educational policy documents are caught up in essentialising notions of ability that construct it as innate (also argued by Gillborn & Youdell, 2001); this is particularly true for the more 'able' or 'gifted' pupils, and hence there is an alignment to romantic inquiring child of mathematics educational research. However, I also argue that for

the majority, ability is written out of educational policy documents, so attainment can be constructed as fluid and possible for all. Thus New Labour educational policy produces a discordant message that is unsustainable in practice. Furthermore, I suggest that assigning pupils to 'ability' groups enhances, stabilises and normalises difference.

In the next section, I argue that if you segregate people into 'ability tables' then you do create opportunity (as befitting of neoliberalism), but only for some and consequently opportunity is limited for others. Moreover, I go on to show how New Labour's incoherent construction of ability causes conflict for the student-teachers.

8.4 Troubling ability within student-teachers' talk

In this section I show that the student-teachers' essentialise pupils, more so than educational policy documents. They form judgements based on grouping and perceived 'ability'. Moreover, they often see pupils as defined by ability over other characteristics; it was the most dominant theme of their interviews. However, they also have functional expectations, in that they know there are certain levels that pupils should achieve. This results in confusion, and frustration. As such, when ability is enacted in the classroom it is not used to mobilise pupils as the fantasy of policy suggests; instead ability demobilises, particularly for the lower groups, the ones who are most in need of movement.

I begin by showing how the student-teachers construct mathematical ability as fixed and innate, though often they frame it around neoliberal ideas that are never fully realised. I then show how ability groupings magnify this and how this leads to restricted pedagogies. Finally, I note the conflation between ability, progress and speed. Overall, I argue that the dominant fixed notion of mathematical ability is incompatible with the inherent fantasy of neoliberal policy.

8.4.1 Troubling the discourse that everyone can achieve at mathematics.

There are several extracts where the student-teachers seem to follow the neoliberal position of New Labour educational policy, that everyone can do mathematics. For instance, in year 1 of her studies Jane states:

> Jane: I don't think it takes a type of person I think it takes a type of education. I think it's the way you're taught it that makes you decide whether you're good or bad at maths.

Jane, constructs being good at mathematics as dependent on how a pupil is taught. This relates to earlier chapters, where Jane recounted not enjoying how she was taught mathematics, shown in Chapter Six, as 'not being able to 'understand' (do)' and in Chapter Seven through her 'lacking

confidence'. This is also consistent to the positioning in Chapter Five, where she placed responsibility for pupils' progress onto the shoulders of the teacher. Jane is perhaps unique in this small group of student-teachers, and demonstrates the most outwardly negative reading of mathematics lessons. She could be read as a functional mathematical child, whose success in mathematics is dependent upon external factors, such as good teaching.

In contrast Louise and Nicola, construct being able to do mathematics in a more neoliberal fashion, as concerned with choice, independence and the empowerment of self:

> Louise: Everybody's certainly got the ability to be good at maths but it's whether they choose to or whether they choose not to. And I think a lot of it again, learning from this course [university], it stems from your early years and what your attitude towards teaching, towards maths is then. Like, most of my teachers had it pretty negative, but I was lucky enough to be able to put myself out of that.

Similarly to Jane, Louise asserts that everyone can do mathematics, but differently Louise takes the responsibility for being good at mathematics onto herself (rather than the teacher). Below she expands on this, by drawing on neoliberal fantasies of the always already 'able' mathematical child as someone who: understands (Chapter Six); is confident (Chapter Seven), and is an independent problem solver (Act Two):

> Louise: No, I've always enjoyed maths, always enjoyed maths, I think it was just the actual day of my exam because I'd been predicted a much higher grade, and I did the higher paper, and I, I know, roughly, I can't remember the exact, the exact exam but I know around the time of my GCSEs 'cos I was ill but I couldn't stay off, and to be honest I didn't revise that much, I got, I knacked it up for myself, so, that's why I ended up with a poor grade but I've always enjoyed maths ... for some reason I seem to have a brilliant understanding of it and it wasn't from my teachers, where did I get it from? ... I'm probably one of the few who really enjoy maths.

This positioning is very typical of Louise's interviews, and is consistent throughout the three years on the course; there is a strong desire to be seen as good at maths (Mendick, 2006). Her discussion signifies the dilemma that educators are faced with, when discussing ability; she states that everyone can achieve, and tries to remove ability by discussing her choice (in a neoliberal fashion). However, she is drawn into essentialising qualities of the 'naturally able' mathematical child.

Nicola similarly constructs herself as the always already 'able' mathematical child; the romantic inquirer of mathematics education research and 'gifted and talented' policy documents.

She states that her success in mathematics was not related to the teaching she experienced but was due to herself:

Anna: Do you think, would you say you're particularly good at maths, or…

Nicola: I've always been good at maths, but getting past GCSE I think I've, just not 'cos the effort,

Anna: Okay, so you didn't choose it [A-level mathematics]?

Nicola: Well I did, but I did it for a month, and got bored of it and gave it up at A-Level.

This was also shown in Chapter Six (section 6.4.3), where she positioned herself as 'naturally' good at mathematics in contrast to her sister, who was good but not naturally so. Moreover, in Chapter Five, certain types of progress were reserved for the 'higher' 'ability', as Nicola "widened" the mathematics.

Both Nicola and Louise are keen to take responsibility for their own progress. They also had the strongest positioning of themselves as the naturally 'able' mathematical child – the romantic natural inquirer. This is consistent throughout their interviews.

8.4.2 The homogenising of each 'ability' grouping – the naturally able and demobilised rest

Kate however is adamant that all cannot achieve. She identifies issues which restrict pupils' progress, such as a lack of understanding (see Chapter Six), but views this as fixed, rather than fluid as in educational policy documentation. In a typical extract, she seems to find this frustrating, and as in Chapter Five, the blame for the lack of progress is placed with the pupils.

Kate: I think you have to be quite logical [to be good at mathematics]. My bottoms they can't see the connection. It's like at the time, they can't do it, they cannot.

The use of "bottoms", to describe her pupils, signifies a fixed and inferior positioning; it is both punitive and demobilising; which contrasts to the mobility afforded pupils in low "attaining groups of educational policy. This positioning is consistent throughout Kate's interviews.

When discussing their own pupils rather than themselves, the student teachers' constructions of mathematical ability are bounded by the 'ability' groups in which the pupils were set. As already established in Chapter Five, and in some of the examples already discussed in this chapter, all of the student-teachers spoke about pupils on each 'ability' table, as if their 'abilities' were fixed and uniform. This is not a new phenomenon, many (such as McIntyre & Brown, 1978,

1979; Ruthven, 1987) have written about 'ability stereotyping' in detail, and as discussed, mathematics education researchers are aware of the problems with this.

> Ability and hierarchy appear, then, to be concepts central to the way in which many mathematics teachers theorise mathematics learning, and their organisational and pedagogical practice. In particular, in making sense of and responding to the successes and failures of pupils. (Ruthven, 1987, p. 245)

However, what is interesting for this thesis is that this thought is unchanged; the mobilising language of neoliberalism appears to have not permeated the fixed discursive construction of ability; moreover, mathematics education research has failed to administer mathematics for all pupils. The following extracts exemplify this; they are all from individual interviews and are indicative of the wider interviews:

Louise: There's a lot of behaviour problems in my group two. Group one you can tell them to do it, but even my group one, my circles have such high ability, they're fantastic you know.

Nicola: My highers can do fractions, equivalent fractions, everything. The Lowers don't even understand basic fractions.

Leah: These can only cope with about Year three work at a push with a bit of support. And they're all in Year four. Then I've got over there, my Year four table, they were in Music which is a bit unfortunate, but they are really, they're up to Year five. They're higher level, they're brilliant.

Sophie: The lower ability want to learn it and want to have a bit more help, but the higher abilities just sit there and aren't fazed by it, unless you give them something really exciting to do like plan a game or do a competition or something like that, then they're not really fazed by it. If you get them to sit down and do sums they'll just do them as quickly as they can and then think they're done

Kate: See, I was surprised that green group flew through it, but that's because they had pennies ... And Josh, bless him. He couldn't quite grasp 15. But he's a green, he's middley, lowey

Jane: I tried putting a higher achiever and an average achiever together, and I just had all the lower achievers together working with the TA, and that just didn't work because the higher achiever was always the dominant.

In the statements, the higher ability groups seem to be more valued and can achieve, similarly to educational policy; "they're brilliant" – "they're fantastic" – they "can do". However, the lower ability are produced as stuck, which is very different to New Labour's neoliberal mobilising policy discourse; "they can only cope with" certain work - they "don't even understand". In addition,

support and teaching assistants (TA's) are restricted to the lower groups. There are subtle differences within their extracts of course. Sophie acknowledges that lower ability pupils "want to learn", though the implication is that they cannot. With regards to language, Jane uses the more neoliberal word "achiever", Leah refers to levels, whilst Kate and Nicola miss out the word ability altogether. Although throughout, the discourse of ability/achiever seem to be similar, in that each group is constructed as having fixed and common traits, and learning potential.

Thus, I suggest that the predominant use of 'ability' setting/grouping demobilises, rather than mobilises, in contrast to what New Labour educational policy suggests. Furthermore, this is shown by the versions of pedagogy that are afforded each group. This builds on the discussions in Chapter Five, where I suggested that different versions of progress were available to certain 'ability' groups; specifically, that the more 'able' were allowed to be the romantic inquiring mathematical child of mathematics education research – the autonomous 'gifted and talented' of educational policy.

The first examples I discuss below, are all linked to the setting up of support, which has already been mentioned in the interviews extracts above. Specifically, Louise states that "with group two you have to spoon feed them", whereas for group one "I can trust them to get on with the work, they will push themselves". Here, Louise is creating a discursive position that the lower 'ability' groups can only work when given more direct support, specifically through more didactic pedagogical methods. In contrast to this, the higher group is allowed independence. As discussed in the previous section, this follows the advice offered by New Labour educational policy, that the more 'able'/gifted are to be treated differently and are independent inquirers.

This is also shown where extracts construct the lower 'ability' groups as needing the support of physical manipulatives, whereas higher 'ability' pupils are more independent, 'natural' problem solvers. As discussed earlier, this division of task by 'ability' set is common practice in primary schools (Houssart, 2001), however we can query if it is useful, as Seeger (1998) has, and we can ask what work it does. In this instance, Kate seems to construct using manipulatives as inferior and not conducive to learning. She states that lower ability groups "would just sit and play with their counters". She reiterates this by validating a higher ability pupil who has poor motor skills:

> Kate: My top boys don't have the motor skills to deal with cutting. One of our boys, he can tell me what's happened, probably on what page, very methodical. Give him a pair of scissors he can't cut out ... he has gained the knowledge through reading.

Nicola also states that her "lower ability are all kinaesthetic learners". Of course, the system may have worked that way, so all of the pupils who prefer kinaesthetic learning have ended up in the lower group, perhaps because they could not access the written work, or Nicola may be constructing the pupils as kinaesthetic because of their placement in the lower ability group. She also reiterates the point that the lower ability group are dependent and they need support "I've got Joan, wonderful TA. But when she's not here a lot of them say 'I can't do it'". Although it is not clear if Nicola would prefer that her pupils had more or less support in order to create independence. It is a similar statement to those explored in Chapter Seven, where I showed that confidence was constructed as an inner state, found only in the most 'able' mathematical child. In addition, with Heather Mendick, I have argued before that:

> by intervening, we position pupils as dependent, slow and unconfident in relation to mathematics, partly perpetuating a cycle that keeps them in their place, as 'unable'. The alternative is not to withdraw support but to question the setting up of independence, speed and confidence as goals and the positioning of support as something needed by those who are lower/lesser. (Llewellyn & Mendick, 2011, pp. 60-61)

In Chapter Five, I mentioned that with her concern to move pupils through levels, one student, Jane conflates speed and progress. My concern here is that this is further embedded, and speed becomes a marker of ability. Whilst this is not dominant through all of the student-teachers' interviews, the few examples I use next illustrate how the conflation can happen. For instance, Sophie states to be good at mathematics "you've got to be quick". This is a common discourse of mathematics (discussed in Chapter Three). Nicola reinforces this by praising a bright pupil for her speed: "she's one of the brightest kids like you ask her twelve times-tables and she can just rattle them off in about ten seconds flat". Hence, in the mathematics classroom, being quick can become the most valuable trait, and as such, pupils can prioritise this over other aspects of mathematics. In another example, Sophie also praises speed, as demonstrating acceptable performance:

> Sophie: Ryan's one of the least able children in the class and if he's given a task to kind of do and he's competitive about it his hand's up quicker. Even if it's the wrong answer he'll give it a try and that's better than him sitting in the corner thinking 'I can't do this, why even bother?' He needs that competitiveness.

Whilst Ryan is not a 'naturally able' mathematical child, the social markers of this construct are seen with the focus on speed, completion, competition, and confidence (see Chapter Seven) these are valued more than other traits which may benefit Ryan, for example he is not praised for

thinking about the problem. This is not a new phenomena, but instead is an established and familiar discourse of mathematics and one that is gendered (Mendick, 2006). Indeed, it is reminiscent of the way Leah learnt mathematics 15–20 years earlier.

> Leah: you're on a table full of people and, like, someone will be on red [book], someone will be on orange [book], and you'll be like, how come you're orange and they'll say well I'm faster than you and it's terrible but that's what it's like bragging in the playground, I'm on purple. It was terrible!

Hence overall, I argue that 'ability' grouping enhances the common discourses of mathematical ability as it functions by enhancing divisions. Teachers look to categorise, and look to impose certain constructions of the mathematical child onto each group. This can be demobilising for pupils who are not highly 'able' as they are required to function through linear levels of progress to which they do not live up (Chapter Five). It is highly mobilising for the more 'able' who are always already positioned as being the mathematical child.

8.4.3 Critiquing the system of labelling and grouping by ability

However, and following Foucault's notion of the subject discussed in section 2.7, the student-teachers are not thoughtlessly caught up in this system. During a group interview, Nicola and Sophie indicate that they are aware of some concerns around ability labelling and grouping. This is shown in the extract below from a group interview. Its length is kept to demonstrate the depth of Nicola and Sophie's reflection.

> Nicola: To be honest the biggest problem is that because there are massive like divides in a single maths class, whereas English fair enough you've got a child than can read, write, spell from the second they enter school, but it's never made as obvious. Whereas in maths you get like your gifted and talented kids, and they're put on a pedestal. And then your kids that aren't getting something are compared to them. They're not made to feel like that child is just exceptional, you don't need to be up there, you need to be at this level. They're compared directly to those gifted and talented kids by themselves and by their friends and as I say, at that sort of time those ones that aren't doing well … I can't even get to like the middle group let alone those ones that are doing like year seven work when they're in year five. I think that's the biggest thing, whereas like with English and things there's no massive segregation like that. You might not be as good but you're still doing the same work, you're just doing it at a slightly easier level. Whereas maths you tend to give them completely separate work, which makes the segregation between your groups so obvious to the kids. But the kids are like well I'm no good at it. I'm going to be doing baby work for the rest of my life, I don't care anymore.

Anna: Do they set in other subjects as well or just in maths?

Nicola: They do usually set for literacy, but when they're set, I just don't think the prejudice is there like within the kids.

Sophie: It's because they can't really tell. I mean I've had it said to me before, that I'm doing the easy work, I'm like 'no you're not doing the easy work, you're doing the work that you can handle'. So they refer to themselves as the one who can't do it, whereas in English they don't see any segregation between each other, they don't compare themselves at all. They don't say oh her works better than mine, they just kind of get on with it and do what they can do. Whereas maths they're always comparing.

Nicola: In English the only time they've ever seen it completely segregated is when they were doing their FLS [Further Literacy Support] because otherwise … Whereas normally it's like they'll still be doing the same style worksheets but they might have more on the worksheet and you've just got to add in like the last couple of sentences, whereas maths you tend to give them like one group will be working with counters and the other group's got worksheets, and there's such a divide, and you know like I've got those toys on mine, and they're year sixes as well, and they've got worksheets with a nice fancy pen in their hand. As much as it's more fun to play with counters, you remember playing with counters in reception and I think you associate the hands on work with being a lower ability. Whereas in English and stuff you've always got the same stuff, everyone in the class has got a pen, everyone in the class has a piece of paper or worksheet or exercise book or, you dividing what you're made

Above, Nicola states that the differences in ability are much more obvious in mathematics that other subjects. She reasons that this is produced by the different work and resources given to each 'ability' group. In addition, she is aware of the inequity and the "prejudice" and discrimination that pupils can encounter. In another interview she states, "they're [more 'able'] always treated as the special kids that know everything". Hence, there is awareness, but there is not yet resistance (as I have shown previously in this section). One of the main differences between Nicola and Sophie's analysis and mine is that they look at how pupils interpret mathematical ability in the classroom, whereas I examine how the student-teachers do so – as both teachers and pupils of mathematics. Similarly to mathematics education research, perhaps the student-teachers are not yet aware of their own roles in this demobilising production, or if they are, possibly they are not aware of how they can alter them. Their language above suggests that compliance is inevitable, and resistance is impossible. As Bibby states "developing personally motivated change is a risky business and the current climate is not supportive of teachers taking risks in the classroom" (Bibby, 2002, p. 719).

The other aspect that comes through strongly in Nicola and Sophie's' discussion is the empathy they have with their pupils. The pupils are not just functional automata that can move through levels, classifications and groupings, without feelings and without emotions, and neither are the student-teachers (as explored in the previous chapter). Nicola imagines how the pupils feel, whilst Jane can demonstrate it through her own experience:

> Jane: I started off in the middle group and went into the lower group and then I just didn't bother then for the whole two years.

In summary, in spite of some awareness of the issues with 'ability' grouping, I argue that the student-teachers overwhelmingly (re)produce mathematics ability as inherent and innate. However, their fixed conceptions of a natural mathematical ability cannot function within neoliberalism, which requires the mathematical child to perform as a functional automaton. Instead, the student-teachers will always already position the student-teachers and/or the mathematical child as deviant and/ inadequate. Furthermore, this positioning enhances the common discourses of mathematical ability, such as 'having understanding and confidence' which have been explored in the previous two chapters. This discursive production is aligned to, and thus aided by, the construct of the mathematical child within mathematics education research, as the romantic natural inquirer.

8.5 Chapter summary and concluding remarks

Overall, in this chapter I have shown that for a neoliberal discourse to succeed, in New Labour educational policy, mathematical ability must either be absent or constructed as fluid. The functional mathematical child of educational policy must have mobility. If this is missing, we may question if all pupils have the capacity to achieve, especially when progress is defined as linear and uniform (see Chapter Five); in particular the less 'able'/mobile would be the most obviously deviant group. I contend that within New Labour educational policy documents, 'natural' 'ability' is both present and absent creating an incoherent message; specifically some special groups are allowed 'natural ability' whilst others are not, creating discordance. The most 'able' are the always already 'able' mathematical child, whilst the rest are required to convert as functional automata.

In spite of this, mathematical ability is overwhelmingly present within the student-teachers' talk, and as such it seems to dominate constructions of pupils and of the classroom. In particular, their production of a fixed and innate mathematical ability can discriminate and legitimise prejudice and inequity in the classroom. This is possible through discourses of individual 'abilities' but is enhanced by the fabricated space of 'ability' grouping as the policy-advocated

norm in the primary classroom. These 'ability' groups/tables can work to normalise, homogenise, and create inequity as teachers have set expectations of/for each group. This is legitimised through the favouring of the autonomous individual with/in neoliberalism, and hence the 'naturally able' group.

Thus there is something rather static about mathematical ability, and 'ability' grouping, and the productions within them. For equity to ever be possible in mathematics classes this needs to be addressed. Hence, the overlooking and simplicity of this in New Labour educational policy is somewhat concerning. Moreover, I question the role of mathematics education research, with their aversion to setting by ability, as they/we ignore the cultural regime in which truths circulate. I also query the impact of favouring the romantic natural inquirer as the mathematical child. The concern is that whilst they/we do this, we are naturalising mathematical ability and the always already 'able' mathematical child, despite their/our critiques of setting; thus, it becomes too easy to exclude people from the mathematics classroom.

In the concluding chapter to follow, I draw all of Act Two together, and reiterate my overall thesis argument. I specify my original contribution to knowledge, and suggest implications for the future for the mathematics education community – researchers, policy makers and teachers.

Act Three: Overture

9 Chapter 9: Concluding Remarks

9.1 Summarising the thesis argument

I began this thesis by contesting the lens through which mathematics education in general and specifically mathematics education research produces itself; arguing that we are bound by the parameters that produce us, and as such we can only see, say and hear certain positions. As Foucault states, people, institutions and societies

> govern (themselves and others) by the production of truth (I repeat once again that by production of truth I mean not the production of true utterances but the establishment of domains in which the practice of true and false can be made at once ordered and pertinent). (Foucault, 2003c, p. 252)

Examples of these truths/discourses in mathematics education unpacked in this thesis include: that progress is inevitable; that teaching for understanding is the best way, and that you need to be confident to succeed in mathematics; these being found in public discourses and mathematics education research. My concern is that once we accept these positions as real, we are always already propagating them as opposed to questioning them. As such, we may be feeding practice that is not 'good' practice in the sense that it excludes many from mathematics.

That is the crux of this thesis, and this forms my 'original' contribution to knowledge, (though 'original' within poststructuralism is problematic, as events and subjects are formed on the past constructions and contingencies). My contribution is to unpack norms of the mathematical child and the work these do in relation to who is included and excluded from this position. I have explored this by focusing on key discursive domains of production that I argue shape what is possible to say and hear, namely mathematics education research and New Labour educational policy. Then I have analysed this in relation to student-teachers' talk, examining how these discourses coalesce and conflict. Throughout, I have used a Foucauldian philosophy to drive my study, arguing that this allows me to step outside the norms of mathematics education, and the practice in which I am situated.

During my analysis, it became apparent that constructions of the mathematical child were homogenised in New Labour educational policy, as functional automata (apart from the most 'able' group) and within the dominant strands of mathematics education research, as a 'natural' romantic inquirer. The former of these positions being my 'original' contribution to the sociology

of childhood. Moreover, I contend that these constructions were most often hidden from view, and thus taken-for-granted as the truth. As such, they were always already parts of the documentation and the mathematical child is always already predetermined and constituted around this version of the normal. Furthermore, this led to inclusions and exclusion from the mathematics classroom. Thus, my research question became: **how is the mathematical child produced within the becoming of primary school student-teachers in England, and how does this include and exclude people within the mathematics classroom**.

In particular to answer this, I have 'originally' shown that both of these productions of the mathematical child, from mathematics education research and New Labour educational policy, are based around the normal cognitive child, but this takes different forms within these different domains. Specifically, and as stated, the construction of the mathematical child of mathematics education research is a 'romantic' natural inquirer, someone who is keen to achieve, and thrives on problem solving and discovery. This position, draws from a Rousseauian perspective where the child is a state of nature (Rousseau, 1755/2007) and/or from developmental psychology which is constructed around the natural child, and the concept of maturation (James, et al., 1998). However, as Walkerdine (1998b) clearly demonstrates, the child of developmental psychology was defined by the process that produces her/him. Both Rousseau and developmental psychology assume that the child is natural and free to make decisions. Hence, I argue that the position of mathematics education research both produces progress as a hierarchy of reason and rationality, as well as romanticising a "golden age" of the past. The mathematical child of New Labour educational policy is similar in that it is concerned with the cognitive child, but different in that its basis is not in nature or hierarchical development, but instead is in the child as a functional automaton. This mathematical child is a product of a programmed production line, who completes objectives through the demonstration of outputs in a mechanistic fashion. Hence, what is missing from both of these productions, is the mathematical child as social, or cultural, as different or as messy. Furthermore what is absent is the mathematical child as different on different days, and as connected to the wider world. Instead, we see how both mathematics education research, and New Labour educational policy, construct and thus produce a version of the normal mathematical child that is an impossible fiction.

I demonstrated these positions by arguing that one of the fundamental norms (and barriers) of mathematics education research (or any education research) is the notion of progress. Education with its emancipatory narrative is always already bound by the promise of improvement, and as such, it only functions around development. Specifically, I demonstrated

how this development takes on certain constructions within the two domains of mathematics education research and New Labour education policy. Progress for the mathematical child of mathematics education research is bound by 'developmental' hierarchies and achieved through progressive pedagogies, such as problem solving. Whereas progress for the mathematical child of New Labour education policy is linear, objective driven and concerned with being able to do. Both of these notions of progress encourage comparison to the norm that increases the production of a normal mathematical child and everyone else is constructed as deviant.

I explored this in more depth in the next chapter by examining it, in relation to a cognitive norm of the mathematics classroom - understanding. Here I unpacked the use of the term understanding and demonstrated the same positions described above, that mathematics education research has a romantic view of understanding and New Labour education policy has a functional one. To provide a broader perspective, I next examined the use of an affective norm of the mathematics classroom – confidence. Here, I again argued that mathematics education research has a romantic view of confidence, in that it is associated with cognition through the lack of acknowledgement of emotion, and the production of the natural mathematical child. In contrast to this, I showed that New Labour education policy has a functional construction of confidence and the mathematical child, through its conflation between confidence and competence.

Throughout, I demonstrated that these were impossible fictions that student-teachers struggled to find in their mathematics classrooms. Instead, I argued that both student-teachers and their pupils are complex doers of mathematics, caught up in cognitive, social, cultural and emotional positions. Moreover, they are not universal or uniform categories and do not behave as such. The mathematics classroom, the student-teacher, and the pupils, were all messy. Teaching is a process which is caught up with the teacher's identities, similarly doing mathematics is caught up with the child's identities. As such, what is mathematically possible for any pupil is a complex hybrid of these.

Finally, I argued that one of the most overriding aspects of the mathematics classroom that strongly influenced the construction of the mathematical child within the student-teachers' classrooms, was the construct of mathematical ability. The student-teachers' talk was dominated by constructions of 'natural' 'ability' that were enhanced by the progress and levelling culture of the classroom, and the practice of ability grouping. As such, pupils become fixed around their table/ability and what is possible for them is bounded by this. Hence this includes and excludes many from mathematics. Alongside this, the student-teachers had functional expectations which

were encouraged through New Labour educational policy. This mix is symptomatic of the incoherent construction of 'ability' within New Labour educational policy. Specifically for everyone to have mobility and opportunity, the mathematical child is constructed as special and as more (naturally) 'able'; this gives them mobility and the right to greater 'progress'. These children perform 'real' mathematics through demonstrating 'understanding' and 'confidence'. Furthermore, this position is enhanced through mathematics education research's commitment to the romantic natural inquirer and to progressive pedagogies, despite a widespread critique of ability within the field. In contrast, the concept of 'natural' ability for the less able in educational policy is disregarded. Instead, anyone below the norm is repositioned as "under attaining", and as any functional automaton they are expected to move seamlessly through targets and levels. However, in practice this does not happen because of the wider discourses of ability, confidence, understanding and progress which construct many as outside the bounds of the mathematical child.

9.2 What are the implications for the mathematics education community: policy makers, teachers and educational researchers

Student-teachers do (and will) struggle with tensions between competing discourses, especially when such value is attached to them. Moreover, they will find it particularly difficult when discourses do not acknowledge or speak to each other. In the case of this thesis, they may look for measurable markers that work within neoliberalism. What is perhaps most concerning, and what is drawn out of this thesis, is the inherent assumptions that are constructed about the mathematical child and the reification of the normal. These are not to be disregarded, "this fiction of what a normal person is like has important effects, according to Foucault, in courtroom, prisons, and various other institutions such as universities" (Pickett, 1996, p. 453). In this case, there are assumptions about what progress pupils should be making and how they should do and demonstrate this. Furthermore this determines who has value.

I would like to suggest some implications, or rather considerations, for teachers, education policy makers and educational researchers. In the first instance, I suggest we should question what else we do when we place certain behaviours, such as progress, understanding, and confidence upon pedestals. Moreover, we should interrupt these dominant discourses of mathematics education. For example, we can disrupt what we mean by progress by contesting the need to demonstrate it as linear and as unproblematic. Instead, we must query what we mean by progress, and examine its cultural relevance. We do not need to privilege understanding but

instead see it as part of a complex process of learning that includes gaining knowledge. Instead of confidence we could at times encourage doubt and questioning. We could foster acceptance around worry and suggest that struggling with mathematics can be conducive to learning it. In addition, we could stop producing children's understanding and confidence as highly valued characteristics, and instead question how we identify them in children as a way of disrupting their naturalisation within some bodies and not others. Also, we could allow emotional responses to mathematics, ones that can at first appear negative. Hence, we must acknowledge that children doing mathematics are not simply cognitive beings, but are complex and made up of emotions, and social and cultural subjectivities. Finally, we should all consider what work we do when we promote something as necessary or good.

It is important that these final two points are considered not only by mathematics teachers, but also by mathematics education researchers, who too often construct themselves as removed from the discourses that circulate and create positions or 'problems' within mathematics. It is the case of this thesis that they may encourage the construction of mathematical 'ability' that many also critique. Hence, I challenge some of the norms upon which mathematics education is based. Particularly, I suggest that the mathematics education research community 'should' look for alternative ways around essentialising and/or normalising the mathematical child. More than this, they 'should' examine themselves in relation to what they do, and what they promote.

Of course, I too am not removed from this. However, in this thesis I have deliberately attempted to disengage from trends in mathematics education, and its dominant discourses. Throughout I have used Foucault to do this and to be aware of the parameters that produce us. As Foucault states it is:

> Discourse – the discourse that names, that describes, that designates, that analyzes, that recounts, that metaphorizes, etc. – constitutes the field of the object and at the same time creates power effects that make it possible for subjugation to take place. (Foucault, 1989f, p. 157)

For policy makers, it is fairly obvious that they need to adopt a less simplistic one size fits all approach to many things. However, and as discussed in Chapter Eight, two sizes is just as damaging creating more divisions. For all of the mathematics educational community I am suggesting more complexity and nuance, more messy fuzzy areas; less box fitting and less best fit. I acknowledge this is difficult in an era which privileges an over simplistic 'what works' version of

educational research, policy and practice. Beyond this I do not wish to offer 'better' alternatives, as Foucault states,

> The work of an intellectual is not to mold the political will of others; it is, through the analyses that he [sic] does in his own field, to re-examine evidence and assumptions, to shake up habitual ways of working and thinking, to dissipate conventional familiarities, to re-evaluate rules and institutions and starting from this re-problematization (where he occupies his specific profession as an intellectual) to participate in the formation of a political will (where he has his role as citizen to play). (Foucault, 1989b, pp. 462-463)

I will make one final assertion: one version is not only good or bad and every account has its technologies of surveillance and its regimes of power; although some are more covert than others. It is these less obvious forms of common sense masquerading as good or as liberation that warrant closer inspection.

Epilogue

Anna is fed up with always being told she is not confident. Anna fails to see how this helps anyone. She thinks she wouldn't be told that as often is she wasn't a woman.

Anna prefers doing what she wants to do, rather than what she should.

Anna finds it difficult working in a mathematics education department, where the only view is of the cognitive pupil.

Anna finds it difficult working in a department where experiments, RCT's and statistics are king.

Anna is sceptical that there really is a best way to learn mathematics for every child.

Anna admires researchers who think the world and education can be measured. Though she disagrees with them, and worries for the future of both education, and over surveilled school children and teachers.

Anna has enjoyed supervising Masters students from different countries, who have different cultural perspectives on learning and teaching.

Anna enjoys learning, thinking, and studying. She found this PhD process both the best, and most difficult thing she has ever done.

In the near future, Anna plans on studying more social and cultural theory.

Anna lives in Newcastle, with her partner Helen and her cat Jasper. There are all very happy.

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Appendix 1: Published work

Educ Stud Math
DOI 10.1007/s10649-012-9409-7

Unpacking understanding: the (re)search for the Holy Grail of mathematics education

Anna Llewellyn

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Abstract In this article, I deconstruct the concept of understanding in mathematics education, examining how it is spoken into being and what work it does for primary school student teachers. I use poststructural analysis to unpack interviews with a student teacher, Jane, drawn from a larger longitudinal study. I show how she negotiates tensions between "romantic" discourses of understanding within mathematics education research and "functional" discourses of understanding within neoliberal mathematics education policy. A romantic discourse constructs understanding as an aspect of being resulting from the natural curiosity of the child. A functional discourse constructs understanding as performances within which the child is indistinguishable from automata. I argue that Jane takes on both functionality and romanticism, but they collide creating a disorderly discourse of understanding that reproduces inequity.

Keywords Understanding · Policy documents · Mathematics education research · Poststructural · Foucault · Neoliberal

1 Introduction

In the field of mathematics education, the "quest for understanding" is akin to the (re)search for the Holy Grail. As I argue in this article, mathematics education research is preoccupied with exploring how to develop student teachers' understanding of mathematics and convincing student teachers to teach mathematics for understanding. Although at first it may appear difficult to argue against this, any discourse makes some things possible and others impossible, excludes some people and includes others. Thus, any term can benefit from deconstruction to determine its "history of the present" (Foucault, 1977, p. 31). By this, I mean that we can unpack how it is spoken into being and the consequent work that it does. What happens when teachers state that they want to understand or that they wish to teach for understanding? What is it they want and what work does this do? And, what if their and our "quest for understanding" (Boaler, 1997b, p. 111) is a masquerade for something else?

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Chapter 11

Should 'teaching for understanding' be the pinnacle of mathematics education?

Anna Llewellyn

> I know that you believe you understand what you think I said, but I'm not sure you realise that what you heard is not what I mean.
>
> (Robert McCloskey)

What does the above quotation mean to you? It reminds me of the frequently heard question in the classroom 'do you understand?'. Whilst looking rather innocent, this can be a problematic question – for instance, how valid is the answer? If you ask this to a student and they answer 'yes', what have you learnt? That they are compliant? That they have heard you? Or that they think they understand you? Perhaps the question you are really asking is 'do you understand in the manner that I understand?' or 'do you understand in the manner that I want you to understand?' but of course the student may not always know if they do. Even if you can establish that they have understood in the way you intended, what do you mean by understanding? Do you mean that you want them to understand how to do the work or are you hoping for something else mathematically; a spark that suggests something 'deeper'?

By asking these questions we have begun to problematise the concept of understanding. We have questioned the amount it is used and the way it is used. We have queried what people mean when they use that word; we have even begun to consider the value it has and what it does to the classroom. We have also suggested that language, in general, is not transparent, meaning is subjective and created in context. This is essentially what this chapter is about; I want to question an accepted good of the mathematics classroom – teaching for understanding. One key way in which I do this is to examine the subjectivity of language and how it can create meaning.

Teaching for understanding seems to be viewed as the crème de la crème of mathematics education. Indeed it features as a topic on most teacher education programs. But why is this? Do we believe this creates better mathematicians or people, or do we believe this is the correct, and only, way to learn mathematics? If we do suppose these things what does that mean for the classroom? Should we blindly pursue teaching for understanding and assume

http://www.routledge.com/books/details/9780415623858/

Appendix 2: Ethics Form

Durham University

School of Education

Research Ethics and Data Protection Monitoring Form

Research involving humans by all academic and related Staff and Students in the Department is subject to the standards set out in the Department Code of Practice on Research Ethics. The Sub-Committee will assess the research against the British Educational Research Association's Revised Ethical Guidelines for Educational Research (2004).

It is a requirement that prior to the commencement of all research that this form be completed and submitted to the Department's Research Ethics and Data Protection Sub-Committee. The Committee will be responsible for issuing certification that the research meets acceptable ethical standards and will, if necessary, require changes to the research methodology or reporting strategy.

A copy of the research proposal which details methods and reporting strategies must be attached and should be no longer than two typed A4 pages. In addition you should also attach any information and consent form (written in layperson's language) you plan to use. An example of a consent form is included at the end of the code of practice.

Please send the signed application form and proposal to the Secretary of the Ethics Advisory Committee (Sheena Smith, School of Education, tel. (0191) 334 8403, e-mail: Sheena.Smith@Durham.ac.uk). Returned applications must be either typed or word-processed and it would assist members if you could forward your form, once signed, to the Secretary as an e-mail attachment

Name: Anna Llewellyn

Title of research project: 'Becoming' a teacher of mathematics: a post-structural exploration of the 'journey' to become a primary school teacher of mathematics; with specific emphasis on the potentially conflicting discourses of primary school teaching, mathematics and gender

Questionnaire

		YES	NO	
1.	Does your research involve living human subjects?	√		IF NOT, GO TO DECLARATION AT END
2.	Does your research involve only the analysis of large, secondary and anonymised datasets?		√	IF YES, GO TO DECLARATION AT END
3a	Will you give your informants a written summary of your research and its uses?	√		If NO, please provide further details and go to 3b
3b	Will you give your informants a verbal summary of your research	√		If NO, please provide further details

	and its uses?			
3c	Will you ask your informants to sign a consent form?	√		If NO, please provide further details
4.	Does your research involve covert surveillance (for example, participant observation)?		√	If YES, please provide further details.
5a	Will your information *automatically* be anonymised in your research?	√		If NO, please provide further details and go to 5b
5b	IF NO Will you explicitly give *all* your informants the right to remain anonymous?			If NO, why not?
6.	Will monitoring devices be used openly and only with the permission of informants?	√		If NO, why not?
7.	Will your informants be provided with a summary of your research findings?	√		If NO, why not?
8.	Will your research be available to informants and the general public without authorities restrictions placed by sponsoring authorities?	√		If NO, please provide further details
9.	Have you considered the implications of your research intervention on your informants?	√		Please provide full details
10.	Are there any other ethical issues arising from your research?		√	If YES, please provide further details.

Declaration

I have read the Department's Code of Practice on Research Ethics and believe that my research complies fully with its precepts. I will not deviate from the methodology or reporting strategy without further permission from the Department's Research Ethics Committee.

Signed …….. Date: 19/09/2006…

Submissions without a copy of the research proposal will not be considered.

Ethics Form Research Proposal - Anna Llewellyn

I aim to examine how the potentially conflicting discourses of primary school teaching, mathematics and gender 'play out' during the construction of student teachers', 'teacher' and 'mathematical' identities. Thus my main research question is:

How are potential primary teachers' identities of mathematics teaching produced and narrated, within the wider discourses of mathematics, gender and teaching?[3]

To do this I am going to work with a group of 6 students who are training to become primary school teachers. The participants will be students on the primary course at the Stockton campus. Specifically I will be focusing on their relationship with mathematics and following the plan below:

Year 1

	Interviews	Other methods	Analysis
Oct	Identify primary group of 25. Conduct initial semi-structured interviews		
Nov			
Dec			Transcribe data
Jan			
Feb			
Mar			Analyse collected data. Identify key participants
Apr			
May			
Jun	Conduct long semi-structured interviews around identified themes.		
Jul/Aug/Sep			Analyse collected data. Plan next year

Year 2

	Interviews	Other methods	Analysis
Oct	Group Interview		
Nov		Collect relevant government documents for analysis	
Dec			Continue to analyse collected data
Jan			
Feb	Interview students, including discussion of lesson	Observations in lessons	
Mar		Establish email conversations	
Apr			Analyse data
May			
Jun	Conduct long semi-structured interviews.		
Jul/Aug/Sep			Analyse collected data. Plan next year

[3] Notice how gender became a small part of the thesis, rather than an overall driving factor of analysis. The original question is not vastly different to the question I examined; specifically, the research methods proposed are very similar to what was originally suggested. Hence a new ethics form was not needed.

It is imagined that the methodologies used during the final year of the project will be a combination of the first two years; the exact format will take shape after the second year.

It is thought the interviews will be largely semi-structured (though some may tend towards unstructured). The initial interview will be the most structured. I will audio record the interviews.

The observations of the lessons (and the subsequent interviews) with the students requires considerable thought. It is imagined that I may present some kind of visual imagery (such as a video of the lesson) to the student; though of course there are ethical implications to consider (Noyes 2004). I would be using the video in the belief that it can aid collaborative discussion (Harper 1998) as I am attempting to conduct research 'with' the student as oppose to 'about' the student. I will contact the headteacher of the students schools to obtain permission to observe/video the lessons. (I will then contact parents on the headteacher's advise – though it should be noted that the video will be focused on the student teacher and not on the pupils)

To conduct this research project I will refer to the 'Revised Ethical Guidelines' from the British Educational Research Association (British Educational Research Association, 2004) and the departmental 'code of practice on research ethics' (University of Durham). For example being a participant on the project shall be completely voluntary and I shall ensure I have written consent; I shall also ensure I have informed the students fully of the aims of the project.

It is worth nothing that this research draws on post-structural and feminist theories and as such the research will be conducted with absolute respect for the person; an aim of feminist research is to create an atmosphere of collaboration and mutual respect (Bryman 2004) and certainly this would be true for post-structural feminism. It is also felt that this style of research will be able to counterbalance any perceived problems from my duel role on the course (of researcher and lecturer). As I only carry out a few lectures, it is felt my role as a lecturer will not be an issue for the students or cause any undue ethical concern for the course. Essentially I am offering the students a time and place to reflect upon their learning, which may be very beneficial to their studies and teaching practice.

BERA (2004) Revised Ethical Guidelines for Educational Research
http://www.bera.ac.uk/publications/guides.php
Bryman, A. (2004). Social Research Methods. Oxford, Oxford University Press

Harper, D. (1998). An argument for visual sociology. In J. Prosser (Ed.) Image based research: a sourcebook for qualitative researchers . London, Falmer Press

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Appendix 3: Interview schedule

Initial interviews November 2006

The purpose of my research is to explore prospective primary teachers' relationships with mathematics and mathematics teaching. In these initial interviews I am interested in finding out about your past experiences with mathematics, your current feelings about mathematics and your hopes for the future. There are no right or wrong answers; I just want to hear your story.

We will end the conversation after about 25/30 minutes (or before if it ends naturally). The dialogue should flow naturally, but I may ask you some questions that are similar to the following:

- The Past: Your history with maths (and maths teaching)
    - What qualifications do you have in maths?
    - Your reflections on school and maths lessons – did you enjoy either? Can you remember specific events?
    - Did you think you were good ta maths – why?
    - What happened in a typical maths lesson?

- The Present: Your current view of mathematics (and maths teaching)
    - Do you like maths?
    - Are you any good at maths? Are other members of your family (or friends) good at maths?
    - What types of people are good at maths?
    - What do people in general think of maths or mathematicians?

- The Future: Your hopes for the future with mathematics (and maths teaching)
    - Do you think your view of mathematics will change?
    - How do you want to teach maths? Is it different to other subjects?
    - Do you have any other hope for the future?
    - Do you have anything else you want to share?

Appendix 4: Initial interview details

Table 5: Initial interview details

Pseudonym	Time (min)	Transcription No	Comments	Status
Rachel	27	008	Liked Maths – very positive. Grade A at GCSE Independent all-girls school. Kumon. Did not choose it at A-Level as she wanted good grades- put off by family). Says she is competitive and likes to work hard. She suggests maths is hard. Strong maternal figure. Maths has to be fun throughout. Describes interesting lessons from her schooldays – discussion/practical lead. Quite young, but nice.	Transcribed in old format Use - no
Nicola	27	009	Liked maths – but both positive and negative and maths and school. A Grad at GCSE. State school to year 7. Independent from year 8 onwards. Took A-Level dropped it after a few months – she was bored (was it too hard?) Talks of maths as rote-learning. Strong maternal figure. Confident (arrogant?) – wants to be seen as strong and in control – she chooses when to work. Fast worker – bored a lot Position maths as boring, rote learning. Distinguishes between maths and problem solving as different things. Lost of storying.	Transcribed in old format Use ?
Jane				
Karen				
Sophie	22	012	Bad experiences. Good at Maths at primary – sat in tables. Mum has high expectations – strong maternal. (horrible story about mum joking 'that's not good enough'. Low in Confidence. Good at English. Describes different methods of learning and book work. Moved sets. Nice but fairly softly spoken. Lots of talk about the social. Pedagogy – silence, worksheets etc. Dislikes the teaching, but can't remember much	Transcribed in old format Use

			about the teachers. Setting- Moved down sets. Strong stories. (went to high-achieving local school).Positions herself at bad at maths. 'Liver's Out/Livers' in'. 18. Positions herself as outsider and 'negative thinker'. –'the worst is going to happen'. Bin opp	
Susan	30	013	GNVQ. GCSE C. Describes the teaching as poor. English strong – has a tutor for maths – very negative memories. Used to be a TA. Defines herself as thick – lots of positioning	Use
Harriet	25	015	'Only GCSE' – seems embarrassed. Streaming in year 14. 'Expected to get higher'. She describes herself as not good at maths. In the top set – bad memories – describes crying in the lesson. Brilliant story teller – but storying throughout the text – descriptive talker. Had a young teacher. Hasn't really thought about how she is going to teach. TA B-Tech Nat dip – did A-Levels but left (with one)	Use ?
Emily				
John				
Lisa	27	016	Confident, mature speaker. (intelligence shown). Has children (from 3 to 14). Describes her father-in-law as good at maths. Pleasant. GCSE (and weak A-Levels) – passed GCSE second time. Interested in my research	?
Sarah	23	017	Grade B at GCSE. 18 y old. Good stuff but gave quite concise answers (from memory it wasn't that easy interview). Didn't take at A-Level, took English – but doesn't really like English. Liked her maths teacher. Liked school in general. Parents are teachers. 'You're good at this, stick with that'. Likes setting (she may have been in a mixed group at school). Scared about teaching high ability. Positive about maths, but when challenged said she was	Good stories but prob not…

			negative about things in general. She asked me lots of questions at the end of the interview – said I like maths etc….very interesting…(this was the interview I did the most talking/questioning in)…	
Kate	25	018	Quite well spoken. A* at GCSE – the only person in set 3 to get an A* - she went to a high achieving state school. Took A-Level but found it 'really hard' got a C (she took 4 others very academic A-Levels). Still likes maths but the A-Level put her off – lots of Algebra. 'Boring old maths', 'you have to know the message to get the right answer' Maths = genius, maths geek. Was behind at A-Level because she hadn't done the same work as those in eth higher sets – dangers of setting	Use ?
Leah	28	020	Lost voice – but spoke anyway. GCSE Grade D. Foundation course, worked in a bank for a bit. Primary Good, really disliked secondary school maths. Talks about 'grasping' maths on the foundation course – simultaneous equations…'proving things to other people'. Setting – set 2…felt this was too high. Good storyteller, lots of Bin opps. Talks of people as gifted at maths. And 'breaking it down' lots of social stuff. Doesn't want others to feel like she did at school. Maths as quiet (at school).	Use ?
Elsa	30	021	Grade C GCSE (intermediate entry wanted to do better – mam had battle with school). Started A-Levels – no exams (family issues). Access course. Loved primary maths hated secondary. Mentions Setting; male teachers. Lots of Bin opps, lots of storying and positioning. Single parent family – talks really well about her child – good storyteller. Says she is quick at maths or number. Talks of children being 'scared of maths'. Interested in my	Good stories but prob not…

			research.	
Jean	18	(022) x		
Louise	37	023	Confident – A positive attitude. Better at Maths than English. In Group One – really interesting. (Nice contrast to Rachel). Access course (and GCSE). Got a D at school, but re-sat last year. Positive maths attitude comes from self not from teaching. Enjoyed Maths. Nice stuff about Carol Vorderman and 'maths geek' and other socio-cultural references. Lots of storying. Positive about uni as well. Good, strong, honest and realistic opinions about school and teaching. Good understanding of self. Very strong memories.	Use - definitely
James	23	024	Similar to Lindsey in some respects – he really seems to have considered what it is to learn maths and the course has changed him. Access course again. GCSE D. Not mathematically minded. Interesting gender stuff. Strong female role models. Good at Art/English. Great quote about mathematical = academic.	Use - definitely
Alice	19	(025) x		
Rita	34	026	Very Quietly spoken. 'Just a grade C' at GCSE. Started A-Levels, but dropped out. Worked for a while then foundation course. Positive about maths – positive about school. Talks about Maths as rote-learning. Seems to be quite influenced by peers or social stuff. Dad has helped with maths and continues to help with work. 20? Years of age.	Good stories but prob not…
Mark				
Amanda	25	(027) x		

Appendix 5: Contact/emails to students

Letter of invitation to large group Oct 06

Dear

Proposal to join research group

As you may know I am currently work at Durham University and will be teaching you on some modules in the second and third years. What you may not know is that I am also undertaking a PhD research degree at the University, which is a study in the field of teacher education.

I am seeking to understand what it means to become a primary teacher of maths from specific perspectives. I really want to look at how people view maths and also how they teach maths. To do this I will explore your past experiences with maths and your present experiences on the course.

My fieldwork will focus on a small research group of about 6 people, whom I will hope to work with throughout their degree course. What it means for you, is that at various points during the year I would wish to interview you, either individually or occasionally in a group. During the second and third years of the course I would also like to watch you teach a few times (and talk to you about it afterwards).

One important aspect of doing research for me is the benefit that emerges from the project for you, the researched as well as the researcher; thus it would be interesting to discuss this towards the end of the project. I do not imagine that being involved will increase your workload, in fact I hope that potentially it could enrich your learning experience on the course.

If you have any questions about the project, or your potential involvement, please do not hesitate to drop me a line.

Thanks for your time

Best Wishes

Anna

a.e.llewellyn@durham.ac.uk
0191 334 8378
07855 748 048

Email to chosen participants May 07

Hi …,

Hope your exams are going well. I know this may be a difficult time to contact you about my research project, but please just put the email aside and read it later if necessary.

I have now begun to plan the rest of my research project and would like to work specifically with 5 or 6 people over the remainder of their degree**. Would you be interested in being one of those people?**

I'm guessing you have loads of questions about how much time of yours that would take up and what exactly it would mean for you? I can't be too exact but roughly I would like to interview you once more this year (for about 45 minutes or so) and then over the next two years I would conduct some more interviews and probably some observations of your lessons (which I would always talk to you about). I may also ask you to keep some sort of diary or blog. So it wouldn't be too much of your time, but it would be more than the two interviews I will have done during your first year.

Just in case you forgot my aim of the project is simply to tell a few stories of trainee primary teachers' relationship with maths and maths teaching – nothing more, nothing less. My style of research is very informal and I would involve you in, and consult you over, thing I wrote about you. You may even get something out of it yourself – as I will be asking you to reflect on things. And I could always talk to you about any maths stuff if you wanted.

If you agree to be part of the project, you don't have to stick with it – you can pull out of it at any time you want to. But obviously it would be helpful to me if you didn't do that and thus if you really aren't keen, just say no and I will ask someone else – that's absolutely no problem.

But if you are slightly interested but aren't really sure, just think about it for a few days or give me a call or email me or even speak to Patrick - we would be happy to chat to you about my work.

So what do you think, ?
Drop me a line as soon as you can (so I can contact others if you aren't interested) and of course if you are interested we can fix a time for your final interview of this academic year – (which can be any time before the end of term and I will happily meet you at university/your school/your home or whatever). All the interviews and observations throughout this project will be at your convenience – I really want to work with you and make it as easy for you as possible.

Thanks for reading the above and your first interview – regardless of whether you agree to continue working with me.
Good luck with your exams and your final teaching practice.
Cheers, anna

Appendix 6: Project information for student-teachers

'Becoming' a primary school teacher of mathematics

Information for participants

As you know I am currently working on a research project involving students who are training to become primary school teachers. You may not know that this research project will become part of a study that will eventually lead to my PhD.

In this project, I am seeking to understand what it means to become a primary school teacher of mathematics from quite specific perspectives. Particularly I am interested in: how your history with mathematics shapes your beliefs about the subject; how does the course shape your beliefs about the subject and how do outside effects (such as the public image of maths) shape your relationship with the subject.

I am designing my field work around focusing on a small research group of students who I will aim to work with throughout the 3 years of their degree course. What it means is that at various points, which we will identify, I would wish to interview you either in a group or individually (possible at two or three times during the year). I would also like to observe you teaching at some point during the course (if you consent we may video the lesson). The final thing I may ask you to do is respond to a few email questions throughout the 3 years.

The way I aim to conduct my research is very much to work with you and not just to talk about you, hence I may use the email questions to ask you to respond to my analysis of the situation; also at some point after your observed lesson I would aim to sit down and for us both to reflect upon the lesson. My primary aim is, for as much as I can, to attempt to understand things from your perspective and to give you a voice. Another aspect of the project which is of interest to me is the potential benefits to you the researched (from being given a chance to reflect upon your experiences).

I realise that you are very busy with your studies, but I do not imagine your work load will increase. In fact I would hope that potentially it could enrich your experiences on the course.
You can of course opt out of the project at any time.

If you have any further questions, please do not hesitate to contact me
Best wishes
Anna

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'Approved by Durham University's Ethics Advisory Committee'

Appendix 7: Student-teacher consent form

TITLE OF PROJECT: Becoming a Primary School Teacher of Mathematics
(The participant should complete the whole of this sheet himself/herself)

Please cross out as necessary

Have you read the Participant Information Sheet? YES / NO

Have you had an opportunity to ask questions and to discuss the study? YES / NO

Have you received satisfactory answers to all of your questions? YES / NO

Have you received enough information about the study? YES / NO

Who have you spoken to? Dr/Mr/Mrs/Ms/Prof. .....

Do you consent to your interviews being tape recorded? YES / NO

Do you consent to the tape recording being transcribed by the researcher or a paid transcriber? YES / NO

Do you consent to your lessons being recorded by video? YES / NO

Do you consent for the video of your lesson to be viewed by the researcher and yourself? YES / NO

Do you consent for the video of the lesson to be used at research conferences? YES / NO

Do you consent to participate in the study? YES / NO

Do you understand that you are free to withdraw from the study:
* at any time and
* without having to give a reason for withdrawing and
* without affecting your position in the University? YES / NO

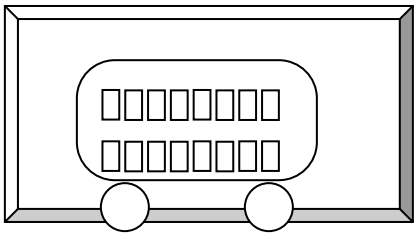
Signed ..... **Date** .....

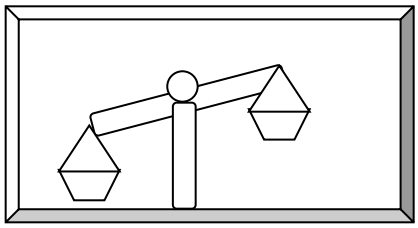
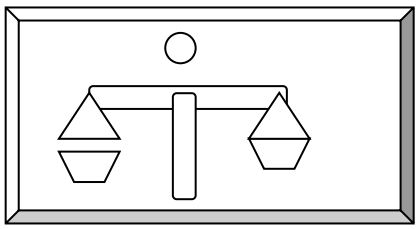
(NAME IN BLOCK LETTERS) .....

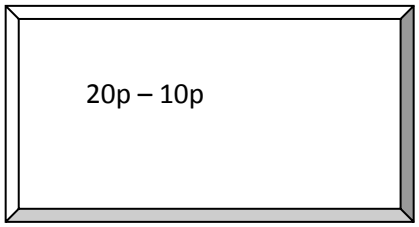
Appendix 8: Typed lesson observation

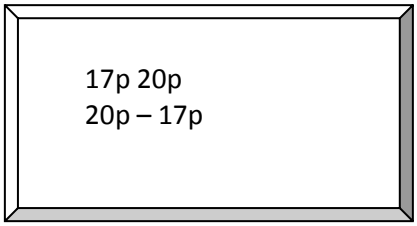
Lesson Observation Kate Tues 29th Jan 2008

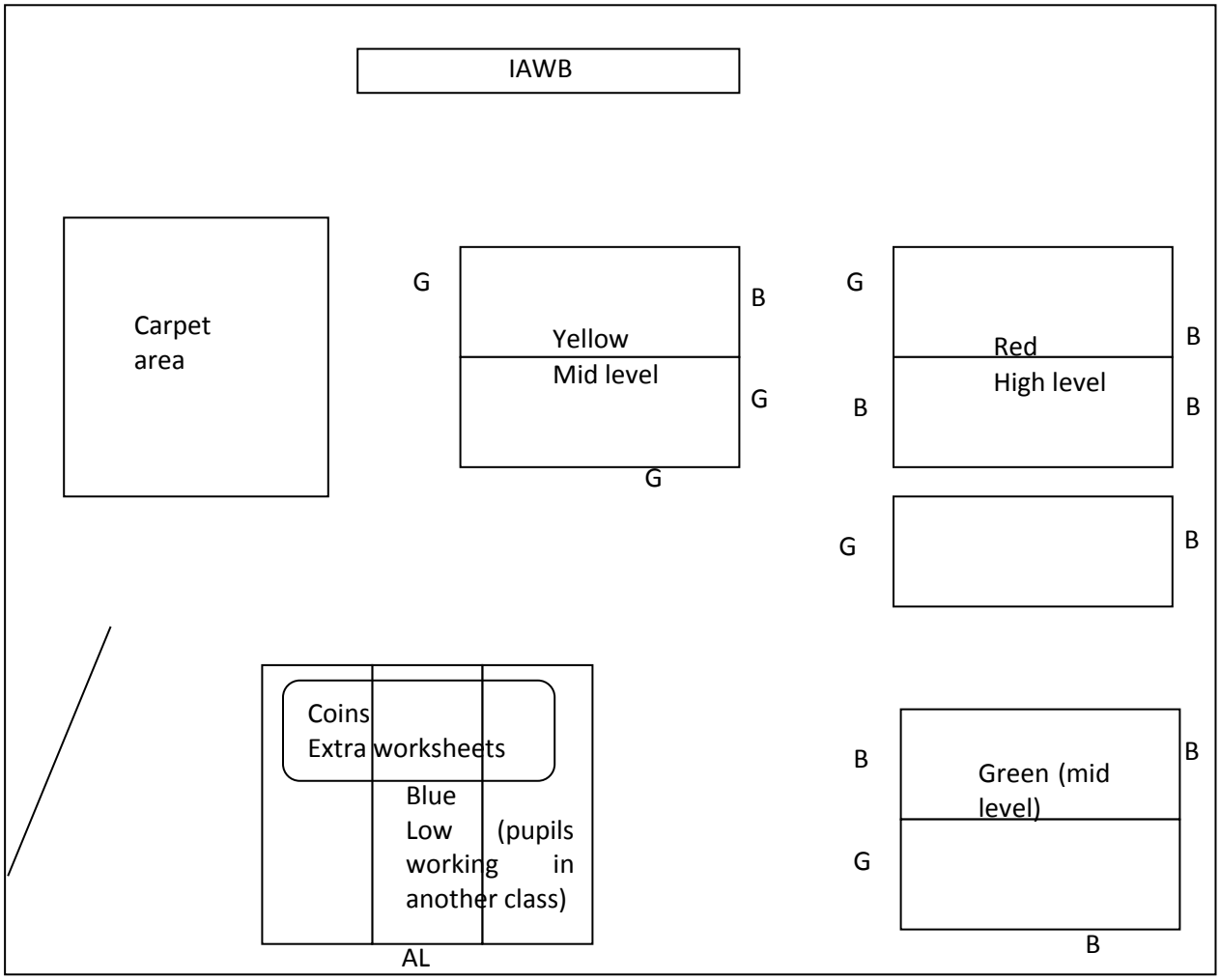
Lesson Script		Anna's thoughts	Kate's thoughts
	Before the lesson The class is well organised. Differentiated worksheets are laid out on tables with the pencils and books, The 'resources' table (which normally seats the lower attainers but they will be absent today, as they are working with the normal class teacher) has pencils, spare worksheets and coins – all ready for the lesson Lesson Start Count in 2's up to 20 To explore simple word problems To explore one more and one less than up to 30 Pupils are all sat in the carpet area (space A), most are drinking their milk and Kate sits on the yellow table and begins the lesson. Kate asks 'What did you do last lesson' Pupil (Oliver) 'We counted money to see what we could make' Kate 'What else did we do' She explains they were counting up in 2's etc… and then goes into the lesson objective – 'by the end of the lesson we will be able: to count up in 2's up to 20; explore simple word problems; explore one more and one less up to 30 Pupils take their milk back to the desk (one at a time)	you seem very relaxed – are you? Why? Is this normal? You seem very calm again Lots of praise	
9.15	Kate 'Who knows how the times-tables start – who can be fantastic?' Kate questions using pupils names Class recall of 2 times-table '1 times 2 makes 2; 2 times 2 makes 4 etc.' Kate asks 'add on 2, James from 6 – think about it James – you're not thinking'.	Recall of facts? Relating maths Odd phrase – but it was said in a nice tone A clever skill to multitask	

	Kate multitasks between instructing pupils to put their milk in the bin and chanting the 2 times-table Asks Tom question. He replies. She says *'fantastic – good boy'* (quite loudly) Class recital of 2 times-table Individual pupils answers questions (with their hands up) We get to 8 times 2. 'I wonder if anybody knows the next one – some people said 17, why can't it be 17?' Pupils says something about odd numbers Kate '17 is an odd number and ( ) in our 2 times-table is an odd number' Class recital of 2 times-table	A mixture of asking individuals and chanting – deliberate? Linking to wider maths – can they only cope with it in order – is that how they will learn? Nice inclusive bit here – giving the pupils a voice – deliberate?	
9.22	'Right are we agreed it's 18' Class recital of 2 times-table Kate holds up her fingers to show the value of the sum – some pupils are doing this also Kate 'By the end of the week, you'll be able to count up to twenty without me' Pupil 'Are you not gonna help us' Kate 'Oh we need a bit more practice'	Should all pupils be holding their fingers up?	
9.24	'Right then everyone looking at the board'  Using the IAWB (above), Kate places large dots in the passenger windows. (Kate is now stood up in front of the IAWB). She use the number line (which is above the board) to add 1 and places another dot. Class count the dots Kate makes a tiny mistake whilst using the IAWB – the pupils giggle	I like the bus idea – this allows pupils to relate More authoritative? Nice questioning I guess this is important for year one You deal well	

9.31	Kate moves them into one less. The IAWB won't rub the dot off – so she crosses the dot out instead. 'There are 15 on the bus, one gets off' Pupil '16' In response Kate doesn't say no, she takes them through how to do it. Kate goes through more questions concerning less than. The difficult language is reinforced throughout 'more than, 'less than'	with this hiccup Do you find this odd – that they can only add and take 1's, but they know complex language of more than etc…	
9.33	'One person gets off I have on less than 30' Pupil *'29'* 'Good girl' New slide 	There is quite a quick pace to the lesson	
9.35	Kate – now standing up. Shows 10 on her fingers. A pupil (Abigail) comes out the IAWB to do the calculation – she gets it right (the scales corrects itself) – they all smile 	This is a nice interactive game – what do you think it adds to their learning?	
9.37	Three pupils (all girls) come up to the board and answer this type of question on the IAWB 'If we're stuck we can use our fingers'	There are lots of resources here – lots of effort from you – why?	

9.37	'In my magic bag' Kate gets her (Oasis) bag and pulls out items one at a time. A torch?, a piggy pen; a teddy; a DVD; the BFG book; candle? She explains they are for sale in her shop	Is this a realistic price for a teddy – or does it not matter?	
	She places a 10p price card on the ruler and a price card on the book. 'If I want to buy a ruler and a book how much is that going to cost? She articulates how to do this. She then asks individuals and then counts on fingers. The pupils answer the questions	I'm confused here – are you?	
	'I'm gonna have to use some bigger numbers, you're just too good for me'	Is this deliberate – are you used to remembering things like this – do you think it's important?	
9.42	Kate asks more questions about adding prices When she holds up the DVD (Shrek) there is an animated debate between 2 pupils and Kate about whether it is Shrek		
	More questions concerning change. Kate gives wait time, 'Put 17 in our heads' 'Try something a bit harder' 'Oliver is going to be our shop keeper'	Is Oliver doing as much as you'd like?	
	A pupil comes out to stand the other side of table 1 (Kate is near the board) to act as shopkeeper (coins are on the table)		
	'If I give Oliver 20p and my ruler cost 10p, how much change am I going to get? *(*I think the pupils reply and miss out the pence)' 'We always have to remember to put out pence		
	Kate moves to the IAWB and writes  		
9.45	Kate rubs something out on the IAWB and the pupils all		

	say 'bye, bye' 'Do I put my bigger numbers or my little numbers  	Difficult skill here being asked of the pupils – are they struggling – what are you thinking?	
9.50	Kate writes 17p and 20p – she asks them how to write it as a sum. She draws 20 lines and crosses out 17 (with the pupils counting along) *'20 lines and I'm taking away 17 – how many have I got left'* Kate holds up the BFG book and asks a question	Have you deliberately brought the level of maths down here?	
9.54	(10p – 5p) 'I give Oliver 15p, if my book costs 14p, how much change do I get?' She asks James – he's not sure. Kate gets him to stand up by her. They get 15 on their fingers, using both James hands and one of Kate's. They manage to do the sum. She goes through more sums. 'You know we need another 5 to make 10'. Kate sits on the desk again (yellow table). 'I buy a rocking horse' Kate goes through questions that are similar to the worksheets the pupils will be doing	Is James being slow here? – what are you thinking?	
9.58			
10.00	The class count. Abigail (pupil) kneels by the yellow table and counts (with coins?) Pupils go back to their tables. They quietly sit at their tables – the green table has coins. The pupils are all working on different level worksheets – all the sheets are to do with calculating change. Kate helps at different tables. At the red table a girl asks a question 'No try and have a go at it yourself – right Abigail out 45 in your head – count up in 50's'	Do you think you gave enough them for them to try? Multi-tasking	
10.04			

10.07   10.09   10.10

	Kate decides that assembly has started and they are too late 'Sit down, we'll do some more sums – who can remember how to count in 2's' The pupils go back to the mat The class teacher comes back in and the pupils then line up and go to assembly