"We all play teacher"
A study of student discourse in adult numeracy classrooms

Submitted by

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Abstract

In this study, the emerging methodology of linguistic ethnography is applied to the under-researched setting of the adult numeracy classroom. Students' naturally-occurring discourse is audio-recorded during mathematical collaborative groupwork, and analysed to provide privileged insights not always apparent through observing teacher-led interaction. In particular, the "funds of knowledge" brought by students to their formal learning is investigated, and findings are related to Bourdieu's concepts of cultural capital and habitus, and Bernstein' theories of pedagogic discourse.

Participating students were found rarely to draw spontaneously on numeracy funds of knowledge, and tended to ignore the supposedly "real-life" contexts presented by traditional word problems. However, some alternative activities did encourage students to relate classroom learning more to out-of-classroom practices, and the implications of these for pedagogy are discussed. The students were also found to draw on a broad repertoire of linguistic resources to express uncertainty and anxiety; to enhance group cohesion; to elicit contributions from other students; and to ease interactions with humour. However, students additionally brought to the classroom a "schooled habitus" which tended to constrain their discourse and activities to curricular expectations. A categorisation of students' knowledge contributions into "disruptive" and "conformative" is proposed.

The study concludes that collaborative groupwork can be highly effective for adult numeracy learners, with participating classrooms demonstrating high rates of retention and achievement, but further research is urgently needed to extend these benefits to students with disabilities, learning difficulties and English as a second language. It further suggests that traditional word problems are not effective in helping learners relate mathematical skills to everyday numeracy practices.

However, in introducing innovative and potentially more effective pedagogies, it is recommended that the schooled habitus of adults be taken into account. In particular, pedagogies designed for children and young people may not transfer unproblematically to adult classrooms.

Dedication

To Helen Walters, for inspiring me with the affection and respect she has always shown to adult literacy and numeracy students, and for trusting the tutors who worked for her to show students the same affection and respect.

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This work would not have been possible without support from some people who have been very important to me during its completion.

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And most of all to Dominic, for his patience, support and endless cups of tea.

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[1] The names of all students, the teacher and the towns in which they live, work and study are pseudonyms throughout this document.

This research has received Ethical Approval from University of Sheffield.

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Chapter 1

Introduction

This is an account of how students worked together in two adult numeracy classrooms in England, told through the recording and analysis of their naturally-occurring discussions during collaborative, mathematical groupwork. I examine what the students' talk reveals about the knowledge, experience, practices and attitudes they brought to the classroom and how these were used to further their mathematical learning; the diverse linguistic repertoires with which they explored mathematical ideas and developed social relations within the class; and the way different types of knowledge were valued and privileged by prevailing discourses in the classroom. My aim has not been to intervene in these classrooms; but rather, as far as possible, to capture talk which would have taken place had I and my recording equipment not been there.

In this introductory chapter I explain the rationale for my choice of research topic and methodology, and set out my research aims and questions. In doing so, I also reflect on my own background and positionality with respect to my research. Finally, I provide an overview and guide to the contents of this thesis.

Rationale

The greatest influence on my research aims has been my role, until two years ago, as a numeracy teacher in adult community education. I have always had a warm regard for my students, and the greatest respect for the courage and determination they have shown in choosing to return to the classroom.

Within the current policy discourse of the *Skills for Life* strategy to improve adult literacy and numeracy (DfES[2] 2001) there is a tendency to describe

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[2] Abbreviations are listed in Appendix J.

such learners in terms of deficits; to focus on what they *cannot* do, rather than on what they *can*.   One of my aims in this study is to offer an alternative to this deficit view, and to represent the voices of the adult numeracy students amongst whom I have worked for the last ten years.

This study is inspired by Moll, Amanti, Neff and González's (1992) work on "funds of knowledge", although it is naturalistic rather than transformative in design. I wanted to investigate the knowledge and practices which adult numeracy learners bring to the classroom, and how this can be used more effectively in teaching and learning. In particular, I wanted to examine how classroom learning might thus be made more relevant to students' numeracy practices outside the classroom. As a teacher-educator and former teacher, I am especially interested in research which informs classroom practice and so a further aim is that this research should be of interest to, and accessible by, practitioners.

My study takes advantage of a recent trend, officially endorsed as good practice, for increased use of collaborative groupwork in adult numeracy classrooms (Ofsted 2006; DfES 2007). The data takes the form of audio-recordings of participating students' naturally-occurring discussions as they worked together on mathematical activities with little intervention from the teacher.   The recordings give privileged insights into the students' experiences of learning mathematics, and the knowledge and practices they brought to the classroom, which might not be apparent though observing teacher-led interaction.

I draw upon an emerging set of epistemologies and methodologies known as linguistic ethnography. Linguistic ethnography involves the analysis of naturally-occurring talk (and other interaction) in order to learn about the social settings and structures within which that talk takes place, and the ways in which these structures shape, and are shaped by, discourse (Rampton *et al* 2004). My final research aim, therefore, is methodological: to investigate the potential of applying this emerging methodology in the under-researched context of adult numeracy education.

Thus my research questions are:

- What knowledge, practices and dispositions do students bring to the adult numeracy classroom?

- How might students' knowledge, practices and dispositions be used to develop teaching and learning approaches which are more meaningful and relevant to their numeracy practices outside the classroom?

- What can recording and analysis of naturally-occurring classroom discourse reveal about adult students' experiences of learning numeracy?

As with many doctoral studies, my research journey has not always gone as planned. When I wrote my research proposal, I was still working as an adult numeracy teacher myself. This study was thus originally planned as practitioner-research, including some elements of action-research. However, before my fieldwork started, I took on a new position in teacher-education. Instead of action-research in my own classrooms, therefore, my research is an ethnographic account of student talk in another teacher's classrooms. I have not attempted any intervention in these classrooms; instead, obtaining naturalistic talk has become a primary methodological aim. Partly as a result of this change of emphasis, I also found myself questioning "what counts" as funds of knowledge, and revising part of my analytical framework in the light of this conceptual crisis to take into account the "schooled habitus" the students also seemed to bring to the classroom. Therefore my outcomes include a critical deconstruction of the concept of funds of knowledge as well as my empirical findings.

Starting Points: Personal Perspectives on Research in Mathematics Education

No research is value-free, objective and neutral, but is constructed by human researchers who bring to it their background, context, personal history and the values that shape their approaches. It is important that researchers recognise and acknowledge any vested interests or partisanship

and are aware of underpinning assumptions that influence methods and analysis, in order to make explicit both their stance and the influence it might have on their work (LeCompte and Preissle 1993; Patai 1994; Pillow 2003). Thus, while wishing to avoid solipsism, here I briefly set out my own relationship to this research, especially two aspects of my personal history: my work as an adult numeracy teacher with a commitment to social justice; and my own educational experiences.

Coming to Research as a Teacher

I come to this research not as a linguist, nor primarily as an ethnographer, but as an educator. Fascinating as I find the students' discussions and diverse linguistic repertoires, my primary aim in this research is to investigate how the students use their talk to further their mathematical learning, and what their talk reveals about the knowledge, practices and dispositions they bring to the classroom.

The following quotation is taken from the document with which the *Skills for Life* strategy was launched in England in 2001 (see Chapter 5), and forms the starting point for my research interests.

> A shocking 7 million adults in England cannot read and write at the level we would expect of an 11-year-old. Even more have problems with numbers (DfES 2001).

From my earliest experiences of teaching in the adult community sector, I began to be aware that the adults I was teaching did not conform to this deficit model constructed for them by *Skills for Life* policy documentation (DfES 2001; BSA 2001; Papen 2005; Hodgson, Steer *et al* 2007), and my research interests to date have focused on challenging such deficit models, especially implicit comparisons between adult learners and 11-year-old children (Oughton 2007; 2008). The experiences which adults bring to the classroom reflect their rich prior histories, both in their daily working lives and their previous education, and I wanted to question the assumption that pedagogies developed for children and young people can unproblematically be offered to adult learners.

My work, therefore, is inevitably framed by critical perspectives, which are explored in more depth in Chapters 2 and 4. Moll *et al*'s (1992) work on the funds of knowledge held by families in the US-Mexican borderlands appealed to me not just as a pedagogical approach, but in its power to disrupt discourses of deficit.

My research also takes place within the adult community education service in which I used to teach, and one of the research sites is located in the small town near which I live. Many of the student-participants have children at the same school as my own children and shop in the same high street as I do. The teacher-participant is a colleague, a friend, and an ex-student. In many respects, this "insider" knowledge enriches my research by giving me deeper, multi-stranded or "thick" insights into my participants' lives. Conversely, however, it can also compromise my objectivity. The focus on naturalistic linguistic data in my methodology provides a useful mechanism here for getting some analytic distance on the familiar (Rampton *et al* 2004), rather than the classical anthropological challenge of getting familiar with the strange.

Earlier Influences

My beliefs about adult numeracy, and about entitlement to education in general, are inevitably shaped by my own education. In the mid 1970s, I was part of the second year of Comprehensive intake in a former Secondary Modern school. The mathematics we studied was pre-National Curriculum SMP (Schools Mathematics Project) and was related to the "New Math" introduced in the USA at about the same time. I did not encounter quadratic equations until I began A-level Mathematics, but between the ages of 11 and 16 I studied subjects such as matrices, Boolean algebra, network topology and set theory, none of which appear now on the Key Stage 3 or 4 National Curriculum. This has had a strong influence on my beliefs about the arbitrariness of the curriculum. I do not take issue with one curriculum content rather than another; only the cultural hegemony which has left students – and indeed many younger teachers – apparently unaware that any alternative to the National Curriculum might exist.

In those first two years of Comprehensive intake, my school succeeded in getting three pupils into places at Cambridge University; I was one of those who gained a place, reading Natural Sciences to specialise in Physics. My privilege in receiving such a high-quality education – one which was entirely funded by the state, yet has opened doors for me throughout my adult life – has contributed to my commitment to social justice, but has also made me more conscious of cycles of educational and social reproduction.

Far from encouraging me to impose methodologies from the physical sciences onto social scientific research, my scientific training – and particularly an optional module in the History and Philosophy of Science – has made me sceptical of attempts to do so. I regard many variables in educational research, such as what counts as "knowledge" or "numeracy", to be social and political constructs and am suspicious of attempts to reify and measure such constructs with insufficient critical reflection. Nonetheless, my natural sciences training has perhaps influenced my choice of methodology, especially the appeal for me of collecting naturalistic data. My aim in data collection has been to intervene as little as possible, and by making and storing audio-recordings to ensure that my data is open to reinterpretation and even falsification (Mehan 1979).

Overview of Thesis

In writing this thesis, one of my priorities has been to represent the voices of the participating students and, as far as possible, to let those voices speak for themselves. The students' voices are represented in transcript form throughout the thesis, and are also used for many of the chapter headings, reflecting parallels between the students' mathematical learning journeys and my own learning journey in undertaking this research (see Appendix I).

In Chapter 2, I review research and other literature related to the "under-researched and under-theorised" field of adult numeracy (Coben *et al* 2003:117), necessarily also drawing on research from school mathematics education, adult literacy, and adult education in general. In particular I

focus on: conceptual issues in the terminology of numeracy and mathematics; social practice theories of numeracy; the application of funds of knowledge approaches; and the use of constructivist, collaborative pedagogies in mathematics classrooms.

Chapter 3 sets out my methodology. I review the emerging field of linguistic ethnography, and discuss methodological and ethical issues relating to my study. I then describe my methods of collection, transcription and analysis of naturally-occurring classroom talk as data.

The theoretical concepts which underpin my analysis are critically examined in Chapter 4. In particular, I reflect on the strengths and limitations of using the notion of funds of knowledge as an analytical framework, and discuss the problematic issue of what to categorise as funds of knowledge.

In Chapter 5, I set the scene for my research, outlining the current *Skills for Life* policy context in England and describing the two, sometimes conflicting, official discourses which currently prevail in adult numeracy classrooms. I then introduce the participating teacher and students, and the types of mathematical learning activities which they undertook in the classroom. I examine the classroom as a community of practice and explore the relationship between learning and other aspects of the students' lives.

In Chapters 6 and 7, I present the main findings from my analysis of the students' recorded discussions. Chapter 6 focuses on the students' linguistic practices in the classroom; how they used expressions of uncertainty to foster a creative and productive learning environment; the prevalence of humour and self-deprecation and their role within the classroom; and the ways in which the students' language choices reflected their sense of agency within the classroom. Chapter 7 focuses on the different types of knowledge which the students brought to the classroom and the different ways in which these were valued and legitimated in classroom discourse. In particular I examine the extent to which the students related their mathematical learning to out-of-classroom numeracy practices.

In my discussion in Chapter 8, I draw together my analysis by considering the characteristics of the different types of knowledge, practices and dispositions which the students brought to the classroom and whether they served to broaden students' learning and make it relevant to out-of-classroom practices, or whether instead they constrained learning to curricular expectations.

In Chapter 9, I discuss the implications my findings might have for teachers' practice, and also for wider policy considerations.

I conclude, in Chapter 10, by reflecting on the limitations of my study, the ways in which it developed and evolved from my original ideas, and the potential for future research directions.

The title of my thesis comes from a comment made by one of the participating students, Dawn, to two of her fellow students, Ruth and Jackie, when they all had been sharing ideas and strategies to solve problems on a ratio worksheet which they were finding difficult.

Extract 1.1: "We all play teacher, don't we?"
Ruth, Dawn and Jackie are working collaboratively on a ratios worksheet.

1	Ruth	So what goes into five hundred – five hundred four times?
2	Dawn	So it'll be a hundred – a hundred
3	Ruth	Always go back to this four
4	Dawn	Yeah
5	Ruth	So what goes into five hundred four times?
6	Dawn	A hundred and fifty?
7	Ruth	No
8	Dawn	Well it's not a hundred
9		Hundred and twenty five.
10		**We all play teacher, don't we?**

[M1: 135-144]

To me it epitomises the way the participating students worked together, and the support and encouragement they gave each other in the classroom.

Chapter 2

Charting the Moorland: A Review of Literature and Research in Adult Numeracy

Compared to the related fields of adult literacy and mathematics education, the study of adult numeracy is under-researched and under-theorised (Brooks *et al* 2001; Coben *et al* 2003). Any review of the literature on adult numeracy must also draw upon related fields, and negotiate the permeable boundaries between them. Research in adult numeracy has been described as more like moorland than a field because of its undefined edges and uncultivated terrain (Wedege, Benn & Maaß 1999). Even the concept of numeracy, and its relation to mathematics, is contested.

In order to address my first two research questions: "What knowledge, practices and dispositions do students bring to the adult numeracy classroom?" and "How might students' knowledge, practices and dispositions be used to develop teaching and learning approaches which are more meaningful and relevant to their numeracy practices outside the classroom?" it is necessary first to consider what is meant by "numeracy", and then to explore the idea that numeracy practices might be different in different domains. I therefore begin by reviewing conceptual issues surrounding numeracy and mathematics; and theories of literacy and numeracy as social practices; and the ways in which formal and informal practices are valued. As described in Chapter 1, these research questions draw on the notion of funds of knowledge (Moll et al 1992), and so I then review the background to this concept, together with a range of studies taking a funds of knowledge approach. My final research question is methodological: "What can recording and analysis of naturally-occurring classroom discourse reveal about adult students' experiences of learning numeracy?" While methodological issues are explored more fully in Chapter 3, I provide a background here by reviewing literature on the role of language and collaborative groupwork in mathematical learning.

Necessarily, I draw on literature from mathematics education, adult literacy and adult education, as well as the small but growing body of literature on adult numeracy itself (Fig. 2.1).

Other literature is also reviewed elsewhere in this thesis. In Chapter 4, I draw on theorists such as Bourdieu and Bernstein to help develop a framework for analysing the different types of knowledge the students brought to their adult numeracy classrooms, and in Chapter 5 I critically review current policy in adult numeracy education in England.
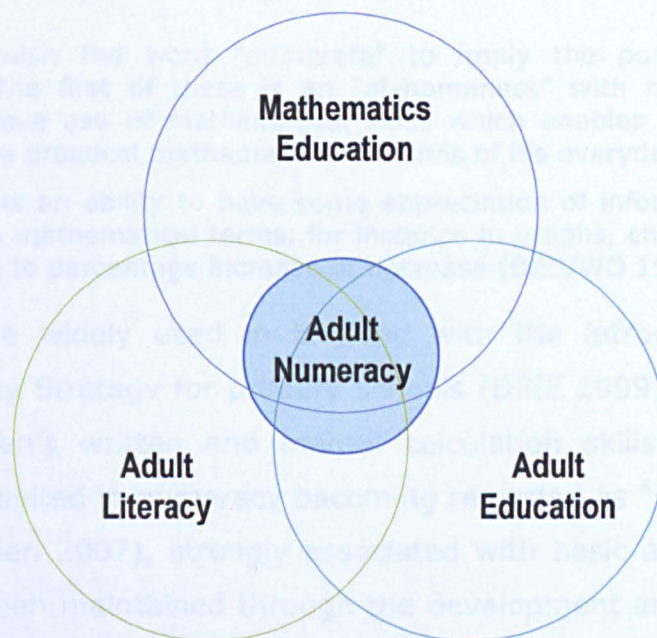
Fig. 2.1 Overlapping Fields Relating to Adult Numeracy

Over the last decade, there have been a number of comprehensive reviews of research in adult numeracy from the UK (Brooks *et al* 2001; Coben, Colwell, Macrae, Boaler, Brown and Rhodes 2003), the USA (Condelli 2006), Australia (Galligan and Taylor 2008) and New Zealand (Benseman, Sutton and Lander 2005), as well as a number of shorter overviews (for example, Johnston 2002; FitzSimons 2004). In particular, the review by Coben *et al* (2003) has been an invaluable starting point for many of my literature searches. Written as part of a policy-driven impetus to develop research capacity through the newly-established National Research and Development Centre for Adult Literacy and Numeracy (NRDC), it is a testament to the success of the initiative that the review is rapidly becoming out of date.

Conceptual Issues: Numeracy or Mathematics?

The concept of *numeracy* was coined relatively recently by Crowther (DES 1959). Despite the implied analogy with literacy, "numeracy" is not clearly defined and is often used interchangeably with "mathematics" (Barwell 2004; Baker and Street 2004).

Early uses of the term implied an adult level of competence, and were associated with mathematical confidence and the practical application of mathematical knowledge, for example as used in the Cockcroft Report:

> We would wish the word "numerate" to imply the possession of two attributes. The first of these is an "at-homeness" with numbers and an ability to make use of mathematical skills which enables an individual to cope with the practical mathematical demands of his everyday life.
>
> The second is an ability to have some appreciation of information which is presented in mathematical terms, for instance in graphs, charts or tables or by reference to percentage increase or decrease (DES/WO 1982: para.39).

The term became widely used in England with the introduction of the National Numeracy Strategy for primary schools (DfEE 1999). Focusing on developing children's written and mental calculation skills, the strategy seems to have resulted in numeracy becoming regarded as "watered-down" mathematics (Steen 2007), strongly associated with basic arithmetic. This association has been maintained through the development and introduction of the numeracy strand of the *Skills for Life* strategy (Moser 1999; DfES 2001), which draws heavily on the primary numeracy strategy, and positions numeracy as a low-status narrow subset of mathematics:

> the ability ... to use mathematics at a level necessary to function at work and in society in general (Moser 1999).

This reflects a general tendency in many countries to consider numeracy as "a limited proficiency vision... with the emphasis on equipping the workforce with the minimum skills required for industry and commerce" (Coben *et al* 2003:9).

Arguments have been made that numeracy should have a higher status which reflects the way mathematics might be used in society (for example Steen 2000). The following definition offered by Tout (1997) closely

matches my own conception, recognising it as a practice which is social (see below) and which takes place amongst power structures:

> We believe that numeracy is about making meaning in mathematics and being critical about maths. This view of numeracy is very different from numeracy just being about numbers, and it is a big step from numeracy or everyday maths that meant doing some functional maths. It is about using mathematics in all its guises - space and shape, measurement, data and statistics, algebra, and of course, number - to make sense of the real world, and using maths critically and being critical of maths itself. It acknowledges that numeracy is a social activity. That is why we can say that numeracy is not less than maths but more. It is why we don't need to call it critical numeracy - being numerate is being critical. (Tout, 1997:13)

Nonetheless, the low-status, functional definition of numeracy currently predominates in adult education in England, particularly within the discourses of *Skills for Life*, and is currently reified by its use in the title of a set of nationally-recognised qualifications (QCA 2000)[3].

The contested relationship between numeracy and mathematics naturally raises questions of the terminology to use in this thesis. Generally I have followed my own beliefs about these concepts by using the term mathematics to describe what is learned in the classroom, and numeracy to describe the way such knowledge is applied outside the classroom. However, an aim of this study is to represent the participants' voices, and while students do, indeed, tend to refer to what they do in the classroom as "maths", the classes they attend are described by the provider as "adult numeracy" classes, they work from the *Adult Numeracy Core Curriculum*, and the qualifications they take are *National Certificates in Adult Numeracy*. I have thus necessarily taken these uses into account as well. Similarly, some authors resist reifying the phrase *Skills for Life* – which is, after all, just a policy brand name – when writing of adult literacy and numeracy education in England. However, I have chosen to use it here, since the phrase also implies the set of structures and discourses within which the classrooms in my study must operate.

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[3] Whether or not the adult numeracy curriculum and qualifications will be replaced in future by the new Functional Skills qualifications (QCDA 2009) was under review at the time of writing. FitzSimons (2008) compares meanings of "functional skills" with those of "mathematics" and "numeracy" and concludes that the difference consists largely in the situation in which mathematics is practiced and the purposes for which it is used. See also Wake (2005) and Burkhardt and Bell (2007) for discussions of what the term "functional mathematics" might encompass.

Social Practice Theories of Literacy and Numeracy

For over two decades, social practice theories of literacy and numeracy have provided a new perspective which has been particularly relevant in adult basic education, and have been welcomed by many practitioners in the sector as an alternative to the deficit views prevalent in policy discourse[4] (Gee 2000).

The idea of literacy as a social practice was first developed in the 1980s by researchers such as Scribner and Cole (1981), Heath (1983) and Street (1984), who studied literacy in use in a variety of communities. This perspective recognises literacy as embedded in people's lives at home, work, school or in the community. Literacy is not regarded as a set of autonomous skills, to be learned in school and transferred unproblematically to other domains, but as an ideological practice, which "encompasses the knowledge, feelings, embodied social purposes, values and capabilities that are brought into play through the reading and writing of texts" (Mannion and Ivanič 2007:16). Literacy is seen to be practiced differently in different domains, only one of which is the domain of formal schooling. The relationship between literacy and power is acknowledged, and the privileging of certain forms of literacy over others is challenged (Street 1984; Gee 1996; Barton and Hamilton 1998; Crowther, Hamilton and Tett 2001; Papen 2005). According to Street (2003:77), this perspective:

> takes nothing for granted with respect to literacy and the social practices with which it becomes associated, problematizing what counts as literacy at any time and place and asking "whose literacies" are dominant and whose are marginalized or resistant.

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[4] I use the word "discourse" throughout this thesis to describe ways of writing and speaking which are inherently ideological, which invoke a set of powerful values and viewpoints, and which resist criticism by marginalising alternative values and viewpoints (Gee 1996; Papen 2005).
Gee (1996) uses "Discourses" (with a capital D) to distinguish this meaning from other forms of spoken and written interaction which he refers to as "discourses" (with a small d). I find this anomalous use of capitals interrupts the flow of reading, and so prefer to make a similar distinction, if rather less precisely, by using the terms "discourse" and "discussion".

Barton and Hamilton (1998; 2000) set out six propositions about the nature of literacy, most of which, I suggest, may also be applied to numeracy:

- Literacy is best understood as a set of social practices; these can be inferred from events which are mediated by written texts.
- There are different literacies associated with different domains of life.
- Literacy practices are patterned by social institutions and power relationships, and some literacies are more dominant, visible and influential than others.
- Literacy practices are purposeful and embedded in broader social goals and cultural practices.
- Literacy is historically situated.
- Literacy practices change and new ones are frequently acquired through processes of informal learning and sense making.

(Barton and Hamilton; 2000:8)

Many of these ideas have since been embraced by those working in adult numeracy (Baker 1998; Johnston and Yasukawa 2001), including the recognition of numeracy as embedded in social practice and that certain domains of numeracy and mathematics are more highly-valued by dominant discourses than others (Coben 2002). Street, Baker and Tomlin (2005:20) also extend the concepts of events and practices from literacy to numeracy, defining numeracy *events* as "occasions in which a numeracy activity is integral to the nature of the participants' interactions and their interpretative processes", while numeracy *practices* involve "the conceptualisations, the discourse, the values and beliefs, and the social relations that surround numeracy events as well as the contexts in which they are located". They draw attention to the distinction between *sites* – the physical locations in which activities take place – and *domains* as "areas of activity not located in specific places" (p.33). For example, a student doing mathematics homework is a numeracy event in which practices from the classroom domain are carried out in the site of the student's home.

Lerman (2000:36) describes the "social turn" in mathematics and numeracy research, beginning in the 1980s, toward accounts which brought together "agency, individual trajectories, and the cultural, historical, and social origins of the way people think, behave, reason, and understand the world".

Early research within this social perspective included ethnographic studies of: children living by selling water melons and sweets in Brazil (Carraher, Carraher and Schliemann 1985; Saxe 1988); adults grocery shopping and weight-watching in the USA (Lave 1988); adults working as market traders, fishermen, builders, carpenters and farmers in Brazil (Nunes, Schliemann and Carraher 1993); and young unemployed adults in Australia (Johnston, Baynham, Kelly, Barlow and Marks 1997). The common theme emerging was that the situated numeracy practices undertaken by the participants were fundamentally different from mathematics as it is usually practiced in the classroom. The real-life problems to be solved were generated by the participants themselves, and were structured in terms of goals to be achieved, rather than mathematics, with social relationships central to many practices. Participants maintained control of the problem-solving process, could decide how to solve the problems, and could determine whether a precise or approximate answer was required. Participants who might struggle with written problems in the classroom were found to perform competently within these meaningful contexts.

While these studies focus largely on the *contexts* of situated numeracy practices, Baker (1998) and Street *et al* (2005) argue that a social practice model of numeracy should also take into account *cultural* and *ideological* considerations. They propose four "dimensions" of numeracy: content (i.e. the autonomous skills to be learned); context; culture (values and beliefs); and ideology (social and institutional relations). They link these ideas to Bourdieu's notion of habitus, the systems of durable dispositions which may be seen as an individual's tendency to act, think and perceive in a certain way as a result of their experiences of the social world (see Chapter 4).

Attempts to apply social practice theories to numeracy have not gone unquestioned. Coben (2006a) argues against the implication that adults' numeracy practices are so rich that no further teaching or learning is necessary and also warns that numeracy risks becoming subsumed within "literacies". Green and Howard (2007) suggest that the autonomous "skills model" should be seen as *complementary* to the "social practice model", and that both have value in developing adult numeracy (and literacy) learning.

Issues of Status and Power: Numeracy as "Functional"

According to Harris (2000:176), "Maths was and still is one of the most powerful stratifying tools society has", and Benn (1997) argues that traditional mathematics is constructed in such a way as to deter and exclude less powerful groups in terms of gender, class and ethnicity.

Adult numeracy (and literacy) education in England is currently funded through and driven by the *Skills for Life* strategy (DfES 2001) (see Chapter 5), and a key assumption is that adult numeracy should be *functional* and lead to increased employability and economic effectiveness. This emphasis on functionality has become more pronounced in later iterations of the strategy (DIUS 2009), and is extended to young people in the new Functional Skills agenda (QCDA 2009), drawing on an assumed relationship between literacy, numeracy and employability which has been called into question, for example, by Wolf (2004) and Evans and Waite (2008).

Bernstein (1990) argues that an emphasis on vocationalism further disempowers dominated groups, while Sarangi (1996:206) critically engages with the rhetoric of the "new vocationalism" and its tendency to create hierarchical tiers of opportunity:

> the role of vocational education is in fact a reproduction of a "low" cultural capital, as opposed to the "high" cultural capital associated with higher education. The "low" cultural capital is then convertible to economic capital, but only in a restricted sense with regard to accessing the higher echelons in the world of work.

Dowling (1998) categorises mathematical activity into a hierarchy between the superior intellectual (esoteric) domain and inferior manual (public) domain. His analysis of a commonly-used two-tier series of school mathematics textbooks shows how lower-level students are constructed as engaged in "everyday" practices and are excluded from esoteric mathematical practices.

The assumption that adult learners need "functional" numeracy to help them in their daily lives is challenged by Swain (2005:305), who concludes that few adults study numeracy in order to apply it to everyday life. The main reasons were found instead to include:

to prove to themselves that they have the ability to study and succeed in a high-status subject, which they perceive to be a signifier of intelligence. The other main reasons are for learners to help their children, and for understanding, engagement and enjoyment.

The study suggests that, while most adult numeracy is restricted to the public domain, many learners aspire to the esoteric domain. Tomlin (2002a) challenges the assumption that adult numeracy should be functional, describing how the students in her action-research study were intrigued by esoteric mathematics rather than interested in solving "everyday" problems. In practitioner-research with my own students (Oughton 2008) I found that students' interests were shaped by the existing curriculum, and included fractions and multiplication tables as mathematical topics they "had always wanted to understand" (p.49). Coben *et al* (2003:17) suggest that the word "functional" itself is insufficiently examined:

> There are many senses in which numeracy may be considered to be functional: the question is, functional with respect to what context and purpose, for whom and from whose perspective?

Relating Learning to Out-of-Classroom Practices[5]

Even where "functional" numeracy is agreed to be relevant to the learners' purposes and goals, issues of transfer from the classroom to the workplace or other sites of use are found to be highly problematic (Lave 1988; Evans 2000a). Dowling (2001:20) describes how attempts to set classroom mathematics problems in supposedly real-life contexts merely "mythologise" the practices they are supposed to represent, while Evans and Tsatsaroni (2000:56) warn of the dangers of "an overly simplified notion of context as a 'thin veneer' of applicability, that only *seemed* to make 'word problems' in the classroom different from abstract calculations." (original emphasis):

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[5] Within this thesis I use the terms "classroom" and "out-of-classroom" to distinguish between domains of practice, using the latter to describe any domain in which numeracy is practiced informally, such as the home, the community or the workplace. The tendency to dichotomise practices into just two opposing domains has been critiqued (e.g. Moje *et al* 2004; Presmeg 2005). Nonetheless, the "classroom" versus "out-of-classroom" binary is convenient for my discussion here, provided it is remembered that the boundary between the two is blurred, negotiable and permeable.

> A student doing a calculation in shopping has different purposes and constraints than when they are doing it in the mathematics classroom. The calculations have to be more accurate in the classroom, because that is what is required, or what it takes to keep the teacher happy, and because this is what is a valid answer in school assessment practices (Evans and Tsatsaroni 2000:59)

The characteristics of mathematical word problems in schools have been extensively critiqued (e.g. Cooper and Harries 2002; Wyndhamn and Saljo 1997; Verschaffel, De Corte and Lasure 1994; Mukhopadhyay and Greer 2001). According to Gerofsky (1996; 1999), word problems generally have a three-part structure consisting of a "set-up" to establish a scenario or minimal story-line, a number of items of information, and one or more question(s). It is generally expected that the problem will contain two numbers which are to be combined using addition, subtraction, multiplication or division.

Attempts have been made to identify pedagogical approaches which are more appropriate to workplace numeracy and which facilitate learning transfer (Bessot and Ridgway 2000; Wedege 2004; FitzSimons and Wedege 2004). FitzSimons (2005) draws upon Bernstein's distinction between vertical and horizontal discourse and suggests that while many adult numeracy courses attempt to follow the vertical discourse models of school mathematics, numeracy should be regarded as a horizontal discourse:

> The acquisition of numeracy competence could be compared to the development of a tradesperson's knowledges, skills and techniques, developed via an apprenticeship model. This model blends theory and practice, formal and informal learning, and the physical presence of an experienced practitioner is essential (p.5).

In the classroom, learners focus on arithmetic skills and the "correct" answer expected by examiners. By contrast, in the workplace, calculators and spreadsheets may reduce the need for basic arithmetic, but employees might need to consider issues of cost-effectiveness, efficiency or safety in their calculations. Experience and convenient shortcuts replace textbook methods, as in this example of the numeracy used by council employees responsible for minor civil works (Black 2004:12):

> Numeracy skills appeared more significant, such as calculating concrete pours, but these were soon learnt on the job: you've only got to multiply the width by the length ... give us three by four is twelve, that's 1.2 (cubic metres), that's four inches (100mm in depth) ... you learn that (supervisor).

> This was not the sort of academic maths learned at school involving the understanding of underlying concepts. Instead, it was an example of performance-driven numeracy; that is, numeracy learned in practice.

In conclusion, then, a social practice model does not necessarily focus on "everyday" numeracy practices, but acknowledges and embraces learners' goals, purposes, beliefs and attitudes – whether these are to enjoy the exploration of mathematical patterns and processes for its own sake; to cover the curriculum skills needed in order to gain a qualification required for work or further study; or to develop situated numeracy practices relevant to the learners' lives or work. The essential point is that within a social practice model the distinctions between these different forms of numeracy *are made explicit*; and the ideologies that value one form of numeracy (such as academic mathematics) over another are challenged and open to critique.

Knijnik (1993:25) argues that "merely glorifying popular knowledge does not contribute to the process of social change", a claim adopted and applied to adult numeracy by Civil (2003:3):

> There are different forms of mathematics, each associated with a different discourse and set of values. Our task, I think, is to accept and value these different forms and bring them into the open for discussion.

Lives and Learning

The complex interplay between adult numeracy and literacy learners' lives and their learning is explored by Barton, Appleby, Hodge, Tusting and Ivanič (2006; 2007). As this work offers ethnographic accounts of classrooms similar to those in which my own research took place, it serves to triangulate my findings and is worth reviewing in some detail.

Learners' histories were found to include negative previous experiences of education, including bullying from teachers and other pupils, and being positioned as "thick" or a failure. Learners' goals might be short-term and focused, such as finding work or improving job prospects; or might be longer term and more general, such as broadening horizons through more

general learning, and increasing their sense of well-being or purpose. Many also valued the social experience of learning, and the structure and interest it gave to their lives.

Learners needed to juggle many different commitments, including caring for children or other family members, so it was important that learning opportunities could be fitted in with their everyday lives. Accessing learning was particularly difficult if learners possessed few financial or social resources. For people learning in community settings, an important benefit was the proximity of provision to their communities and homes. Factors which discouraged participation included provision at times or places which did not fit in with learners' lives; and learners feeling coerced to attend, for example through Job Centre Plus provision. Learners' motivation and ability to take up learning opportunities depended on social factors such as health, caring responsibilities and working hours, and economic factors such as the cost of courses, travel and childcare (Barton *et al* 2006; 2007; Tett and Maclachlan 2007; Rhys Warner and Vorhaus 2008). According to Barton *et al* (2006:13):

> Each person has a particular combination of practices and identities, with a history behind them and an imagined future towards which they are travelling, situated within a set of current life circumstances and events ... The four aspects can be expressed in chronological terms: what has happened in people's pasts, who they are now, what is happening in their lives now, and where they want to go.

The Adult Classroom as a Community of Practice

An understanding of learning as participation in a community of practice has emerged over the last two decades as an alternative to traditional notions of teaching and learning as the transmission of acquired knowledge (Lave and Wenger 1991; Wenger 1999; Barton and Tusting 2005). Learners become members of the community of practice by a gradual process of peripheral participation, taking part in a shared system of cultural meanings and discourses.

While Lave and Wenger's original examples focus on vocational communities such as mid-wives and tailors, they also argue that participation in the practices of classroom communities may be seen as an important part of

students' learning (1991:40).   Harris and Shelswell (2005) discuss the learning trajectories and changing identities of learners in adult basic education and suggest that classrooms can be seen as communities of practice in their own right.   Ivanič, Appleby, Hodge, Tusting and Barton (2006) observed that classroom practices such as groupwork and recording progress were gradually learned through participation.   Little explicit explanation was needed of regularly undertaken tasks, and shorthand labels were used which both teachers and learners understood.   They describe these classes as "learning communities" which had formed:

> shared understandings of what it means to be a member of the community, of how to participate, of what tasks consist of, of what counts as the beginning and end of a class, of the routines and rituals associated with class time. A class culture of peer friendship, support, a joint endeavour to learn and common learning goals provides a relaxed, positive learning environment (Ivanič *et al* 2006:40).

Wedege (1999) describes how legitimate peripheral participation can help develop a learner's habitus for learning mathematics, and Swain (2007) reports similar transformations of students' dispositions and understanding of themselves through participation in adult numeracy classes.

Funds of Knowledge

Although the concept of funds of knowledge is most often associated with the work of Luis Moll, Moll himself (2002) disclaims credit for the term, which was originally coined by Vélez-Ibáñez and Greenberg (1989). In their anthropological study of households in the US-Mexican borderlands, Vélez-Ibáñez and Greenberg describe the formation of "strategic and cultural resources, which we have termed *funds of knowledge*, that households contain" (1992:313). They relate their use of the term to Wolf's (1966) categorisation of economy in peasant households into several funds, including caloric funds, replacement funds, ceremonial funds and funds of rent.

In its extension from anthropology to education by Moll *et al* (1992), the concept of funds of knowledge gains power to disrupt discourses of deficit and to transform teachers' attitudes. Again working in the US-Mexican

borderlands, Moll *et al* apply a funds of knowledge approach with teachers as ethnographers and explore how these new insights can be brought to the classroom. They suggest that the funds of knowledge identified by their study represent "a positive and realistic view of households as containing ample cultural and cognitive resources with great potential utility for classroom instruction" (p.134). A wide variety of funds of knowledge were found to be held by participating households, including knowledge and skills associated with agriculture and mining, economics, household management, medicine and religion (Fig. 2.2).

A Sample of Household Funds of Knowledge	
Agriculture and Mining	*Material & Scientific Knowledge*

Ranching and farming
  Horse riding skills
  Animal management
  Soil and irrigation
    systems
  Crop planting
  Hunting, tracking,
    dressing
	Construction
	  Carpentry
	  Roofing
	  Masonry
	  Painting
	  Design and archi-
	    tecture

Mining
  Timbering
  Minerals
  Blasting
  Equipment operation
    and maintenance
	Repair
	  Airplane
	  Automobile
	  Tractor
	  House maintenance

Economics	*Medicine*

Business
  Market values
  Appraising
  Renting and selling
  Loans
  Labor laws
  Building codes
  Consumer knowledge
  Accounting
  Sales
	Contemporary medicine
	  Drugs
	  First aid procedures
	  Anatomy
	  Midwifery
	
	Folk medicine
	  Herbal knowledge
	  Folk cures
	  Folk veterinary cures

Household Management	*Religion*
Budgets Childcare Cooking Appliance repairs	Catechism Baptisms Bible studies Moral knowledge and ethics

Fig. 2.2. A Sample of Household Funds of Knowledge (Moll *et al* 1992:133)

Shifts in Conceptions of Funds of Knowledge

Moll *et al*'s work has been highly influential on subsequent work examining the funds of knowledge of different communities[6]. The term has become widely used within discourses of educational research and practice, especially those with a social justice agenda.

There have been varying interpretations of what is encompassed by the term funds of knowledge in different studies over the decades. Here I examine three main shifts in interpretation: from resources held by households to those held by individuals; its extension to include interpersonal, communication and metacognitive skills; and its uptake by the discourse of policy.

From Households and Communities to Individuals

In some studies, the term funds of knowledge shifts from describing the resources possessed by *households or communities,* to those possessed by *individuals*. This shift coincides with the extension of the concept from the education of children (who draw on the funds of knowledge of their households) to the education of adults and young adults (who draw on their own funds). For example, Seiler (2001) uses the funds of knowledge of young, urban, African-American males to explore alternative approaches to high school science teaching. She draws on the students' *own* out of school practices, rather than those held by their families. Hensley (2005) describes the funds of knowledge, held by parent-helpers as individuals, which she makes use of in her kindergarten class. Andrews, Yee, Greenhough, Hughes and Winter (2005) discuss the funds of knowledge held by teachers themselves, again as individuals. Contrast this with Moll *et al*'s description of funds of knowledge available within a household, but which might not all be held by any one person in that household. This shift in conception provides a more useful model for adult learners than for children, and allows teachers to draw on knowledge and practices which their students have acquired throughout their lives.

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[6] A Google Scholar search on 14 December 2009 suggests that Moll *et al*'s 1992 study has been cited in nearly 900 publications, compared to around 130 for Vélez-Ibáñez and Greenberg's paper

From Practical Skills to Interpersonal and Metacognitive Skills

Another shift is the widening of the resources embraced by the term to include interpersonal and communication skills (for example, Hensley 2005). Baker (2005) and Baker and Rhodes (2007) also use a broader definition in order to apply the concept to adult numeracy classrooms; one which resonates with a social practice perspective on adult numeracy to include:

> knowledge, experiences, histories, identities and images of themselves;
> attitudes, dispositions, desires, values, beliefs, and social and cultural relations;
> relationships with learning, teachers and mathematics itself;
> and numeracy practices beyond the classroom (Baker 2005:16)

Such "broader" funds of knowledge are again particularly relevant to adult learners. Within the deficit model promoted by current policy, the literacy and numeracy skills of adult learners are sometimes compared to those of children, and recognition of a wider range of knowledge, practices and experiences allows teachers to acknowledge and build on the personal, interpersonal and metacognitive resources of these mature adults. However, widening the concept inevitably raises the question of where its boundaries should be drawn, and I attempt to address this problematic issue in Chapter 4.

From Critical Ethnography to the Discourse of Policy

From its inception two decades ago, the funds of knowledge approach has generally been used, often overtly, to disrupt discourses of deficit:

> This view of households contrasts sharply with the prevailing and accepted perceptions as somehow disorganised socially and deficient intellectually; perceptions that are well-accepted and rarely challenged in the field of education and elsewhere (Moll *et al* 1992: 134).

However, the term has more recently entered the official discourse of policy, for example in a DfES document for teachers of pupils from minority ethnic backgrounds:

> Schools have much to gain from the experiences and understanding of pupils, their families and communities. Drawing on their funds of knowledge enriches a school in a range of valuable ways (DfES 2004:8).

It remains to be seen whether this represents a genuine shift in government discourse away from deficit models, or merely a weakening of the critical power of funds of knowledge as a concept. Since the aim of the original funds of knowledge project was to recognise and utilise resources which were not valued by dominant educational discourse, the adoption of the term by official rhetoric seems in danger of allowing dominant groups to stand in judgement of what does or does not constitute funds of knowledge.

Studies Taking a Funds of Knowledge Approach:
A Selective Review

Here I review a selection of studies taking funds of knowledge approaches. This is not a complete systematic analysis; the number of studies drawing on this concept is beyond the scope of this chapter. Instead, I reflect on those closest to my research interests, including: studies involving numeracy or mathematics education; studies based in the UK; studies taking an overtly critical approach or aiming to disrupt deficit discourses; and studies which focus on social class rather than ethnicity.

Marta Civil and others continue the work in the US-Mexican borderlands, focusing on how funds of knowledge approaches can bridge the gap between home and school mathematics (Civil 2003; 2004; 2006; Diez-Palomar, Varley and Simic 2006). Of particular relevance is Civil's work with parents as adult learners of mathematics, in which she asks the question "what would a funds of knowledge adult education program (in mathematics) look like?" (Civil 2003:2). The participating adults (mostly women) did not value their own out-of-school, "ethnomathematical" methods and asked to be shown the "proper way" (p.2). González, Andrade, Civil and Moll (2001) emphasise the importance of practices in which mathematics is embedded, and describe a project in which Civil, as teacher, took on the role of learner to experience the mathematics embedded in dressmaking.

Street, Rogers and Baker (2006) describe a series of workshops in India to provide local teachers with experience of ethnographic-style approaches to

investigate their adult learners' literacy and numeracy practices, in order to support teaching and learning in these areas.

Moje *et al* (2004) examine how US high school students draw on funds of knowledge to scaffold their science learning. Family and home-based funds of knowledge were *not* normally revealed through classroom discourse in the high school classrooms they studied, and the extent to which this did happen depended largely on the teacher. Thornton (2006) follows up Moje *et al*'s ideas on funds of knowledge and scaffolding by suggesting how they might be applied to high school mathematics classrooms.

Differences between UK and US contexts are examined by Thompson and Hall (2008) who investigate whether the constraints of the English National Curriculum allow children's funds of knowledge to be taken up by teachers:

> González *et al* ... worked in another country and in another context – this suggests strongly that shifting to pedagogies which connect children's lives with school learning is not simply a matter of changing national policy and curriculum structures. Other factors – deeply held teacher habits and beliefs, for example – are also involved (p.100).

Baker (2005; 2008) and Baker and Rhodes (2007) examine the "broader" funds of knowledge brought to adult numeracy classrooms, and conclude that teachers do not always make use of these in formal classrooms. They point out that dominant approaches to teaching numeracy tend to be about assessing what learners cannot do, and suggest that instead teachers could work with what learners can do as a starting point for gaining the skills and knowledge required in formal numeracy classrooms. Participating teachers felt that through their engagement with the concept of funds of knowledge they had become more critically self-reflective about their teaching.

The Home-School Knowledge Exchange (HSKE) project (Hughes *et al* 2005; Hughes and Pollard 2006) explores how home knowledges can be used to support UK children's in-school learning, including literacy and numeracy, and again aims to offer alternatives to deficit models of families. The paper by Hughes *et al* is one of the few to critically examine the concept of funds of knowledge (whilst still offering it as useful construct for their study), and this formed a valuable starting point for my own deconstruction of the term in Chapter 4.

Language and Discussion in Mathematics Classrooms

> Language is about more than words; mathematics is about more than numbers (Barwell, Leung, Morgan and Street 2005:146).

Morgan (2006) suggests that language may serve as a "crucial window" into the processes of teaching, learning and doing mathematics, reflecting a shift in focus in mathematics educational research over the past two decades. Mathematics classroom discourse is seen to be shaped by cultural and historical factors, and mathematical learning as needing to be examined in the context of the social and communicative nature of classroom activity. In this final section I review literature on the role of language in mathematics classrooms, both as a research lens and as a pedagogical resource.

According to Barwell *et al* (2005:142) "We have moved beyond simplistic notions of mathematics being 'language free', or alternatively and conversely, of mathematics being a language":

> A more "social" approach suggests that much work in making meaning occurs in more "hidden" processes, partly organised or constituted by social action, social structure or ideology ... Mathematics, rather than being seen as reified, abstract knowledge, is seen as constructed, or reconstructed, through social practice.

The unit of analysis in research is no longer the individual student's knowledge or mental schema; but is more likely to be activity, practice or discourse.

Semiosis in mathematics classrooms does not take place through verbal interaction alone. The multi-modal or multi-semiotic nature of interaction is explored in studies which recognise the contributions of linguistic, diagrammatic and symbolic semiotic resources, and particularly the role of gesture in student-student discourse (O'Halloran 1998; Reynolds and Reeve 2002; Street and Baker 2006; Arzarello, Paola, Robutti and Sabena 2009; Maschietto and Bartolini Bussi 2009; Radford 2009).

While many studies examine the role of language in children's mathematical learning, its role in adult classrooms has only rarely been investigated. Tomlin (2000, 2002b) uses classroom discourse to question notions of student-centred learning and Freirean empowerment, and she also describes how her attempts to discuss "real-life" numeracy practices were deflected by her adult students' interest in academic mathematics (Tomlin 2002a). The use of humour as an interpersonal resource in adult numeracy classrooms is demonstrated by Baynham (1996); and Marr (2000) investigates how adults, including those with English as a second language, need both the "means to speak" and the "opportunity to speak" in order to participate in mathematical classroom discourse. Evans, Morgan and Tsatsaroni (2006) examine how emotion in adults' mathematical learning is constituted in discourse and the role it plays in constructing social identity. Swan (2006b) examines the outcomes of learning GCSE mathematics through discussion for 16-19 year-olds in FE colleges, and this research forms the basis for major reforms of teaching and learning activities in adult numeracy classrooms, as discussed below.

Social-Constructivist Theory and Classroom Discussion

The "discursive turn" in research and theoretical perspectives reflects a corresponding shift towards the use of language in classrooms as a pedagogic resource. As Hoyles (1985:1) points out, discussion in mathematical classrooms can serve many functions for learners: "the organisation and articulation of one's own ideas for oneself; the elaboration of one's own ideas for communication to another; the dynamic feedback inherent in dialogue; and the creation of cognitive conflict."

Kieran, Forman and Sfard (2001:1) describe learning mathematics as "becoming fluent in a discourse that would be recognized as mathematical by expert interlocutors". Cognitivist theories of individual learning have given way to neo-Vygotskian social-constructivism, and researchers tend to speak of learning less as a process of acquisition and more as a process of participation:

> The traditional mathematical classroom featuring one blackboard, one outspoken teacher and twenty to forty silent students seems to belong to

> history. It has been replaced by small teams of learners talking to each
> other, by groups of students voicing their opinions in whole class discussions
> (Kieran *et al* 2001:1)

In constructivist theories of learning, knowledge acquisition is regarded as a product of a learner's interaction with their environment, actively built up and experienced by that learner (Piaget 1975; von Glaserfeld 1995). In social-constructivism, knowledge is seen to be constructed as *shared* meanings and understandings, and learning as a social process achieved, for example, through discussion and collaborative groupwork. Cognitive development is redefined as a dialogue rather than a process of individual discovery (Vygotsky 1934).

Rather than individual mental schema, Vygotskian approaches are based on social interactions within the learning environment, which are an essential part of a learner's experience and contribute fundamentally to individual knowledge construction. Vygotsky suggests that learning through language is also a process of enculturation into, and action upon, the socio-cultural context in which learning takes place. The role of language is regarded as central in "talking knowledge into being" (Green and Dixon 1994:231). Speech is seen as a tool that provides metacognition, and learners create internal dialogue to prompt and interrogate themselves (Vygotsky 1934; Jaworski 1996; Swan 2006a).

Neo-Vygotskian researchers such as Mercer (1995; 2004) emphasise dialogue, between teachers and students and between students themselves, as an important site for learning. Mercer identifies three modes of talking and thinking in groupwork in mathematics (and other) classrooms: disputational talk, characterised by disagreement and individualised decision-making; cumulative talk, in which speakers build positively but uncritically on what others have said; and exploratory talk (Barnes 2008), in which participants engage critically but constructively with each other's ideas and statements and suggestions are offered for joint consideration. Exploratory talk is thought to produce more effective social thinking which enables learners to accomplish tasks together and achieve greater understanding. Mercer and Sams (2006) suggest that many children initially lack the necessary skills to participate in exploratory talk, and that

they benefit from interventions which encourage and develop children's awareness of language as a tool for reasoning. Mercer's work has also informed some of my methodological approaches, as discussed in Chapter 3.

Two related Vygotskian concepts are: the *zone of proximal development*, the distance between a learner's current developmental level, and the level that can be obtained with guidance from a teacher or supportive peers; and *scaffolding* (Wood, Bruner and Ross 1976), the support provided by the teacher, peers, or even the structure of the learning activity.

Collaborative Groupwork

Recent years have seen a transformation in mathematics education from transmission-oriented teaching, in which most interaction takes the initiation-response-evaluation (IRE) sequences identified by Mehan (1979), to approaches informed by social-constructivist theory, and in which collaborative groupwork and student-student discussions play a major part. In considering such approaches, Jaworski (1996:1) reminds us that:

> Constructivism is not about teaching at all. It is about knowledge and learning. So I believe it makes sense to talk about a *constructivist view of learning*. And we might ask about the teaching which *results* from such a view of learning.

Reforms of mathematics teaching were introduced in the USA by the National Council for Teachers of Mathematics (NCTM 1989; 1991). The new standards called for more emphasis on conceptual understanding and problem-solving, informed by a social-constructivist understanding of how children learn and with a decreased emphasis on direct teaching of facts, algorithms and rote-learning:

> Emphasizing communication in a mathematics class helps shift the classroom from an environment in which students are totally dependent on the teacher to one in which students assume more responsibility for validating their own thinking (NCTM 1989:78).

Similar approaches have recently been introduced in post-compulsory mathematics and numeracy classrooms in England. Originating in research carried out by Askew, Brown, Rhodes, Johnson and Wiliam (1997) and Swan (2000; 2006a), two resources have been developed and disseminated

to teachers via free learning materials, guidance booklets and training programmes (DfES 2005a, DfES 2007). Until the introduction of these approaches, numeracy had generally been (and often still is) taught to adults through a transmission approach in which teachers break concepts down into simple stages and demonstrate procedures. Classroom activity consisted of either teacher-led whole-class interaction, or learners working individually through worksheets, and collaborative groupwork was rare. There is evidence that transmission approaches do not promote robust, transferable learning, or produce knowledge and skills that can be used in non-routine situations outside the classroom (Askew *et al* 1997; Swan 2006a; Ofsted 2006; Coben *et al* 2007).

Based on social-constructivist principles, the new approaches instead promoted collaborative groupwork and discussion between learners, and focused on understanding rather than "right answers". The first of these resources, *Improving Learning in Mathematics* (DfES 2005a), was aimed at 16-19 year olds working at GCSE (Level 2) and AS-Level (Level 3)[7]. Activities were designed on social-constructivist principles to promote collaborative learning through rich, exploratory tasks, and to motivate and increase the confidence of disaffected college students (DfES 2005a; Swan 2006a; 2006b):

> "Rich" tasks are accessible yet admit further challenges: tasks which invite children to make decisions; tasks which involve children in speculating, hypothesising, explaining, proving, reflecting and interpreting; tasks which promote discussion and questioning; tasks which encourage originality and invention; and tasks which have an element of surprise and are enjoyable (Swan 2006a:64)

The resource was not designed for, and did not specifically meet the needs of, mature adult learners. As Baker (2008) points out, it presents an "autonomous" perspective of mathematics[8], focusing on abstract concepts rather than the social settings in which they are used.

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[7] A GCSE (General Certificate of Secondary Education) pass at Grades C-A* is a Level 2 qualification and is the target level for 16-year-olds completing compulsory schooling in England. AS-Level (Advanced Subsidiary Level) Mathematics represents the first year of post-compulsory study for students who have chosen to undertake more specialised study in mathematics.

[8] Note that the titles of both DfES resources refer to "mathematics" rather than "numeracy".

Swain and Swan (2009:76) report that:

> There remained a need to address the very different contexts and requirements of those teaching adult numeracy. In particular, there was a need to investigate how far the same pedagogical principles could be applied in this very different context.

The *Thinking Through Mathematics* resource (DfES 2007; Swain and Swan 2007) was developed to adapt these approaches to meet the needs of adults studying numeracy at Entry Level, Level 1 and Level 2, and includes some activities related to adults' out-of-classroom numeracy practices. In Chapter 5, I describe how the new approaches, including collaborative groupwork, are gradually gaining acceptance in adult numeracy classrooms and how they were used in the classrooms I studied.

Social-Constructivist Pedagogies: Some Challenges and Criticisms

Here I review practical challenges which teachers and learners may have to negotiate in implementing collaborative groupwork and other new approaches based on social-constructivism. Later in this section I review more fundamental and problematic criticisms of the new approaches.

In their report on the initial trials of the *Thinking Through Mathematics* activities, Swain and Swan (2007) report how both learners and teachers needed to change their behaviour and practices in the classrooms. Learners come to classes with clear expectations of the teacher, of mathematics and of the ways they would be expected to learn, and for some it was difficult to adapt. However, they also found that many learners generally enjoyed collaborative groupwork, felt less threatened and more relaxed in the classroom, and learned from each other, particularly when they were required to explain their thinking.

Chazan and Ball (1995:1) describe the dilemmas encountered by US high school teachers about whether or not to intervene when their students struggle with mathematical groupwork. Difficulties are also reported in the introduction of collaborative mathematics activities in England where "initiatives that appear conflicting, disempowering and prescriptive" were

found to inhibit uptake of the new approaches (NCETM 2007:23). In particular the inflexibility and expectations of internal inspection regimes, often carried out by managers who are not mathematics specialists, were found to result in externally acceptable but inhibited forms of teaching.

While the above challenges are, at least in principle, surmountable, there have also been more fundamental criticisms of social-constructivist pedagogies. Maybin (2003:1) points out that Vygotskian research has focused on cognitive aspects of classroom dialogue and has been limited by an under-theorised conception of "context" which neglects issues of power:

> Although neo-Vygotskian researchers often refer to their approach as 'socio-cultural', from the point of view of linguistic ethnography, they do not seem to address the socio-cultural nature of language and literacy events and practices in the classroom (Maybin 2003:1).

Several commentators also warn that constructivist approaches, particularly in mathematics education, can reinforce inequality. Critics are concerned that full and successful participation in collaborative groupwork demands a competence in academic and mathematical language, and that constructivist approaches may disadvantage students with lower socio-economic status and less linguistic capital (Zevenbergen 1996; 1998; Lubienski 2000; Bourdieu 1991) (see Chapter 4):

> For those students who enter the mathematics classroom with a competence in the discursive practices, access to mathematics is made more easily. Simultaneously, such students are more likely to be constructed as successful (Zevenbergen 1998:1).

Conversely Tudge (1992) shows that collaborative groupwork may result in higher achieving students being held back by their lower achieving peers, while Boaler (2002) contends that equity in the classroom depends more on the attitude and commitment of the teacher than on the pedagogy which is practiced.

Related criticisms concern students whose first language differs from that in which the activity of the classroom is conducted (Marr 2000; Barwell 2003a; 2005a; 2005b; Ivanič et al 2006). Baxter, Woodward, Voorhies and Wong (2002) examine the difficulties encountered by students with learning difficulties in constructivist mathematical classrooms, but further research

into the needs of students with learning difficulties, physical disabilities or sensory impairment in collaborative groupwork is hard to find.

Conclusion

In this chapter I have reviewed research and theoretical perspectives relating to adult numeracy education. The relationship between numeracy and mathematics is shown to be problematic and contested, with policy placing an increasing emphasis on low-status arithmetic. Social practice theories of numeracy provide a useful alternative to "functional" and "deficit" models of numeracy, taking into account learners' goals, attitudes, experiences and beliefs, and examining the relevance of classroom learning to out-of-classroom practices. Numeracy learning is found to be just one strand in adult learners' complex lives, and the social aspects of the classroom as a community of practice to be an important factor in participation. Funds of knowledge approaches, involving teacher-ethnography to make learning more relevant to learners' prior knowledge and interests, have been effective in transforming teachers' attitudes to their learners. Finally, the role of language in mathematics classrooms has been examined - both as a research lens and as a pedagogical approach – and the challenges and criticisms associated with social-constructivist pedagogies have been reviewed.

In Chapter 4, I examine theories of knowledge and power to further develop my analytical framework, and in Chapter 5, I report on how the teaching and learning approaches reviewed above have been applied in the classrooms participating in my study. First, however, I provide a methodological background to my study, and set out the methods used in my fieldwork, data collection, transcription and analysis.

Chapter 3

"Don't let me hear myself": Methodology and Method in Researching Naturally-occurring Talk

> The argument that the facts of greatest value for the study of education are those constituted in classroom interaction, and that they are most readily displayed in classroom talk, provides a persuasive reason for regarding classroom research as "basic" research and recorded language as its vital evidence (Edwards and Westgate 1994: 55).

In this research I draw on a set of methods and epistemologies which have in recent years been increasingly classified as *linguistic ethnography*. My aim is to study language-in-use in adult numeracy classrooms, and what it tells us about adults' numeracy learning, the knowledge, practices and dispositions they bring to it, and the social structures within which it takes place. In this chapter I discuss the methodological considerations behind this approach to research, and my methods of audio-recording, transcribing and analysing naturally-occurring classroom talk.

My methodological decisions often emerged out of pragmatic compromises or serendipitous opportunities, and a major influence, as described in Chapter 1, was my previously unplanned career move from teaching to teacher-education between the proposal stage and fieldwork. What had been planned as a transformative study in my own classrooms, evolved into ethnographic research in another teacher's classroom. Obtaining naturalistic data gradually became a primary methodological aim and has driven much of my approach to data collection.

Choice of Methodology

My choice of methodology evolved alongside my research questions rather than being selected in response to them. I was looking for ways to examine how classroom numeracy might be made more relevant to

students' out-of-classroom practices, and had previously considered interviews and "numeracy diaries". I had several reservations about these methods: I was wary of interpretive approaches such as interviews as I felt the students' accounts might represent what they thought I wanted to hear rather than their own practices; numeracy diaries were not appropriate for those students who also had literacy difficulties; and also I wanted to find how the students might choose to draw on these practices in the classroom.

Audio-recording students' naturally-occurring classroom discourse seemed to answer these difficulties and also intrigued me as a research method. As a teacher, I used to find that overheard snippets of student-student interaction gave me fleeting but fascinating insights into their experiences and social worlds. I wanted to continue and formalise these insights, and so student talk seemed to me the ideal unit of analysis for examining how adults learn numeracy. Writing of teachers moving into linguistic ethnography, Rampton (2003:3) reflects that:

> the move to linguistics and ethnography was about trying to find a way of adequately rendering quite extensive personal experience ... we were looking for some kind of public language to make ourselves more hearable, to enable us to speak more authoritatively about what really seemed to be going on in the institutions where we worked.

As Christie (2002) suggests, in order to genuinely understand education, researchers must engage with the discourse practices particular to it. Linguistic analysis enables the otherwise taken-for-granted components of communicative practice to be interrogated, providing an "analytic distance" on the familiar, which I hoped would give me new insights into the classrooms in which I had been teaching for many years. In numeracy classrooms in particular, this approach also provides a potential answer to one of the major difficulties in researching the numeracy practices of adults – namely, the invisibility of many informal practices, such as calculating in one's head (Coben 2006b). In explaining their methods together through exploratory talk (Mercer 2004; Barnes 2008) (see Chapter 2), the students "think aloud", and many of their invisible practices are made audible.

Traditionally, recording and analysis of classroom data has tended to focus on teacher-led discourse. This reflects not only the predominance, at least until recently, of teacher-led pedagogies, but also the methodological

difficulties of obtaining naturalistic student-student discourse (Edwards and Westgate 1994). More recently however, recording and analysis of peer-peer discourse in schools has been used powerfully by Maybin (2006) to examine examples of "unofficial" and "official" literacy activities by 10 and 11-year-olds and to argue that the division between "vernacular" and "schooled" literacy practices is not as clear-cut as is sometimes assumed; by Rampton (2006) to examine how language, ethnicity, class and identity are performed by boys and girls in a London secondary school; and Lefstein (2008) to interrogate how teachers responded to literacy policy initiatives in primary schools.

Linguistic Ethnography: A Background

Linguistic ethnography encompasses a range of methodological and epistemological approaches involving the collection and analysis of naturally-occurring talk (and other interaction) in order to learn about the social setting and structures within which that talk takes place, and to investigate the ways in which these structures shape, and are shaped by, discourse:

> Linguistic ethnography generally holds that, to a considerable degree, language and the social world are mutually shaping, and that close analysis of the role of language can provide both fundamental and distinctive insights into the mechanisms and dynamics of social and cultural production in everyday activity (Rampton *et al* 2004:2).

Linguistic ethnography is a relatively recent term, and has been described as a "site of encounter where a number of established lines of research interact" (Rampton 2007:585). Although it now has its own article in the *Springer Encyclopædia of Language and Education*, the article acknowledges that "the debate about 'what is' and 'what is not' distinctive to an understanding of linguistic ethnography is current and the term linguistic ethnography itself is in its infancy" (Creese 2007:229). Proponents argue that ethnography can benefit from the analytical frameworks provided by linguistics, while linguistics can benefit from the processes of reflexive sensitivity required in ethnography.

Instead of testing theory by seeing if the data fits a hypothesis or imposing pre-existing categories on the data, ethnographic research starts in a more open-ended way, with themes, categories and concepts gradually being drawn out of the data. Ethnography seeks to question the oversimplifications in influential discourse, and interrogates prevailing definitions and constructs (Rampton *et al* 2004; Bloome and Green 1996; Roberts 2003).

These characteristics sit in a "productive tension" with some features of linguistics as a discipline, including the recognition of shared structural patterns in the ways people communicate; and a discourse of technical and analytic description which helps in understanding the subtle and complex processes involved when people talk and interact with each other. Rampton *et al* (2004:4) summarise the effects of this tension as:

> "tying ethnography down": pushing ethnography towards the analysis of clearly delimitable processes, increasing the amount of reported data that is open to falsification, looking to impregnate local description with analytical frameworks drawn from outside.

> "Opening linguistics up": inviting reflexive sensitivity to the processes involved in the production of linguistic claims and to the potential importance of what gets left out, encouraging a willingness to accept (and run with) the fact that beyond the reach of standardised falsification procedures.

It is also useful here to draw on Bloome and Green's (1996:183) distinction between "doing ethnography", which involves "a broad, in-depth, and long-term study of a social or cultural group", and adopting, as I do in this study, an "ethnographic perspective", which involves taking a "more focused approach ... to study particular aspects of everyday life and cultural practices of a social group".

Historically, linguistic ethnography draws upon linguistic anthropology in the USA, and a number of fields emerging from the UK, three of which in particular resonate with my own interests: the New Literacy Studies (Barton and Hamilton 1998; 2000); critical discourse analysis (Fairclough 1989); and neo-Vygotskian social-constructivist theories of classroom interaction (for example Maybin 2003:4):

> Linguistic ethnography also has something valuable to offer, particularly to Vygotskian researchers who are interested in bringing together the

knowledge and cultural resources of students' home communities with the academic purposes of teaching in school and those interested in harnessing resistant, subversive discourses in the classroom.

Epistemological and Ontological Considerations

Researchers using linguistic ethnography need to consider to what extent participants' language-in-use represents the social worlds in which that language takes place, and the different ways in which talk may be interpreted by the researcher (Barwell 2009). Sealey (2007) takes a realist perspective (i.e. one which recognises the social world as existing independently of researchers' descriptions of it) and reminds us that different researchers, using different analytical concepts, may arrive at different conclusions about similar data.

Morgan (2006: 219) describes students' language as "a crucial window for researchers onto the processes of teaching, learning and doing mathematics". Appealing as this metaphor is, I am more inclined to take the view of Mehan (1984: 181), who argues that:

> By treating language as a mediating force in people's lives, sociolinguists have pointed our the importance of looking *at* the window of language and not just *through* it … acts of speaking and listening enable people to make sense of the world. That is, language transforms the world, changing nature into culture (my emphasis).

Mehan (1979) also suggests that if the original recordings and transcripts remain available for possible re-analysis then the final account can be taken as "warranted" and open to challenge.

Capturing Visual Semiosis

Collaborative groupwork in mathematical learning necessarily involves multi-modal interaction, with mathematical symbols, diagrams, graphical representations and gesture clearly central to conceptual understanding (O'Halloran 1998; Reynolds and Reeve 2002; Street and Baker 2006; Maschietto and Bartolini Bussi 2009; Radford 2009).

However, although video data and other means of capturing multi-modal semiosis is increasingly regarded as an important strand in researching

classroom interaction (Pahl 2009; Jewitt 2009, Arzarello *et al* 2009), I felt that video-recording equipment would be overly intrusive, would inhibit natural discourse, and would raise greater ethical concerns about anonymity. Although audio-recordings do not yield so much data about multi-modal interactions, they can be supplemented with field notes and photographs of artefacts used or produced by the students.

Selection and Recruitment of Participants

My choice of settings has been, of necessity, a mix of purposive and "opportunity" selection (Cohen, Manion and Morrison 2007). I particularly wanted to research collaborative groupwork rather than teacher-led activity, and although such collaborative approaches are increasingly promoted in adult numeracy classrooms in England, as a teacher-educator I was aware that their uptake was still not widespread (see Chapter 5). Thus I needed to identify a teacher who regularly used collaborative approaches. The teacher I approached, Elizabeth, is both an ex-colleague and ex-student of mine, and is an experienced numeracy teacher with a commitment to a variety of participatory approaches to teaching and learning. Elizabeth works at several community education centres run by a local authority in the north of England, and together we selected two of her classes in which the students had responded well to collaborative groupwork. Throughout this document I refer to the centres where these classes took place as "Milltown" and "Farmton". The classes, teacher and students are introduced more fully in Chapter 5, and group profiles are provided in Appendix A.

Ethical Issues in the Recruitment of Student Participants

Recruitment by researchers of adult numeracy or literacy learners requires considerable sensitivity. It has often taken courage and commitment for an adult to join a class, and I was concerned that a careless approach to recruitment or data collection might result in a participant withdrawing from classes. In recruitment, therefore, my priority was that no aspect of my

research should discourage participants from attending classes, if necessary compromising my sample.

Conversely, however, I also found recruitment personally rewarding in terms of the willingness, and even enthusiasm, with which many of the students – even those apparently lacking self-confidence – agreed to participate. Many adult numeracy and literacy learners have been disempowered throughout their lives and their voices are not often heard (Ivanič et al 2006). Most of the students seemed to welcome my interest in their lives and their learning.

All students in the selected classes were given information about the research and were invited to participate at different levels, including being observed and being audio-recorded (see Appendix B for copies of the informed consent documentation). It was explained to the students that they would suffer no disadvantage if they chose not to participate. As some of the students had literacy needs, I also provided verbal clarification of the participant information and consent form, and they were given time to chat to each other about the research and consider whether or not they were happy to participate.

The question arose of how we could audio-record participating students, but not non-participating students working in the same group, and it was agreed that if no satisfactory arrangements could be made, no recording would take place. However, such an eventuality did not arise, as all the students agreed to participate (a deaf student, Linda, although happy to participate in other aspects of the research, chose not to take part in audio-recordings, but as she worked at a separate table with her signer, her talk was not recorded).

One student went so far as to regard her participation in the research as a measure of personal achievement:

> Judith   If I'd been asked when I first started, I'd have said, no, you're not recording me, no, you're not doing that.
>
> [F1/L2B: 597]

Judith spoke of wanting to prove that she could participate and having overcome her earlier lack of confidence.

However, the students did express a strong wish **not** to hear recordings of their own voices. Roz's plea here is typical:

> Roz   [on my collecting the recording device at the end of a session] Don't let me hear myself.
>
> [F2/L1B:469]

Such a dislike is recognised as widespread and Karpf (2006) suggests that listening to their own voices forces people to confront aspects of themselves which they do not like. For related reasons I also decided, after much deliberation, not to show transcripts of the recordings to the students unless they asked to see them. I was worried that the students might feel self-conscious about reading detailed transcriptions of their own talk (particularly as they lacked confidence in their own mathematical ability) and that subsequent talk might be constrained and less naturalistic than before (see Chapter 10 for a reflection on this decision).

Generalisability

Rather than making new generalisations, ethnographic perspectives seek to challenge unjustified generalisations (Howe 2008). My research aims to examine "telling" rather than "typical" cases (Mitchell 1984), which serve to illuminate our understanding, and to let "small facts get in the way of large issues" (Hannerz 1987:556).

Inferences may be made about the typicality of cases from factual details provided by the researcher (Edwards and Westgate, 1994) and in this study, information I provide about the class, the teacher and the students can also be triangulated against the extensive quantitative, qualitative and ethnographic studies carried out in *Skills for Life* classrooms in England by the NRDC at around the same time (Ivanič *et al* 2006; Barton *et al* 2006; 2007; Rhys Warner and Vorhaus 2008; Cara, Litster, Swain and Vorhaus 2008).

My own judgment of the typicality of my setting is based on my subjective experience of ten years teaching in similar classrooms and observing

student-teachers. While I would strongly reject any notion of a "typical student", I would suggest that the *range* of the 19 participating students – for example, in terms of age, gender, ethnic homogeneity and distribution of mathematical aptitude – was not untypical of the hundreds of students with whom I had worked during the previous decade.

An important caveat, however, is that all the students in the participating classes had *chosen* to study numeracy. My sample thus comprises only adults who had assessed themselves as needing to attend numeracy classes (either because they believed themselves genuinely to lack necessary skills; or because they required a formal qualification), and had chosen to address this need. As such, their beliefs and attitudes about numeracy learning are likely to be different from those of other adults with numeracy "needs" who do not attend classes, or who attend classes compulsorily (for example as a Job Centre requirement).

Fieldwork and Data Collection

Obtaining 'Natural' Data: The Researcher in the Research

All ethnographic research needs to be sensitive to the impact of the researcher. While my aim has been to record talk which is as naturalistic as possible, the discourse practices of participants are at risk of being affected by the research, whether through my direct involvement or through the presence of recording equipment. For example Samph (1976) found that under observation, teacher's verbal behaviour came to resemble both their own ideal teacher and that which they believed a visitor might expect of them.[9]

While such effects can never be eliminated, a number of strategies can be used to minimise them. One method was to research over a period of time, so that I became familiar and less obtrusive (Edwards and Westgate 1994). Labov (1972) also suggests that speakers' discourse tends to become more

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[9] Especially as the participating teacher was previously a student-teacher of mine.

natural when they are intensely engaged in the subject under discussion, as the students were in their mathematical problem-solving, and they seemed quickly to forget that they were being recorded.

Another strategy was to use low-technology, unobtrusive audio-recording equipment. I found that a mobile phone, placed on the table around which students were working collaboratively, provided sufficient quality of digital recording. It is common in adult classrooms for students to place their own phones on the table tops during sessions and they have thus become "part of the furniture"[10]. Students' lack of self-consciousness about being recorded was illustrated when my own phone was often moved gently to one side with the other phones to make room for a card activity, or had sheets of paper inadvertently place on top of it (Fig. 3.1).
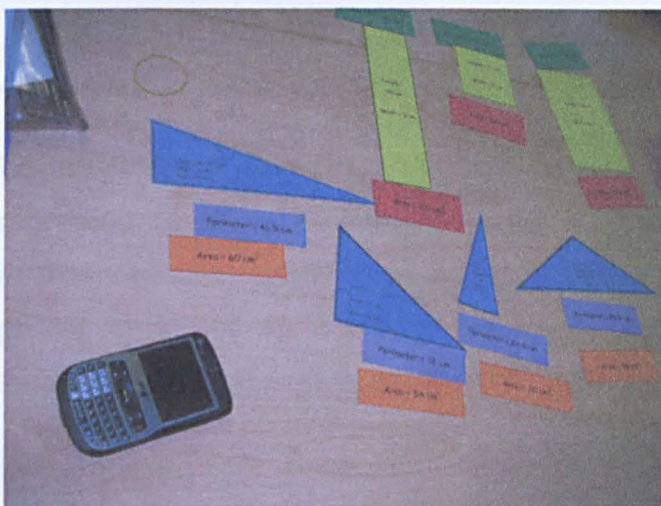
Fig. 3.1 Mobile phone in use during audio-recording, located on a classroom table alongside a card activity.

Methods of Collecting Data

The first phase of my fieldwork covered five weekly two-hour sessions[11] of the Milltown class, and the second phase covered four two-hour sessions of the Farmton class. While participant observation is traditionally a strand of

[10] 25 years ago, Stubbs (1983) commented that young people's increasing familiarity with cassette-recorders made their recorded talk more natural than it had been in earlier research; I would suggest that using mobile phones as recording devices takes similar advantage of a contemporary development.
[11] While these had originally been planned as consecutive sessions, the participating teacher's commitments, and breaks in classes during examination periods, meant that not all sessions were consecutive.

ethnographic research, my aim was to collect data that was as naturalistic as possible; so I did more observing than participating. My main data collection methods are described below; a summary of the full dataset collected is included in Appendix C.

Observing and Making Field Notes

In order to be unobtrusive, I generally sat on a separate table at the back to observe sessions and took notes of what happened in the classroom. However, because of my colleagual relationship with Elizabeth, I occasionally contributed to the class when asked for information or advice. I did not direct any classroom activities; nor did I intervene in Elizabeth's usual classroom practices by asking for any activity to be included, omitted or adapted.

Audio-Recording of Collaborative Groupwork

Collaborative groupwork activities were recorded using a mobile phone as a recording device. The students' permission was asked on every occasion (in addition to the formal consent obtained at the outset of the study). The phone was set to record, placed on the table between participating students, and left unattended in order to be as unobtrusive as possible.

In early fieldwork sessions, I attempted only to record those parts of the sessions which had been planned as collaborative groupwork. However, I soon found that the boundaries between collaborative groupwork and teacher-led activities were not always clear, and that rich discussions might arise spontaneously and unexpectedly. For later sessions, therefore, I recorded as much as possible of the whole session, usually in two hour-long recordings.

At the Farmton class, the students worked in two groups at different levels of the numeracy curriculum, so two mobile phones were used concurrently, one for each group. In total, I recorded approximately eleven hours of useable audio data.

Photographing or Photocopying Learning Materials

Card activities were photographed in use, with care taken not to photograph participants (or any identifying materials). Elizabeth provided photocopies of all worksheets and other paper-based learning materials used by participating students during the fieldwork sessions.

Interview with a Deaf Student

Linda, one of the students in the Farmton group, was deaf and chose not to participate in collaborative groupwork (see Chapter 5). I felt that it would be very useful to obtain Linda's perspective on collaborative groupwork, and so arranged a face-to-face semi-structured interview with her, with support from her signer.

Focus Group (pilot only)

During early fieldwork at Milltown, I piloted the use of a focus group to discuss issues arising during collaborative groupwork. Although this focus group yielded some interesting insights, I realised that what fascinated me was the students' *spontaneous* contributions of knowledge and linguistic practices to the classroom. Rather than transform those practices, I wanted to study in more detail how the students themselves used them, and so this pilot represents my only use of a focus group (see Chapter 10).

Transcribing the Recordings

> Remember that when you are transcribing talk, you are transcribing people.
> (Roberts 2003:31)

Choices about how to transcribe spoken discourse are part of the process of analysis, influenced by theories, values and ideology (Roberts 2003). Here I outline factors which influenced my decisions what to transcribe, and how.

With considerable amounts of audio data (up to two hours of talk per session) my first consideration was whether I needed to transcribe it all. However, the data was very rich and multi-stranded, and every passage of

talk yielded useful insights. I felt it essential to the naturalistic integrity of my data to make basic transcriptions of the audio-recordings in full.

I also needed to consider whether to transcribe the students and teachers in my study as I heard them, or as they meant to come across; and to what extent I should represent regional dialects and other individual characteristics of speech. Naturally-occurring spoken language is not planned and performed to be written down, and so transcriptions of spoken language will rarely look as coherent as written language. For the level of analysis I was interested in, the speakers' hesitations, false starts, redraftings, overlaps and silences were all as much a part of the data I collected as the words themselves, and are represented in transcription in similar research for example by Barwell (2005a), Atweh, Bleicher and Cooper (1995) and Mercer (2004).

Another important characteristic I wanted to represent was the rhythm and "poetry" of the students' narratives and exchanges and, while I have not fully followed the conventions of ethnopoetic transcription (Hymes 1981; 1994), I have tried to set out the transcriptions in such a way that this rhythm is not lost.

The majority of the students in my study had northern (English) accents, and many used some features of northern dialect. When attempting to use transcription to convey anything other than a "standard" variety of speech, there is a danger of marking that speech as aberrant and "other". This would have strongly misrepresented the normal status of the northern accent in these classrooms, in which only two students had southern accents (and were therefore regarded as "posh" by their fellow students). Nonetheless, some life and authenticity is lost if too much of my speakers' dialect is corrected, and I have chosen to leave much of it as I heard it, particularly where dialect was essential to the rhythm or humour of the talk.

However the detailed transcription conventions used for marking prosody (intonation) in conversation analysis and microethnography did not feel appropriate to my purposes, as I was interested not so much in interaction for its own sake, but how education is accomplished through it. Therefore I

have kept conventions for marking prosody to a minimum. As Mercer (2004:147) suggests:

> No one particular convention for transcribing speech is intrinsically better than another. Transcription choices should be determined by the research questions being addressed and the claims which will be made on the basis of the analysis.

The conventions used in my transcriptions are listed in Appendix D.

While my process of transcription was iterative and occasionally intuitive, it generally involved the following steps. I listened first to each full recording without attempting to transcribe it in order to make sense of the discussion, making only rough notes of themes and content. At this point it was also useful to refer to my fieldnotes, and to copies of worksheets, card activities or other learning materials used by the students while they were being recorded. Each recording was then transcribed in full for coding and analysis. Passages of talk chosen for more in-depth analysis were listened to repeatedly and transcribed iteratively, often revealing new insights and interpretations on each subsequent listening.

Analysing the Students' Talk

Early studies of classroom discourse attempted to apply "scientific" methods to traditional, teacher-led classrooms, with approaches that allowed large amounts of data to be collected and analysed quantitatively. A broader range of linguistic, ethnographic and psychological research approaches began to emerge in the 1960s and 1970s, and more recent developments in discourse analysis meet changing perceptions that its purpose is to render accounts of the role of language in the construction of human experience (Edwards and Westgate 1994; Christie 2002).

As emphasised in Chapter 1, I come to my research as a numeracy educator, rather than as a linguist studying language in educational settings. Fascinating as I find the students' discussions in the classroom, and the diverse linguistic repertoires on which they draw, my primary aim in this research is to examine how their talk is used to further their

mathematical learning, and what it reveals about the knowledge, practices and dispositions they bring to the classroom. Language can be regarded as performing two primary functions: "to support the performance of social activities and social identities and to support human affiliation within cultures, social groups and institutions" (Gee 2005:1), and in my analysis I was interested both in the content of students' talk, and in the processes through which that talk is produced (Taylor 2001).

While not adhered rigidly to any one theory or method of linguistic analysis, I did find Halliday's systemic functional linguistics (SFL) resonated well with my research aims, particularly in its emphasis on the metafunctions performed by language, and on talk as a sequence of choices made by the speaker (Halliday 1985). The relationship between SFL and my analytical framework is discussed in Chapter 4.

In the following account of the analysis process, it should be remembered that all discourse analysis is inevitably partial, situated and relative. My own positionality (outlined in Chapter 1), and my familiarity with the sites of my research, both enrich and compromise my analysis (Barwell 2003b).

Coding and Early Analysis

Qualitative, interpretive approaches to analysis of discourse tend to be open-ended, circular and inductive (Taylor 2001, Edwards and Westgate 1994). Miles and Huberman (1994:65) recommend early and ongoing coding of data: "The ultimate power of field research lies in the researcher's emerging map of what is happening and why."

I began my process of analysis with a number of themes already in mind resulting from my research questions and my literature review, and these were used to draw up an initial analytical framework. This framework was based on a funds of knowledge approach (Moll *et al* 1992), but also took into account critical factors such as Bourdieu's notion of cultural capital (Bourdieu 1986).

However, I was also open to new themes that might emerge from the data during analysis, and these were identified using interpretive comments

written in a column alongside my initial transcription (Wolcott 1994). Together with the original themes identified from my research questions and literature review, these were used to draw up a set of initial codes or "labels for assigning units of meaning" to data (Miles and Huberman 1994:56). During an iterative process of listening again to recordings, and re-reading and revising transcripts, these codes were then added alongside the transcripts in a third column, and reviewed and grouped into clusters of codes and sub-codes.

Codes based on my research questions and literature review were:
- Funds of knowledge brought by the students to the classroom
- References to numeracy practices outside the classroom
- Use of metaphor
- Use of mathematical register
- Mercer's typology of group discussion (cumulative, disputational and exploratory talk)

Codes emerging from themes identified in my initial analysis were:
- Expressions of uncertainty
- Self-deprecation and anxiety
- Degree of agency over learning
- Classroom as community of practice
- The relationship between learning and other aspects of learners' lives (such as home or family)
- Mathematical pedagogy

A full set of codes and sub-codes, together with a sample of coded transcript, are included in Appendices E and F.

These codes were applied to the transcripts while listening again to the recorded data; I found this continued use of the audio-data in addition to the transcripts essential to the analytical process.

Emerging Patterns: Pulling the Analysis Together

The "rich" or "thick" nature of my data meant that it would have been possible to focus on many additional themes emerging from the interactions (for example, the insights they gave into social-constructivist pedagogies).

It was thus necessary to focus on some themes and not others in line with my research questions.

Both transcripts and original recordings were revisited (sometimes many times) during the analysis process as I attempted to make connections and pull patterns out of the emerging codes, and relate them to my initial research questions.   The physical placing together of similarly-coded extracts proved problematic as utterances needed to be reviewed within the context of the preceding and following talk to be meaningful.   Eventually I found a system of colour-coding helpful; applied to the transcript using the word-processor, and echoed in a "mind-map" which used the same colour scheme and which allowed me to link related themes in an increasing complex network (a copy of this is included in Appendix G).

From an early stage in the analysis process, I began to encounter a major challenge: what to categorise as funds of knowledge.   The very flexibility of my framework made it too easy to argue that almost any classroom interaction drew on, or demonstrated, students' funds of knowledge – yet certain types of knowledge seemed to me to offer less transformative potential than others. As a result of this conceptual crisis, I felt compelled to revise my analytical framework to include an account of the "schooled habitus" which the students appeared to bring to the classroom, and this is set out in Chapter 4.

Following the revisions to my analytical framework, I felt much more confident about using it to interrogate my data, and the eventual themes explored in my analysis in Chapter 6 and 7 are as follows:

- Expressions of uncertainty
- The role of humour
- "They": writers of learning and assessment materials as "other"
- Uptake and rejection of mathematical discourse
- Out-of-classroom numeracy practices and classroom talk
- Discourse and the curriculum
- "Right" answers and the "Test"

Conclusion

In this chapter, I have introduced linguistic ethnography as an epistemological and methodological approach, and explained why it suited my research aims and interests. I have described how I selected and recruited participants, and have discussed the generalisability (or otherwise) of my study. Obtaining naturalistic talk was a major methodological aim, but was made easier by the intense engagement with which the students worked on mathematical activities. Finally I have outlined how I embarked on the iterative, cyclical, and at times extremely challenging, process of transcription, coding and analysis. In the next chapter I set out my analytical framework, which was initially developed during my literature review, and then substantially revised in the light of themes emerging from my data.

Chapter 4

Whose "Funds"; Whose "Knowledge"?

Thomas (1993:19) reminds us that "critical self-consciousness is the ability
... to discern in any scheme of association, including those one finds
attractive and compelling, the partisan aims it hides from view". If I feel
entitled to critically deconstruct ideologies I reject, such as a deficit model
of adult numeracy learners, I must also accept responsibility to deconstruct
ideological concepts which I find appealing, such as that of funds of
knowledge.

In this chapter I discuss the strengths and limitations of funds of knowledge
as an analytical framework, and explore other theoretical constructs which
may provide further critical power in analysing the relationship between
discourse, power and the knowledge which the students brought to their
classroom discussions. The ideas presented here arose initially from my
literature review (see also Oughton forthcoming) and, as described in
Chapter 3, were developed further in the early stages of analysis in
response to themes emerging from my data. The resulting framework must
thus be seen as both informing, and being informed by, my analysis.

Funds of Knowledge: Reflections and Concerns

In Chapter 2, I introduced Moll et al's (1992) concept of funds of
knowledge, used to describe cultural resources found in US-Mexican
households in Arizona. Subsequent researchers extended its application
from households to individuals, and from practical knowledge to
interpersonal resources, making it even more applicable to adult classrooms
as an analytical framework. In particular, Baker's adaptation of the concept
for adult numeracy learners offers great flexibility in identifying and
exemplifying instances of learners drawing on their funds of knowledge, and
in using the concept to disrupt "deficit" discourses:

> knowledge, experiences, histories, identities and images of themselves;

> attitudes, dispositions, desires, values, beliefs, and social and cultural relations;
> relationships with learning, teachers and mathematics itself;
> and numeracy practices beyond the classroom (Baker 2005:16)

However, the very flexibility of this broader framework presents conceptual difficulties. Early in my analysis I became concerned that it was too easy to argue that almost any classroom interaction drew on, or demonstrated, students' funds of knowledge, and that I was called upon to arbitrate what should "count" as funds of knowledge in my analysis, and what should not. I appeared to be in danger of replacing one set of cultural arbitraries (the curriculum privileged as legitimate knowledge by policy or other dominant discourse) with another (the resources privileged as funds of knowledge by myself as researcher).

The term "funds of knowledge" has great ideological power, with both "funds" and "knowledge" being value-laden constructs. I felt that careful and critical reflection was needed in order to use the concept in a rigorous and principled way.

The Metaphor of "Funds"

Sfard (1998) describes metaphors as "the most primitive, most elusive, and yet amazingly informative objects of analysis" and reminds us of their constitutive power:

> Because metaphors bring with them certain well-defined expectations as to the possible features of target concepts, the choice of a metaphor is a highly consequential decision. Different metaphors may lead to different ways of thinking and to different activities ... and – above all – perpetuate beliefs and values that have never been submitted to a critical inspection (p.5).

In adopting the term "funds of knowledge", Vélez-Ibáñez and Greenberg (1989) associated their concept with two metaphors widely used in education (though more typically within traditional and neo-liberal than in critical discourses): economic metaphors and metaphors of learning as acquisition.

Historically, learning has been perceived as *acquisition* of knowledge, human minds as containers to be filled, and learners as *gaining ownership* of that knowledge. According to Sfard (1998), the acquisition metaphor has

become so naturalised that there might be little awareness of its existence had not an alternative metaphor started to develop. This alternative metaphor is *participation*: the process of becoming a member of a certain community (Lave and Wenger 1991). Within this metaphor, the state of "having" gives way to the process of "doing", and situatedness, context and culture come to the fore.

Hughes *et al* (2005) suggest that Sfard's distinction between the two metaphors may be applied to learning inside and outside school, linking the acquisition metaphor with school learning, and the participation metaphor with out-of-school learning. Of these two metaphors, the participation metaphor does, indeed, seem more appropriate for the type of learning through which people might develop funds of knowledge. The term as it is used by Moll *et al* (1992) implies experience and understanding which might result from participation in a community rather than the deliberate and purposeful pursuit of knowledge. Note that Freire (1972) uses the economic acquisition metaphor to *critique* the "banking" model of education, in which legitimised knowledge is "deposited" in the learner. The similarity of metaphor between funds of knowledge and Bourdieu's (1986/2004) cultural capital is also striking, and the relationship between the two concepts is explored below.

Funds of Knowledge and Cultural Capital

Bourdieu (1986/2004:15) describes capital as something which:

> in its objectified or embodied forms, takes time to accumulate and which, as a potential capacity to produce profits and to reproduce itself in identical or expanded form, contains a tendency to persist in its being, is a force inscribed in the objectivity of things so that everything is not equally possible or impossible.

He outlines three forms in which capital may present itself, and which, he suggests, contribute to the reproduction of inequality in society:

> as economic capital, which is immediately and directly convertible into money and may be institutionalised in the form of property rights; as cultural capital, which is convertible, in certain conditions, into economic capital and may be institutionalised in the form of educational qualifications; and as social capital, made up of social obligations ("connections"), which is

> convertible, in certain conditions, into economic capital and may be institutionalised in the form of a title of nobility (p.16).

Bourdieu suggests that cultural capital may be in the form of: long-lasting dispositions of the mind and body; cultural goods; or educational qualifications and membership of professional organisations. Academic qualifications are the "objectified" form of cultural capital, which can be exchanged for economic and symbolic capital (Bourdieu 1977). The transmission of cultural capital within a social class maintains an inequality of educational achievement, but because it is less visible than economic capital, the advantages it confers may not be recognised as capital and may instead be seen as legitimate competence and the deserved result of hard work. Bourdieu emphasises that cultural capital is not inherently valuable; it has been given *arbitrary* value because of its legitimation by the dominant class. The power of Bourdieu's concept rests in its challenge to cultural hegemony.

We can draw many parallels between cultural capital and funds of knowledge. They are both characterised by sets of gradually-acquired and long-lasting dispositions (or *habitus*, see below) and manifested in skills, know-how and competences. Despite the economic metaphors used in both cases, neither is diminished through use. They may be transmitted between generations and within a selected community.

Nonetheless, the differences are highly significant. Coben (2002) applies Marx's distinction between use-value and exchange-value to different domains of numeracy practice. Numeracy practices which have high use-value but low exchange-value (for example those used in household budgeting or cooking) may be regarded as part of an individual's funds of knowledge, while numeracy practices which have low use-value but high exchange-value (for example, academic mathematics) confer cultural capital (Ward-Penny 2009). Practices encompassed by the term funds of knowledge tend to be dismissed as low-status, or common-sense, possessed in some form or other by everyone. Contrast this with Bourdieu's cultural capital, exchangeable for symbolic and economic capital (Bourdieu 1977), and privileged and legitimated by a dominant elite.

Habitus and Field in Adult Numeracy Education

Bourdieu (1977; Bourdieu and Wacquant 1992) defines *habitus* as a system of durable and transposable dispositions which individuals develop in response to the determining structures, or *fields*, they encounter, such as social class, family and schooling, and which may be seen as a *tendency* to act, think and perceive in a certain way. The concept of habitus recognises the limitations of individual autonomy while rejecting the notion of complete determinism by social factors, and accounts for action that does not seem to be guided by "rational" motives. The choices of the individual are guided by habitus, without being reducible to prescribed rules.

While habitus is seen as durable, it is not necessarily permanent, and may be modified by later experiences, including adult education. Nonetheless, Bourdieu notes a hysteresis, or lag, which may occur between an encounter with new experiences and the resulting changes in habitus. Bourdieu and Wacquant (1992) also suggest that for many individuals, social conditions encountered later in life will only serve to confirm early habitus.

The concept of habitus is proposed in relation to *field*, a social arena or system of social positions in which individuals manoeuvre in pursuit of capital in its various forms. Field may be seen as relating to the objective conditions of social space, while habitus is an expression of individual subjectivity. Individuals do not subscribe to a particular field explicitly, but implicitly by adopting the practices of that field.

> A field may be defined as a network, or a configuration, of objective relations between positions. These positions are objectively defined, in their existence and in the determinations they impose upon their occupants, agents or institutions (Bourdieu and Wacquant, 1992:97)

Habitus and field are both structured and structuring, and while a field is constituted by the habitus of the individuals who participate in it, habitus reflects the shaping of a person's action and thought by the structures of the field. Habitus and field are related to cultural capital, as the legitimation of a particular type of cultural capital depends on the field and is therefore arbitrary, and similarly cultural capital can be derived from an individual's habitus.

Education is an example of a field which reinforces and legitimises a certain kind of habitus (usually that of the middle-class). Students enter adult numeracy classrooms with a habitus that influences the way they think and act (Sarangi 1996, Boaler 2007), and this may need to change in order to adapt to and negotiate the new field. The durable nature of habitus can make it difficult to adapt quickly enough to the demands of the new field (Bourdieu 1977; Bourdieu and Wacquant 1992). Barton *et al* (2006:17) describe the challenges faced by learners entering the field of *Skills for Life* classrooms:

> Given that many people had these negative associations with education, we found that learning and, particularly, participating in formal structured learning meant more to people than just acquiring new skills. It could mean entering a different culture or taking on a whole new identity, a process that could be experienced as difficult and sometimes even as dangerous.

The concept of habitus resonates with social practice theories of numeracy and literacy. Barton and Hamilton (1998:12) propose that practices are historically situated, at levels both of the individual's life history and of social history. Baker (1998) and Street *et al* (2005) offer a social practice model which takes into account four dimensions of numeracy; content, context, ideology and culture, all of which might be supposed to contribute to the development of an individual's "schooled" habitus through formal classroom mathematics. Barton *et al* (2007), following Reay (1995; 2004) discuss the relationship between habitus and an individual's perceptions of the possibilities of actions and thought available to them:

> Habitus shapes the possibilities that are perceived to be open to any individual within any given socially structured field of activity ... It generates a repertoire of possible actions and also rules out some seen as being impossible (Barton *et al* 2007:21)

Maybin (2000) examines the way in which local language and literacy events shape and are shaped by institutional discourses. People's sense of identity is shaped by their immersion in wider institutional discourses via local events, and thus institutional power becomes internalised into their attitudes, dispositions and lives.

> Literacy events are part of a continual construction and negotiation of identity for people in different kinds of groups and communities ... local literacy events both reflect and contribute to the constitution of broader social structures (Maybin 2000:208)

Collins (1999) draws attention to commonalities between the concepts of habitus and funds of knowledge, and Baker (2005) regards adult numeracy learners' dispositions as part of their funds of knowledge. However, I suggest that analyses taking a funds of knowledge approach tend to regard these dispositions as resources to be celebrated and utilised, whereas analyses based on the notion of habitus are more likely to regard such dispositions as part of a cycle of educational and social reproduction.

"Schooled" Habitus

Habitus is seen as historically-constituted, and reflects the inter-relationship between past and present. One way to examine the habitus of adult numeracy learners might therefore be through a life history approach (for example Wedege 1999; Swain 2007). By contrast, my naturalistic, ethnographic approach to data collection provides only a "snapshot" of the participants' life trajectories (although their talk does sometimes contain telling accounts of past educational experiences; see Chapter 5). It can nevertheless be argued that current practices disclose *traces* of habitus (Nash 1999; Rowsell 2000; Pahl 2002):

> Habitus has a history and discloses the traces of its origins in practice. In this ideal conception, habitus thus unites the past and the present for, while being the product of early experience, it is subject to the transformations brought about by subsequent experiences (Nash 1999: 176)

Education can be seen as having a central role in forming and transforming habitus, and a range of terminology is used to describe the different types of habitus which may result from education. While sounding superficially similar, these are nuanced in different ways. "School" (rather than "school*ed*") habitus is often used to describe the collective habitus or ethos associated with a school; while a "cultured", "scholastic" or "academic" habitus is closely aligned with cultural capital (Reay 1995; Bourdieu 1975; Delamont, Atkinson and Parry 1997; Bourgois 2002). By contrast, the less frequent term *"schooled"* habitus tends to be used in analyses which suggest that the habitus has been *imposed* upon the individual by the school system (e.g. Ladwig and Gore 2000) in a manner which may, perhaps, be regarded as symbolic violence (Bourdieu and Passeron 1977). The term implies greater structure and less agency, and suggests a habitus

which may not be relevant to the individual's practices outside the field of the school or classroom (Street *et al* 2005).

My early struggles with my analysis suggested that the notion of schooled habitus might be a fruitful way to interrogate my data. Taking talk as a transient trace of students' practices and habitus, I became interested in the schooled habitus which the participating students seemed to bring with them into the classroom, and in the inter-relationship between their past experiences of schooling and present numeracy classroom practices. It provides an additional, more critical, framework in which to consider which aspects of the participants' classroom practices and discourse might be regarded as funds of knowledge. For example, should a "feel for the game" of mathematical word problems be regarded as part of a student's funds of knowledge, or as part of a schooled habitus "imposed" on them as a schoolchild, and "imposed" once more in the adult classroom?

Bourdieu and Wacquant (1992:104) propose a three-level system of analysis for the ethnographic study of field.

> First, one must analyze the position of the field vis-à-vis the field of power ... Second one must map out the objective structure of the relations between the positions occupied by the agents or institutions who compete for the legitimate form of specific authority of which this field is the site. And, third, one must analyze the habitus of agents, the different systems of dispositions they have acquired by internalizing a determinate type of social and economic condition.

Thus in my analysis I first examine the position of field of adult numeracy education within government policy in England, particularly in terms of the emphasis on employability within the *Skills for Life* strategy and also drawing on my earlier work on discourse and the curriculum (Oughton 2007). I then examine my data to see how the participants negotiate agency within prevailing, structuring discourses of curriculum and pedagogy within the field of the adult numeracy classroom. I investigate the durability of schooled habitus within this new field and, in particular, the way habitus shapes the possibilities of action and thought an individual perceives to be open to them in classroom activity.

Knowledge and Pedagogic Discourse

Where Bourdieu's work on habitus, field and capital relates to a broader variety of social arenas and fields, Bernstein theorises in more detail the ways in which knowledge is transmitted, and the arbitrary ways in which it is selected and transformed in educational processes. Here I summarise those areas of his theory most relevant to my analysis and relate them to the current adult numeracy context.

The Pedagogic Device and Recontextualisation

Bernstein (2000) theorises the transmission of knowledge through schooling in terms of three inter-related rules: distributive, recontextualising and evaluative, which together make up the *pedagogic device* (Bernstein 2000:27). Distributive rules regulate how, and to whom, different forms of knowledge are distributed; recontextualising rules describe how knowledge is transformed as it is moved from its original site of production to the classroom; and evaluative rules constitute specific pedagogic practices, concerned with recognising what counts as valid acquisition of learning. Recontextualised discourse no longer resembles that of the original field of knowledge because it has been converted into pedagogic discourse:

> As the discourse moves from its original site to its new positioning as pedagogic discourse, a transformation takes place. The transformation takes place because every time a discourse moves from one position to another, there is a space in which ideology can play (Bernstein 2000:32).

For example, as FitzSimons (2004) and Watson (2008) point out, school mathematics differs from academic mathematics, and also from workplace numeracy.

Recontextualisation may take place in an *official recontextualising field*, created by policy, such as the development of the adult numeracy core curriculum in England (BSA 2001). Further recontextualisation will take place in the *pedagogic recontextualising field*, including the interpretation of the curriculum by the teacher. Bernstein (2000) and Marsh (2007) note the increasing strength of the official recontextualising field through policy intervention, and the decreasing autonomy of teachers, in many educational

sectors in England. Writing of *Skills for Life* classrooms in England, Ivanič and Tseng (2005:13) argue that:

> Learning and teaching are political acts operating in a context heavily influenced by current policies. Learners and teachers are not often allocated power to evaluate which outcomes of learning are desirable; rather, these are determined by the institutions which produce and administrate policies, curricula and inspection regimes. Learners' and teachers' intentions for learning and teaching are renegotiated and shaped by such external forces, and teachers' autonomy over their pedagogic practices is thereby reduced.

Classification and Framing

Classification describes the extent to which categories of knowledge are insulated from each other, with a strong classification implying that the categories are clearly insulated. Mathematics as a discipline tends to be strongly classified, having a unique identity, discourse, and its own specialised rules (FitzSimons 2004), and I also suggest that the atomised and highly-structured nature of the adult numeracy core curriculum means that the individual *topics* are also strongly classified, a trend also noted in the Australian curriculum by FitzSimons (2002).

Framing refers to the extent to which discourse and learning are controlled by the teacher. Where teachers are firmly in control of the content, sequence, pace and evaluation of learning there is strong framing. Where this control apparently lies with the learner this is described as weak framing:

> Where framing is strong, we shall have a visible pedagogic practice. Here the rules of instructional and regulative discourse are explicit. Where framing is weak, we are likely to have an invisible pedagogic practice. Here the rules of regulative and instructional discourse are implicit and largely unknown to the acquirer (Bernstein 2000:14).

Framing can apply differently to different aspects of classroom activity. For example, in adult numeracy classrooms, collaborative groupwork may be weakly framed, with the learners having apparent control; whereas summative assessment practices are strongly framed, with learners having little control over the process.

Recognition and Realisation Rules

Classification and framing provide the rules of the *pedagogic code* and act on *recognition rules* and *realisation rules*. These are usefully illustrated through Holland's classic study in which primary-age children were presented with a set of 24 photographs of food items (Holland 1981; Bernstein 2000) (see also Chapter 7). The children were asked to group the items and give reasons for their grouping. The instruction was: "Here are some pictures of food. What we would like you to do with them is put the ones together you think go together. You can use all of them or you can use only some of them". Holland concluded that middle-class children were more likely to use general or *abstract* principles of classification, whereas working-class children were more likely to refer to local or *everyday* principles; for example by explaining: "That's what we have for Sunday dinner." Given a chance to classify the pictures in a different way, many of the middle-class children switched to a classification based on everyday life, while the working-class children maintained a similar classification (Bernstein 2000:18).

Bernstein (1990; 2000) explains these findings in terms of recognition rules, which determine *which* meanings are relevant to be put together; and realisation rules which determine *how* meanings are put together and communicated in order to produce legitimate responses or *texts*[12] for evaluation. Bernstein contends that the working-class children in Holland's study found it more difficult to apply appropriate recognition and realisation rules than the middle-class children. Learners are not explicitly taught these rules, but derive and internalise them by making inferences from the discourse within which they are immersed. In discourses which are strongly classified and framed, the rules are made more explicit; in those which are weakly classified and framed the rules are less explicit. Cooper and Dunne (1998) suggest that an understanding of the expectations of mathematical word problems is an example of such rules in practice, an idea which I explore further in Chapter 7.

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[12] Text, as Bernstein uses it here, is anything which attracts evaluation, so in the classrooms under study might include completion of a card sorting or matching activity.

"Rules" and Schooled Habitus

I have found it useful in my analysis to draw on the theories of both Bourdieu and Bernstein, and to relate students' possession of recognition and realisation rules to schooled habitus.   It has been suggested that Bernstein's theories are more deterministic or structuralist than those of Bourdieu (for example Harker and May 1993), not least because of Bernstein's references to "rules".   Bourdieu explicitly rejects the notion of rules and stresses that habitus is neither wholly voluntary nor wholly involuntary, but rather as:

> Objectively "regulated" and "regular" without being in any way the product
> of obedience to rules ... they can be collectively orchestrated without being
> the product of the organizing action of a conductor (Bourdieu 1977:72)

Bernstein refutes accusations of structuralism as "misrecognition" (1995:3), and it is important to examine carefully what he means by "rules". Recognition and realisation "rules" are not deterministic rules (for example, that X must follow Y), nor rules to be enforced (like school rules about wearing uniforms).   The penalty for non-compliance is not punishment, but potential failure.   They might rather be compared to algorithms which lead to success if followed.   It is notable that Bernstein gives learners *ownership* of these rules; he writes of learners "acquiring" or "possessing" the rules (2000:17).   If a learner possesses a rule, they can choose whether or not to follow it.

In my analysis I examine whether the participating students' appear to possess (mathematical) recognition and realisation rules as part of any schooled habitus which they bring with them to the adult classroom, and whether possession of these rules offers affordances, or instead limits students' perceptions of the possible.

Talk as "Traces" of Habitus

The ideas discussed in this chapter are intrinsically bound up with language and its use. The repertoires of linguistic practice to which the students have access – and the ways in which they choose to select from that repertoire in

collaborative groupwork – provide traces of practices and dispositions, and thus of habitus. Bourdieu (1991) defines *linguistic habitus* as a sub-set of the dispositions which make up habitus; dispositions acquired through learning to speak in particular contexts such as family, peer group and school. According to Zevenbergen (2000:202), linguistic habitus will influence the way that a person will speak in future fields (such as mathematics classrooms) and also the way that the person is perceived within those fields:

> As students come to hear and use particular forms of language, this language becomes embodied to constitute a linguistic habitus. When students enter mathematics classrooms, they have accepted the language of their home environment, the consistency of which will vary with respect to formal school language. Where there is greater continuity between the home and school, there is greater chance of success in school mathematics.

Bourdieu (1991) also describes *linguistic capital* as a form of cultural capital and claims that education is dominated by the "linguistic products" of the dominant class. Linguistic capital is defined in relation to field, for example the mathematics classroom:

> In place of *grammaticalness* it puts the notion of *acceptability*, or, to put it another way, in place of 'the' language (*langue*), the notion of *legitimate* language. (Bourdieu 1977:646 original emphasis)

Bourdieu's linguistic capital and linguistic habitus are seen as having much in common with Bernstein's *codes* (Harker and May 1993). Bernstein (1971) developed his theory of elaborated and restricted codes as a result of his experience as a teacher in London schools and later extensive research into language patterns of working-class and middle-class children. Restricted codes are context-dependent and particular, whereas elaborated codes are context-independent and universal. While restricted code is informal, and relies on speakers and listeners sharing background knowledge and understanding, elaborated code is sufficiently explicit to be understood by an outsider. Bernstein suggests that whereas middle-class children often have access to both restricted and elaborated codes, working-class children tend to have access only to restricted codes. Since educational discourse is conducted in elaborated code, working-class children are thus put at a disadvantage. While Bernstein has had to defend his work against inevitable criticism that it projects a deficit view of working-class children, his ideas provide a valuable framework for analysing

the rich, context-specific discourse used in much of the collaborative groupwork in my study.

As described in Chapter 3, Halliday's view of language as a system of choices for making meaning has enabled me to focus on the linguistic repertoire available to the participants, and the functions they achieve through selecting from this repertoire (Halliday 1985). In systemic functional linguistic theory, language is regarded as social semiosis, integral to the construction of social experience and identity. Halliday identifies three metafunctions of language in use; the ideational, the interpersonal, and the textual. The ideational metafunction relates to the subject matter and context of the discourse; the interpersonal metafunction relates to the tenor of the discourse (expressed for example through mood, person, or modalising expressions); and the textual function, related to the mode of the discourse. The available choices to the speaker are various and complex and are not generally considered to be conscious. Analysis within this framework consists in looking at how speakers exploit and deploy these language choices, regarding language as a resource, rather than as a set of rules (Christie 2002).

Critical Discourse Analysis

Also drawing on Halliday's work, critical discourse analysis investigates social inequality as it is expressed, signalled, constituted and legitimised by language use. It involves theorising the social processes and power structures which give rise to, and are maintained by, discourse. Through critical analysis, the institutional practices that directly or indirectly legitimise existing power relations can be exposed and challenged; as can the ways in which ideological assumptions are projected as "common sense" (Fairclough 1989; Wodak 2002; Luke 2002). Critical discourse analysis relates a fine-grained analysis of spoken or written texts to wider power structures and can be used to challenge the underlying assumptions about adult numeracy learners which feed into, and are maintained by, texts such as curriculum documents and learning and assessment materials.

Ivanič and Tseng (2005:13) describe how:

> Beliefs can enter the classroom indirectly by being inscribed in the syllabuses, curriculum documents and learning/teaching resources that are used there. In this way, policymakers, commercial publishers and practitioners devising teaching materials shape classroom pedagogy and learning outcomes.

There are overlaps between linguistic ethnography and critical discourse analysis, and the two methodologies draw on and complement each other (Rampton *et al* 2004). I regard the teacher and students in my study as being in dialogue with policy through their engagement with written learning and assessment materials, and by the extent to which classroom practice is directed by the curriculum and other policy directives (see Chapter 5). Their classroom discourse can be regarded as responses, directly or indirectly, to official texts, and thus my analysis of the participants' discourse also includes a critical component.

Conclusion

In this chapter I have discussed ideas developed initially during my literature review and later informed by the early stages of my analysis.

These ideas provide the framework for the analysis presented in Chapters 6 and 7, in which I examine the diverse knowledge, practices and dispositions which the students draw upon during collaborative groupwork. As well as looking for traces of out-of-classroom practices, I ask whether the students' schooled habitus (particularly that associated with school mathematics classrooms) may have persisted into adulthood, and examine whether traces of this habitus are also manifested in their talk. I take Bernstein's rules of pedagogic code to be part of schooled habitus, and analyse how schooled habitus might shape the possibilities of discourse and thought that students perceive to be open to them during classroom activities. In Chapter 8, I then discuss how this analysis might contribute to our understanding of the differing types of knowledge adult learners bring to

the classroom, and how these knowledges are valued by different discourses within adult numeracy education.

Firstly, however, Chapter 5 describes the settings in which my research took place, and introduces the two (often conflicting) discourses which currently dominate pedagogy in adult numeracy classrooms in England.

Chapter 5

"Can we all work together in the exams?" Setting the Scene of my Research

In ethnographic approaches to discourse analysis, the context within which interaction takes place is seen not so much as background to the data but as part of the data itself (Goodwin and Duranti 1992; Taylor 2001; Blommaert 2005). In this chapter I regard the boundary between data and context as permeable; not only does the context form part of my data, but I also take my recordings of naturally-occurring student interaction as contributing to an understanding of context, particularly, for example, where the students recounted past experiences of schooling, or referred to the efforts they made to fit learning into their lives. The contents of this chapter are thus intended to be ethnographically descriptive rather than analytical.

To set the scene for my research, I first introduce the wider social and political context. Adult numeracy classrooms in England, and the activities of the people within them, are so tightly structured by current policy that the context of my research cannot be established fully without discussing the influence which the *Skills for Life* strategy has had on them. I then introduce the sites of my research – two adult numeracy classrooms in the north of England – and the students, teacher and support staff who met there each week. I also describe the classroom activities during which student discourse was generated, and the nature of each classroom as a "community of practice".

Policy Background: *Skills for Life* in England

In 1999, a report by a working group chaired by Sir Claus Moser (1999) drew on various research sources, including the International Adult Literacy Survey (IALS) (OECD 1997) and longitudinal cohort studies (such as Bynner and Parsons 1997) to establish the scale of adult literacy and numeracy

"need" in England and the impact this might have on the economy and society. The report concluded that up to seven million adults in England had difficulties with literacy and numeracy (a higher proportion than any other European countries except Poland and Ireland). The outcome was a major reform of adult literacy and numeracy provision in England, branded by the Department for Education and Skills (DfES) as "*Skills for Life*" (DfES 2001). Strands of the strategy included: new core curricula; nationally-recognised qualifications in literacy, language and numeracy; and subject specialist teacher qualifications (QCA 2000; BSA 2001; FENTO 2001). A research consortium, the National Research and Development Centre for adult literacy and numeracy (NRDC), was established to inform policy and practice.

The reforms have had a major impact on adult numeracy provision, with learners approximately doubling in number between 2001 and 2005, while numbers achieving qualifications nearly tripled. Although the phrase *Skills for Life* was originally coined as the title of a strategy document, it has been widely adopted as the name of a curriculum area (for example in teachers' job titles and the names of college departments) as an alternative to the low-status "basic skills". In a policy development which was originally resisted by teachers, but has now largely been accepted as an inevitable part of provision, all students are required to work towards formally-recognised qualifications, and funding is dependent on successful achievement of those qualifications.

While measures are to be welcomed which raise the profile of, and funding for, adult literacy and numeracy provision, the strategies have been critiqued for their emphasis on economic effectiveness and workforce development; the deficit view presented of adult learners; and the prioritisation of funding for adults who are close to gaining accreditation rather than those with the greatest need (for example Papen 2005; NIACE 2007; NIACE 2008; Hodgson, Steer *et al* 2007).

The original IALS research has also been questioned. It is suggested that the pen-and-paper methods of testing used to "expose" low levels of literacy and numeracy are inadequate to assess the practices which adults

use in their lives, and that if adults were asked instead to assess their own skills, far fewer would be perceived to be in need (Hamilton and Barton 2000; Gregson, Nixon, Coffield and Edward 2005; Payne 2006). Baker (1998:49) suggests that adult numeracy policy tends to be located within an autonomous model of numeracy, which "take[s] for granted that there is no real debate about what skills are central to these standards, whose standards they are and even why we need them".

As discussed in Chapter 2, a pervasive assumption is that numeracy (and literacy) for adults should be functional and relevant to real-life. This is expressed through the Adult Numeracy Core Curriculum (BSA 2001; LSIS 2009), with its repeated use of terms such as "straightforward", "everyday", "familiar" and "practical" to distinguish adult numeracy from high-status, esoteric forms of mathematics, and to position adult learners in the low-status, functional domain (Oughton 2007).

The *Skills for Life* programme has been given renewed impetus during the decade since its inception by further policy developments. These include: the Smith report (2004) on post-14 mathematics education; the Tomlinson report and subsequent white paper on 14-19 education reform (DfES 2004; 2005b); the DfES, DTI, HM Treasury and DWP (2005) white paper on skills; and the *World Class Skills* and *Numeracy for Employability* strategies (DIUS 2007; 2008). Hudson (2006) expresses a number of concerns regarding these policy developments, including: their renewed emphasis on "functional" mathematics for adult learners and the likelihood that this will be regarded as a lower-status pathway in a two-tier system; and the focus on 14-19 year olds, with the risk that adult learners' needs may be neglected. Barton *et al* (2006) and Appleby and Bathmaker (2006) note the shift in emphasis from Moser's original discourse of an entitlement to lifelong learning, to the perceived importance of skills for a global economy. They too express concern at the emphasis on 14-19 year olds rather than mature adults, particularly those with English as a second language, and suggest that this creates new sites of inequality:

> The emphasis, and the funding that follows it, is now on providing skills for work, especially for young people, rather than providing, and resourcing,

community-based flexible learning opportunities for adults. (Appleby and Bathmaker 2006:711)

It is interesting to note that a different approach to adult numeracy policy has been taken in Scotland, with a social practice model proposed, and numeracy regarded as one of a set of "literacies" (Coben 2005).

Adult Numeracy Pedagogy in England: Negotiating Two Conflicting Discourses

The adult numeracy teacher's role has changed significantly with the introduction of the *Skills for Life* strategy, with teachers reporting decreased autonomy and greater emphasis on bureaucracy and meeting targets, but also the benefits of a shared professional discourse and stronger sense of professional identity (Gregson *et al* 2005; Coffield *et al* 2007; Hodgson, Edward and Gregson 2007; Carpentieri 2008; Tusting 2009).

Adult numeracy teachers in England are currently subject to two officially-endorsed discourses of reform, creating a tension which they (and their students) must negotiate. On the one hand they are subject to the *regulative* discourses of *Skills for Life*, including delivery of the core curriculum, preparing students for qualifications, and meeting targets for recruitment, retention and achievement (DIUS 2008; QCDA 2009; DIUS 2009; LSIS 2009). On the other hand there is a *social-constructivist* pedagogic discourse promoting collaborative groupwork and exploratory discussion (Ofsted 2006, DfES 2005a; 2007). These two discourses are introduced in more detail below.

Regulative Discourse: *Skills for Life* Curricula and Accreditation

The Adult Numeracy Core Curriculum is central to the regulative discourse of *Skills for Life* and is of particular relevance to this research, as its constraints dominated practice in both the classrooms I studied. Although the curriculum document claims not to be prescriptive (BSA 2001), funding

is dependent on the achievement of qualifications based on the same standards (QCA 2000), thus making the curriculum obligatory rather than optional. As a further funding requirement, *Skills for Life* teachers must show in their written planning how the activities of the classroom relate to the relevant Core Curriculum.

To qualify for funding, students need to work towards nationally-recognised qualifications, most commonly the *National Certificate in Adult Numeracy* at either Level 1 or Level 2. Assessment for this qualification is by means of a written examination paper consisting of 40 context-based word problems with multiple-choice answers (see Chapter 6 Fig. 6.2 for an example). Pass marks are at around 25 correct answers out of 40. The nature of the qualifications strongly influences classroom activity, making it desirable for students to become proficient at multiple-choice word problems.

Rhys Warner and Vorhaus (2008) and Cara *et al* (2008) report that the increased emphasis on the attainment of qualifications has brought mixed responses from teachers and learners. National tests were felt to motivate learners and enable them to move on, and are often gateways for learners to employment or further study. However, teachers felt compelled to organise their work to meet targets, and some felt compromised by ensuring that sufficient learners "achieved" to enable provision to continue. Many learners who chose to learn for enjoyment and fulfilment did not want to take tests. One teacher reported:

> Gone is the sense that you can come to college because you enjoy it. Even in the non-vocational courses there is constant pressure for progression, progression. (Ivanič *et al* 2006:30)

The emphasis on accreditation and the conflation of qualifications with achievement is also critiqued by Wells (2006) and Bathmaker (2007).

Social-Constructivist[13] Discourse: *Thinking Through Mathematics* and Collaborative Groupwork

Over the past five years, there has been a transformation in the approaches to numeracy classroom teaching which are currently regarded as good practice. As reviewed in Chapter 2, invidualised worksheets and teacher-led transmission are being displaced by pedagogies based on social-constructivist theories of learning, including collaborative groupwork, discussions between learners, "rich" tasks and a focus on understanding rather than answers.

The *Thinking Through Mathematics* resource (DfES 2007) is part of a range of learning materials, guidance booklets and training events disseminated freely to numeracy teachers in England via the National Centre for Excellence in the Teaching of Mathematics (NCETM) (Newmarch 2006; Swain and Swan 2007; Swain, Newmarch and Gormley 2007; Newmarch and Part 2007; Bouch and Ness 2007; Ness and Bouch 2007). According to Swain and Swan (2009:77) they aim to encourage teachers to explore more "connected" and challenging approaches in the classroom, and to help learners become more active in their own learning:

> Many adult learners appear to view learning mathematics as something "done to them". Instead, [*Thinking Through Mathematics*] intended learners to engage in discussing and explaining ideas, challenging and teaching one another, creating and solving each others' questions and working collaboratively to share methods and results.

Although the new approaches ostensibly have little relationship to regulative discourse, the NRDC research behind them was funded through the original *Skills for Life* initiative, and their underlying principles are disseminated as part of new standards for numeracy teacher education (LLUK 2007). They are officially-endorsed by Ofsted (the Office for Standards in Education, the regulatory body for maintaining standards in educational provision in

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[13] Again, I have given careful consideration to terminology as there is little consensus here. In the USA, similar approaches are referred to as "reform mathematics" (NCTM 1989;1991). In England, "connectionist" is sometimes used, following Askew *et al* (1997). However this seems largely confined to England and risks confusion with connectionist theories of neuropsychology. The phrase "student-centred" is also sometime used, but I feel that this lacks precision in describing what is actually a carefully-defined epistemology of mathematical pedagogy.

England), whose evaluation of mathematics provision for 14-19 year-olds found that significant factors in high achievement included:

> teaching that focuses on developing students' understanding of mathematical concepts and enhances their critical thinking and reasoning, together with a spirit of collaborative enquiry that promotes mathematical discussion and debate (Ofsted 2006:5)

Nonetheless there are inevitably tensions between the two discourses, and the outcomes of this tension on classroom activity and talk are discussed later in this chapter. First, however, I introduce the classrooms, the teacher and the students who worked within these discourses.

The Settings, the Teacher and the Students

The classes in which I conducted my fieldwork took place in two centres run by a local authority adult community education service in the north of England. The centres were based in neighbouring, semi-rural towns which I refer to as Milltown and Farmton.

Both classes were taught by the same participating teacher, Elizabeth. Elizabeth is one of the more experienced numeracy teachers in the service, and is held in high regard by students and colleagues alike. She is well-qualified, with a first degree in Mathematics, and is committed to the use of collaborative groupwork and other participatory approaches. As the data presented in the following chapters demonstrates, she shows respect and affection for her students and deals calmly with the disruptions and difficulties which occur from time to time in any classroom.

Being part of the same adult education service, the Milltown and Farmton centres share much of their organisation and administrative procedures. Both centres offer free literacy and numeracy classes to adults and young people over 16, in which students may study at any level up to Level 2[14]. As a requirement of the provision, which was funded by the Learning and Skills Council, the majority of the students in the participating classes were

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[14] Level 2 is the target level for students completing compulsory schooling at age 16 in England. Entry Level and Level 1 correspond approximately to the target levels for 11 year olds and 14 year olds respectively.

working towards a nationally-recognised qualification, the *National Certificate in Adult Numeracy*, at either Level 1 or Level 2 (usually referred to by students and staff as "*the Test*").

Classes take place over three ten-week terms, timed to coincide with local school term dates. Free crèches are provided during day-time classes for students with younger children. Enrolment for the classes is "roll-on-roll-off", which means that students can join at any time of the academic year, and continue in the class until they have achieved the required qualification. All newly-joining students have an initial interview and assessment to determine their learning needs when they start the classes, and they are encouraged to record their progress on an Individual Learning Plan (ILP), referred to by teacher and students as their "green sheets".

In both the Milltown and Farmton classes most of the students were white-British and were aged between 20 and 55 years old. The ethnic homogeneity of the groups is representative of the rural and semi-rural towns in which the adult education centres are based (approximately 97% white-British in the 2001 census (Office for National Statistics 2001)).

The Milltown Class and its Students

Once a small industrial town in a rural setting, Milltown now serves as a commuter satellite and site of "overspill" local authority housing to a nearby major conurbation. Despite the inevitable changes this has brought, there is still a strong community spirit within the town. The dedicated adult education centre offers classes in literacy, numeracy, computing and in leisure interests such as art, yoga and holiday languages. The centre also includes a crèche and a popular coffee bar, although both of these facilities are now under threat due to funding restrictions.

My research took place in a weekly two-hour evening class. During the fieldwork period there were eight students in the group[15], seven of whom were regular attenders and all of whom were women. All the students in the class were working towards Level 1 and Level 2 qualifications, and no

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[15] See Appendix A for profiles of the Milltown and the Farmton classes.

students were receiving additional support. During collaborative groupwork, six of the regular attenders – Ruth, Dawn, Jackie, Gemma, Melissa and Charlotte – usually worked in a single large and mutually supportive group. Christine, one of the older students, was new to the class when I started my fieldwork, and chose not to participate in collaborative groupwork at first because of her anxiety. The eighth student, Denise, had taken a break from classes due to personal reasons, and only rejoined the class on my final visits.
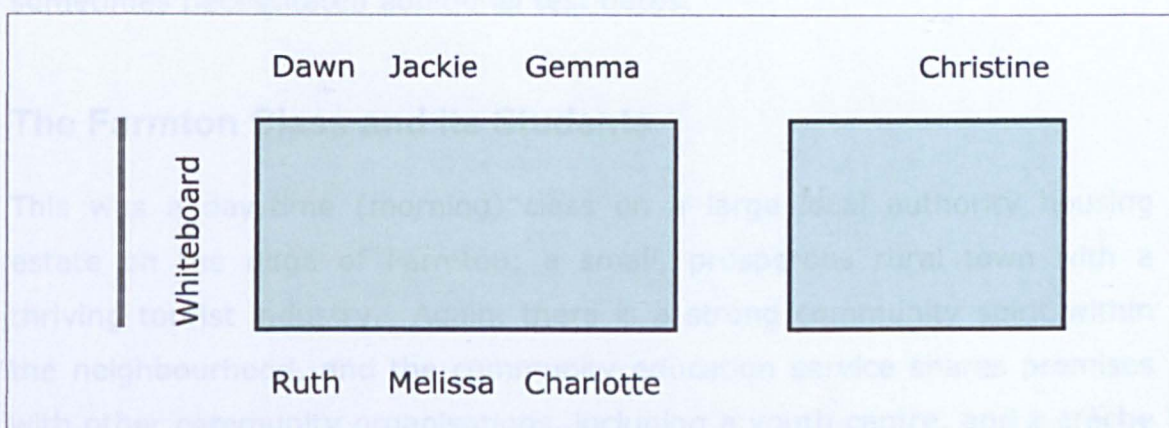
Fig. 5.1. Typical Seating Arrangement in the Milltown class

Although the class was also open to men, the predominance of women reflects a national trend in *Skills for Life* classrooms (Rhys Warner and Vorhaus 2008). Many of the students were women "returners", hoping to gain qualifications in order to return to work or further study as their children grew older.

The evening class took place in a large, dedicated classroom. Generally known as the "English Room", Elizabeth used it in preference to the smaller and less well-equipped "Maths Room" because it contained three (ageing) computers which were used to access on-line resources and activities. The room was bright and attractive with literacy-themed posters on the wall, and large windows (my fieldwork took place during the light evenings of April, May and June). It was well-equipped with stationery, books and a large conventional whiteboard, and specialised mathematics resources were available in the adjoining Maths room. Elizabeth generally arranged the furniture so that most of the students could sit around a single large table

for groupwork, but there was a smaller additional table for those who preferred to work individually (Fig. 5.1).

Opportunities to sit the test for the *National Certificate in Adult Numeracy* at Level 1 and Level 2 were offered "on-demand" at the Milltown centre, with the examinations administrator setting a "test date" when enough students had expressed a wish to take the qualification. This generally occurred once or twice a term, but extra demand at the end of the academic year in June sometimes necessitated additional test dates.

The Farmton Class and its Students

This was a day-time (morning) class on a large local authority housing estate on the edge of Farmton; a small, prosperous rural town with a thriving tourist industry. Again, there is a strong community spirit within the neighbourhood, and the community education service shares premises with other community organisations, including a youth centre, and a crèche which enabled parents of young children to attend classes. Many of the parents also dropped off their children at the neighbouring primary school before coming to the class.

The participating class contained eight women and three men. As a larger class, and with a greater mix of ability levels, the students did not work together as a single group during collaborative groupwork, but were divided according to the level at which the students were working. Five students – Donna, Judith, Abigail, Sally and (on one occasion) Sylvia – were working towards a Level 2 numeracy qualification, and collaborated as a lively and sometimes noisy group. Three other students – Dan, Roz and Pete – were working towards a Level 1 qualification and worked as a smaller and quieter group (Fig. 5.2).

Linda, a deaf student, worked on Level 2 topics with just her signer, and Ameena and Richard, both of whom had learning support needs, worked on Entry level activities with a learning support assistant (LSA). Ameena rarely spoke except to her LSA, and participated very little in the classroom community. Richard had been coming to classes at the centre for many

years, and took pride in contributing by setting out furniture at the start of the class, and by helping to make tea and coffee during the tea break. The requirement for him to gain a qualification each year may prevent him continuing with classes in future.
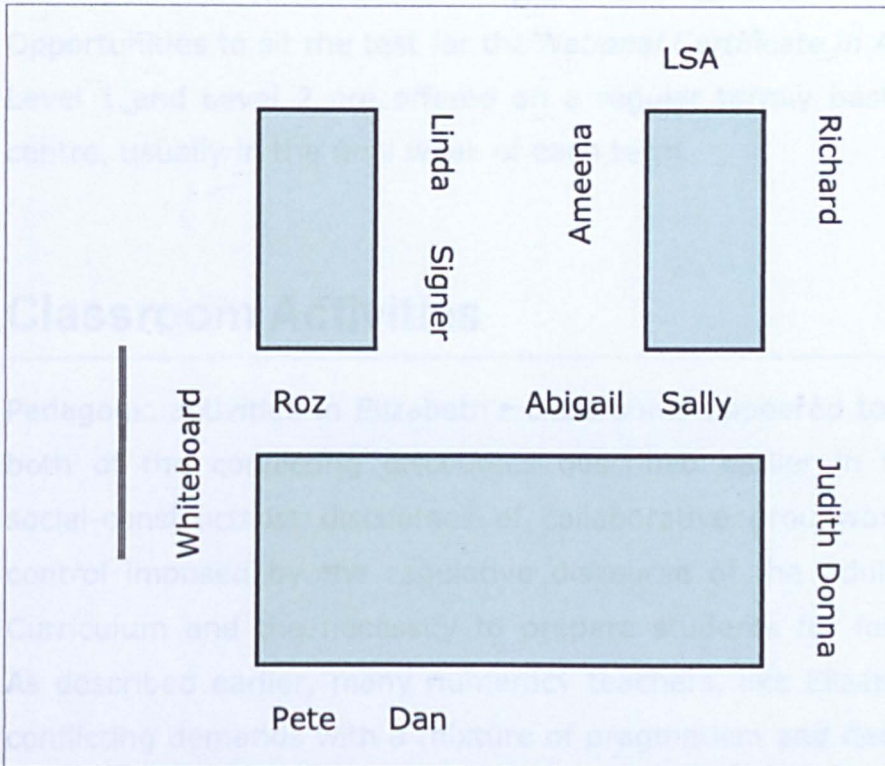
Fig. 5.2. Typical Seating Arrangement in the Farmton class

Being part of a shared community centre, the classroom was not as well-equipped as the Milltown classroom. There was a small conventional whiteboard available, but other than this Elizabeth needed to bring all the required resources to each class in her car. The tables needed to be set out at the beginning of each class (hence Richard's contribution), and were arranged according to the needs of the students. The layout during the period of my fieldwork consisted of one large table and two side tables. The Level 1 students worked at one end of the large table, and the Level 2 students at the other. Linda and her signer sat at one small side table, and Richard and Ameena sat with the learning support assistant at the other.

There was no coffee bar at the Farmton centre, but a kitchenette opened on to the classroom. Halfway through each session, the learning support assistant made tea and coffee, which the students drank in the classroom. Although there was no rigid coffee break, classroom activity would become

less structured for a while, with some work continuing at relaxed pace, and a noticeable increase in informal chat. The room was not large, and the layout felt cramped, but students and staff appeared to be content with its limitations.

Opportunities to sit the test for the *National Certificate in Adult Numeracy* at Level 1 and Level 2 are offered on a regular termly basis at the Farmton centre, usually in the final week of each term.

Classroom Activities

Pedagogic activities in Elizabeth's classrooms appeared to be influenced by both of the conflicting discourses described earlier in this chapter: the social-constructivist discourses of collaborative groupwork; and the tight control imposed by the regulative discourse of the Adult Numeracy Core Curriculum and the necessity to prepare students for formal assessment. As described earlier, many numeracy teachers, like Elizabeth, juggle these conflicting demands with a mixture of pragmatism and dedication (Ivanič *et al* 2006; Cara *et al* 2008):

> We observed many instances of tutors moving skillfully between formality and informality, structure and flexibility... We noticed that in quite informal settings (such as a relaxed, friendly atmosphere at a small table) the nature of the work could be formal (such as worksheets about language forms or abstract numerical operations) (Ivanič *et al* 2006:42)

Order in the classroom was self-imposed and informal. There was no evidence of Elizabeth choosing (or needing) to impose any discipline at any time, and she appeared to enjoy the occasional disruptions from concentrated study as much as the students did (see Extract 6.11 for an example).

Elizabeth strongly encouraged most of the students to work collaboratively in groups, in which they undertook a variety of multi-modal activities designed to promote mathematical discussion, including card-sorting, card-matching, domino games and jigsaws. While some of these activities were taken directly from the *Thinking Through Mathematics* resource described above (DfES 2007), Elizabeth has also designed many of her own activities

based on the same principles. Examples of the activities are shown in Figs 5.3 to 5.6 below.
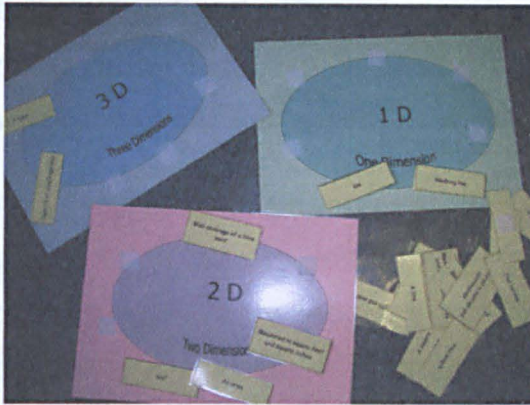
Fig. 5.3 Categorising Activity
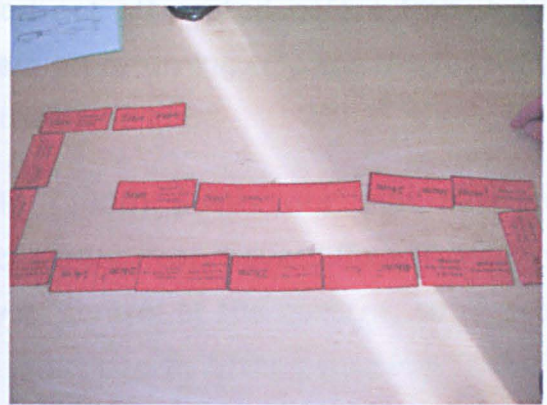
Fig. 5.4 Domino Activity
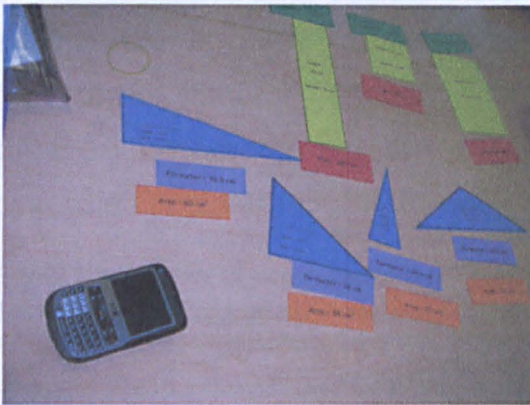
Fig. 5.5 Matching Activity
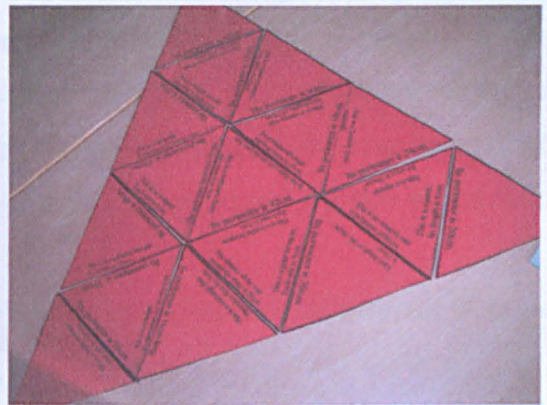
Fig. 5.6 Tarsia Puzzle

The students supported each other during these activities, calling on Elizabeth's help only as a last resort, with "scaffolding" being provided by peers, and for some activities, also by the structure of the activity itself. For example, in the Tarsia puzzle shown in Fig. 5.6 above, the pattern can only be completed if the correct pairs of concepts are matched in the puzzle. About half the students' classroom time was spent on activities of this type and on whole group discussion.

Additionally, Elizabeth encouraged students to work in pairs or groups on more conventional worksheets and assessment materials, which tended to be made up largely, but not exclusively, of word problems, and so also prepared students for the word problems they would encounter when they took "the Test". The Milltown students also on one occasion completed a practice Test paper as a group exercise. The remaining classroom time (approximately half) was spent on these more traditional activities.

Several of the students, particularly those for whom the examination was imminent, took home practice Test papers as homework. Students were self-directed, selecting papers they had not attempted before from a file provided by Elizabeth, and marking them on returning to class the following week using answer sheets provided in the same file.

As discussed in Chapter 4, Bernstein (2000) points out that different elements of activity within the same classroom can have different degrees of framing. Where teachers are firmly in control of the content, sequence, pace and evaluation of learning this is described as strong framing. Where this control apparently lies with the learner there is weak framing. In Elizabeth's classrooms, the weakly-framed collaborative groupwork was set against the strongly-framed assessment elements which loomed, in the form of the National Tests, at the end of each term. This contrast between the weakly-framed, discursive nature of classroom activities, and the tightly controlled requirements of the exam, did not go unnoticed by the students:

Extract 5.1: "Can we all work together in the exams?"
Jackie, Dawn and Charlotte have worked together through a percentages question and have eventually arrived at the correct answer. They reflect to each other on their collaborative effort.

1	Jackie	So we know that's what we have to do
2	Dawn	You've helped us just do the first bit
3		She's helped us with the last bit
4		And I did the middle bit
5	Jackie	So there we are!
6	Dawn	Yeah
7	Jackie	Can we all work together in the exams? [rhetorical tone]
8	Dawn	No!
9		[laughter]
10	Jackie	So if you see me sat there
11	Dawn	(going) where's the door
12	Jackie	I'm waiting, I'll be telling you, I'm (emo-ing)
13		I'll be out of the door

[M2: 608-616]

Lives and Learning in Milltown and Farmton

As described in Chapter 2, goals and purposes for students attending *Skills for Life* classes have been found to be complex and multilayered (Swain 2005; Barton *et al* 2006; 2007; Rhys Warner and Vorhaus 2008; Ward-Penny 2009).   According to Elizabeth, the students rarely mentioned needing everyday numeracy skills as a learning goal[16].   Instead, approximately half the students had said that gaining a qualification was their primary goal on joining the classes, while the others had spoken in terms of personal satisfaction or wanting to help their children.

Many adult numeracy learners have had negative experiences of mathematics at school (Macrae 2003; Swain 2007; Barton *et al* 2006; Tett 2008).   This also seems to have been the experience of many of the students in Elizabeth's classes, as recalled during collaborative groupwork by Abigail, Donna and Judith:

Extract 5.2: "I hated maths at school"
During a discussion activity involving metric measures, Abigail, Donna and Judith begin instead to recall traumatic memories of learning mathematics at school.

1	Abigail	I hated maths at school
2	Donna	I hated maths at school
3	Judith	(...)
		(All the teachers) were frightening
4	Abigail	Yep
5	Judith	He used to shout out and pressure you if you didn't answer
6	Abigail	And I was always at the bottom of the group
7		That was every group.
8		So, I don't think I got the support that I needed
9	Donna	Yeah, they didn't give you confidence
10	Abigail	And I was too frightened to go
11	Donna	They didn't give you any confidence, did they?
12	Abigail	No
13	Donna	I mean sometimes you think you might know the answer
14		But you don't want to give it in case you're wrong

[F1/L2B: 90-103]

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[16] Elizabeth described to me how she and her manager had once attempted to promote a financial literacy class in Farmton, and had been obliged to abandon the project when it failed to recruit students.

The reproduction of these negative experiences of education from one generation to the next was also revealed on several occasions during which the students discussed with each other their children's difficulties at school. The students expressed their anxiety that their children should not have similar experiences to their own, and this was cited as one of their reasons for attending classes (see also Chapter 6, Extract 6.9).

However, the students seemed also to enjoy the classes for their own sake. Some of the students told me how much they wished they could continue classes after achieving their qualifications (an option precluded by funding restrictions) and others delayed taking the Test until the end of the academic year in order to be entitled to more sessions. Rhys Warner and Vorhaus (2008) emphasise that many learners value the social experience of learning, which provides structure and interest in their lives. It seems likely, therefore, that an additional major motivation for Elizabeth's students was social and intellectual engagement.

The importance of the numeracy classes to the students was revealed in the lengths they went to attend their classes, despite the competing demands of home, family and work. At the Milltown evening class, Christine and Charlotte just had time to attend each class before their last bus of the night left for their home village. In the Farmton day-time class, Pete attended even when he was ill with a cold, and Sally and Elizabeth reflected on how Sally was now in her second of two pregnancies during the time she had been attending classes.

Both the Milltown class and the Farmton class lasted for two hours, during which the students were intensely engaged with mathematical work. The recordings several times captured students expressing to each other how tired they felt at the end of a session[17], as Abigail did here as the Farmton class was packing up at the end of a session.

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[17] This illustrates the power of this methodology to reveal unexpected insights; in ten years of teaching I had not realise quite *how* tiring students found a two-hour session.

Extract 5.3: "Like, what happened?"

Abigail   But sometimes I walk home [from the class] and I'm like
           Oh, my God, I'm knackered.
           You kind of don't realise when you're doing it,
           Just when you walk away. Like, what happened?

[F1/L2A: 558-560]

Completing homework presented an additional challenge to students with children.   Donna, in the Farmton class, explained to her fellow student Judith how difficult it had been to make time to do a practice exam paper the previous weekend.

Extract 5.4: "He keeps coming in the kitchen and asking me things"
Donna explains to Judith how difficult it was to make time to do a practice exam paper the previous weekend.

Donna   I did it on (Sunday) afternoon when the kids were watching telly
         And I thought, no, I don't want to watch the telly
         And my husband was (...)
         (He) keeps coming in the kitchen with me, and asking me things
         (I'm) asking him to take them away
         And I'm just trying to do (...)

[F2/L2 37-42]

This juggling of their own learning and the demands of a family provides an example of the tensions which students need to negotiate when practices from the classroom domain cross over in to the site of the home (see Chapter 2) and is also noted by Barton *et al* (2006; 2007).

The Milltown and Farmton Classrooms as Communities of Practice

Chapter 2 introduces the idea of learning as becoming part of a community of practice (Lave and Wenger 1991). Mathematical learning in schools is often seen as a process of enculturation into the community and discourses of academic mathematics. However, for the participants in my study, the process seemed more to be one of enculturation into the recontextualised community and discourses of the *adult numeracy classroom*. This distinction may seem subtle, but it is an important one. Legitimate participation in a community of mathematicians might be achieved and manifested through a display of competence in formal mathematical

discourse, but membership of the classroom community involved access to, and fluency in, a repertoire of discourse, practices and shared cultural meanings which revolved more around administration procedures, accreditation procedures, and the management and structure of groupwork than they did around mathematics itself.   Students negotiated complex but clearly familiar practices such as completing individual learning plans, entering for examinations and collecting their results with very little explicit direction from the teacher.

Take for example, this exchange between Jackie and Dawn in the Milltown group.   Jackie had arrived late at the class and missed out on some important news given to the class by the teacher, Elizabeth. Dawn passed the news on to Jackie shortly after her arrival.

Extract 5.5: "We've got a test date"
The imminence of the "test" is major news for Jackie. Because of the shared understandings in the community of practice of the classroom, Dawn can convey this news with minimal additional information.

1	Dawn	We've got a test date, Jackie
2	Jackie	Eh?
3	Dawn	We've got a test date
4	Jackie	Have you?
5	Dawn	Two weeks today

[M2:127-131]

To make full sense of this news, Jackie needs to know that the "Test" is the *National Certificate in Adult Numeracy*, and that at the Milltown Centre, tests for this qualification are offered on-demand, with the examinations administrator setting a "date" when enough students have expressed a wish to take the qualification. It takes on additional significance because once a Test date has been announced, further students will consider entering for the Test, in many cases regarding it as a target and an incentive to reach the required levels of competence in time to attempt it.   Such shared cultural meanings are embedded in the discourses of the Milltown group, and Dawn needs to give Jackie no further information than that contained in the above extract.

Lave and Wenger describe the process of learning as moving from the periphery of a community of practice inwards (1991:108).   A longitudinal study would be needed to chart the trajectory of an individual student.

However, because of the flexible enrolment arrangements in the participating classes, some students had been members of the class for only a few weeks, while others had been studying for two years or more. It was thus possible to obtain a "snapshot" of students at various stages along their learning trajectories, from the newer students tentatively beginning to contribute via legitimate peripheral participation, while the old-hands moved on as they completed their qualifications.

Increasing participation in collaborative groupwork seemed to play an important part in this trajectory. Many students come to adult numeracy classes with expectations of what mathematical learning should be, and may at first be resistant to collaborative groupwork (Swain and Swan 2007). Judith, an initially hesitant but later fully participating member of the Farmton Level 2 group, recounted her early experiences to me:

Extract 5.6: "She freaked me out when she said about working in groups"
Judith recalls her initial resistance to taking part in groupwork

1	Elizabeth	On the initial assessment, you put you didn't want to work in a group, didn't you?
2	Judith	Yeah
3	Elizabeth	She thought she didn't want to work in a group
4	Judith	She freaked me out when she said about working in groups
5		...
6		I thought I wouldn't like it

[F1/L2: 524-532]

At Milltown, Charlotte had joined the group only a week before my first visit. Her participation for the first few sessions was peripheral; she listened to the group discussions about the mathematics problems they were working on, and wrote down answers, but did not contribute very many of her own ideas. However, on her fourth attendance, two of the most talkative and confident members of the group were absent. This created an opportunity for Charlotte to participate by making tentative suggestions, although they were hesitant and self-deprecatory. This increasing willingness to participate in groupwork might be regarded as a gradual transformation of habitus and as involving the unlearning of a disposition towards more traditional modes of learning.

Beyond the Periphery

I have described how the classroom functioned as a community of practice, but significantly there were some students who did not participate in this community. For some, such as Charlotte, this situation was only temporary as she commenced her "centripetal" trajectory. An older student, Christine, experienced mathematics anxiety at first and chose to work separately. Very hesitantly, she began to participate in occasional groupwork, and towards the end of my fieldwork was participating more fully.

However, Richard and Ameena, who have learning support needs, and Linda, who is deaf, did not attempt to participate in collaborative groupwork at any stage, and worked only with their LSA and signer. It should be emphasised that such students were not deliberately excluded from the activities; but it is nonetheless of concern that the nature of such activities deterred them from joining. Linda complained that when she attempted to join in groupwork, the other students talked too fast and did not understand her needs. "Everybody is blah, blah, bah," she told me. Elizabeth was aware of these students' difficulties, and was seeking ways to include them in a wider range of group activities, but with little success.

I regard the difficulties in including all students in these officially-endorsed approaches as an area of significant concern, especially as it seemed to affect their wider participation in the classroom community; for example these students did not seem to be included in humorous episodes, nor in coffee break discussions of their lives outside the classroom. Further research is urgently needed to address this, and I discuss implications and potential approaches in Chapter 10.

Conclusion

In this chapter, I have set the scene of my research, in terms of the wider policy issues which shape activities in the classroom, and the two discourses – regulatory and social-constructivist – which currently define adult numeracy pedagogy in England. I have introduced the teacher and the students who participated in my research, and the collaborative group tasks during which the recorded discussions take place.

Numeracy classes were only one strand in the students' busy, complex lives, but one which they went to great lengths to maintain. The classroom functioned as a community of practice, with many shared meanings, rituals and discourses, but it is of concern that certain students can become excluded from this community.

In the next two chapters I present the main findings from the analysis of my data. Chapter 6 focuses on the students' linguistic practices in the classroom, while Chapter 7 focuses on the different types of knowledge which the students brought to the classroom and, in particular, how mathematical learning was related to out-of-classroom numeracy practices.

Chapter 6

"I'm not often right and you knock me down!" Linguistic Practices in the Classroom

Language, whether spoken or written, is the medium through which most educational activity is accomplished. In classrooms in which collaborative groupwork is the primary activity, therefore, linguistic repertoires and practices can be regarded as among the most important resources which students bring to the classroom. According to Barton *et al* (2006:17):

> Part of people's identities and practices were the ways of talking and interacting ... that they brought with them, which were shaped by their histories.

In this chapter, I analyse how the students used their diverse language practices during collaborative groupwork (and during the informal chat which was inevitably interwoven with it). Prevalent features of the students' talk included expressions of uncertainty and self-deprecatory humour, and I investigate the role of such talk in the construction and maintenance of the learning environment. I also examine how the students' language reflected their perceptions of agency within the structures in which they studied, including hierarchical relationships with the teacher, the discourse of formal mathematics, and the discourse of assessment.

I consider the extent to which this repertoire of linguistic practices reflects their experiences as adults skilled in negotiating social worlds, and how these might differ from the classroom talk of schoolchildren. As discussed in Chapter 4, I also examine which aspects of their linguistic habitus served to broaden the scope of discussion and thought, and which tended to constrain it.

Expressions of Uncertainty in Collaborative Groupwork

Uncertainty is often seen as problematic in adult numeracy learning (for example Tobias 1978; DES/WO 1982; Gal 2000). Students' lack of confidence is seen as a difficulty to be "overcome", both in policy and scholarly discourse, and confidence as something to be "sought" or "increased" through mathematical learning (LSC 2009; Coben *et al* 2003; Lee 2006; DfES 2005a). Rowland (1995) suggests that students' fear of making errors is based on their belief that there are "right" and "wrong" answers, and that the teacher always knows the right answer. Buxton (1981) describes the "nakedness", or vulnerability, which students feel of exposure to success or failure.

According to Rowland, this feeling of vulnerability results in mathematics learners using expressions of uncertainty, or *hedges* (Lakoff 1973), as a "shield" against vulnerability. Hedges are modalising words or phrases which indicate the speaker's degree of commitment to, or certainty about, the statement they are making and may be used to accomplish a variety of functions. Rowland (1999) observed that children acquire an increasingly broad repertoire of hedges as they grow older and, although he only studied children up to the age of 12, it is not unreasonable to suppose that adults will have a still broader range of hedges to choose from for their different purposes. While Lakoff (1973) suggests that women are more likely to use hedges than men, and Davies (2003) suggest that boys are less comfortable than girls with discursive activities, Rowland's studies (1999) showed no significant difference in the use of hedges between boys and girls studying school mathematics.

Uncertainty and Exploratory Talk

Expressions of uncertainty and doubt were highly prevalent throughout all the recordings of collaborative group work I collected and, while my samples are too small to make any quantitative comparison meaningful, there was no indication that the male students used them less frequently

than the female students. The students made use of a wide repertoire of linguistic devices to express this uncertainty, including a variety of modalising expressions, or hedges, such as "isn't it?", "would that be...?", "I think..." and "is that right?", which were used extensively whenever students were working in pairs or in larger groups.

On first examination, this prevalence of expressions of uncertainty may seem negative. If the aim of mathematical learning is held to be increased confidence with numbers, then surely expressions of uncertainty suggest that learning is unsuccessful? However, a more careful analysis of the way such expressions were used by the students began to reveal a more complex, and less negative picture. Here I explore the subtle ways in which uncertainty was expressed and used by the students to elicit and provide support, to invite evaluation and to articulate difficulties, and to bring metacognitive resources to bear upon those difficulties.

Consider the following extract from the Farmton class, in which Judith and Donna were struggling to convert between metric units of measure.

Extract 6.1: "It's knowing which way to go round with them"
Donna and Judith are working through a worksheet which requires them to convert metric measures of length between metres, centimetres and millimetres. [N.B.: although Donna twice reads "m" (metres) aloud as "millimetres' (lines 12 and 25, corrected by Judith in line 13) she corrects this herself later in the session (not presented here)].

1	Donna	That would be –
2		That would be –
3		Seventy-five millimetres
4	Judith	(...) cm is much more
5	Donna	Is that right?
6	Judith	I think it's right – but I'm not
7		Not overconfident on these
8	Donna	It's knowing which way to go round with them, isn't it?
9	Judith	Yes
10	Donna	So if you convert one of them
11		Nought point nought... That's just tiny
12		(...) millimetres
13	Judith	Oh, metres, even
14	Donna	Ahh
15		(...)
16	Judith	That's right
17	Donna	Is that (...) centimetres?
18		(...)
19	Donna	Is that right?

20	Judith	Something like that
21		(...)
22	Donna	So
23		(...)
24		So
25		A hundred centimetres is one millimetre, so that's, that's
26	Judith	Nought point seven five isn't half, is it?
27	Donna	It's five – I've put five centimetres
28		Cos you times it by a hundred

[F1/L2B: 366-389]

Donna and Judith use a variety of devices to express uncertainty to each other, including: eliciting an evaluation (lines 5 and 19); presenting a suggested answer as a question (line 17); and reversed polarity question tags such as "isn't it?" (lines 8 and 26). To some extent, their hedging may be regarded as a "shield" against the failure of getting it wrong. Judith is so anxious to distance herself from her suggestion that 0.75 might be equivalent to a half, that she actually presents the question as a negative (line 26). However, as suggested above, hedges may serve a variety of functions. In the above extract, Judith and Donna also use hedges and expressions of doubt to *admit* their own uncertainty and to *acknowledge and accept* the uncertainty felt by the other (lines 6 – 9), and these lines are also used to help them articulate metacognitively what aspect of the problem is causing them difficulty.

The hesitations, false starts and pauses which occur throughout this extract are characteristic of exploratory talk. The speaker "thinks aloud", and takes the risk that others will hear and comment on their ideas (Barnes 2008; Mercer 1995; Mercer and Sams 2006):

> Exploratory talk is hesitant and incomplete because it enables the speaker to try out ideas, to hear how they sound, to see what others make of them, to arrange information and ideas into different patterns ... Exploratory talk provides an important means of working on understanding, but learners are unlikely to embark on it unless they feel relatively at ease, free from the danger of being aggressively contradicted or made fun of (Barnes 2008:5-6)

Judith and Donna's discussion enabled them to recognise that their difficulty lay in knowing whether to divide or multiply by 100, and so to ask the teacher for advice. Note the confident and humorous way in which Judith is now able to elicit Elizabeth's help.

Extract 6.2: "I think we need your help"

Following their discussion in Extract 6.1 above, Judith and Donna have identified their difficulty in converting between different units of metric measure as knowing whether to multiply or divide.

1	Judith	I think we need your help, Elizabeth
2		[laughs]
3		I'm confusing myself
4		Which way round do you do it?
5		I've just really muddled myself up [laughs]
		...
6	Elizabeth	Yeah, if you think, if you're measuring here
7		What does it say? Nought point -
8		If you're measuring in metres, and you want to change to centimetres
9		Are you going to have more of them or are you going to have less of them?
10	Judith	It's – sorry? I'm going from metres to centimetres
11		So I'm going to have more, aren't I?
12	Elizabeth	Yes, so it's going to get bigger

[F1/L2B: 416-444]

Writing of schoolchildren, Rowland (1995:351) comments on the role of expressions of uncertainty in alerting the teacher to a pupil's need for help:

> the assertion of uncertainty draws the attention of the teacher ... and thus opens up the possibility that s/he might provide for the student some cognitive "scaffolding" to support, and perhaps transform that state.

However in the above example I would ascribe agency, not so much to the teacher, as to Judith as an adult learner. It is Judith who recognises her own difficulty, who has the confidence to ask for help (line 1), and who can now articulate it clearly (line 4). It is these characteristics of Judith's (and Donna's) talk which enable Elizabeth to provide a clear and useful strategy to help them with their problem (lines 8-12).

The characteristics of exploratory talk were equally apparent when larger groups worked together, suggesting that the students felt safe to explore ideas even when working with several other students. Again, such expressions were used to elicit encouragement and support from other students, and to invite other students to evaluate their contributions. Morgan (2006) points out that the position of evaluator is a powerful one, and I suggest that students' willingness to express uncertainty and invite evaluation serves to empower other students.

Expressions of uncertainty also gave the students opportunities to formulate and articulate their difficulties in understanding, and thus to share metacognitive strategies, as when students in the Milltown class were struggling to express the ratio 3:2 as a fraction:

Extract 6.3: "I draw pies"
Jackie and Dawn are struggling to express the ratio 3:2 as a fraction. By articulating their difficulty Dawn, Ruth and Charlotte are able to share with Jackie a strategy for visualising three-fifths and finding the correct answer.

1	Jackie	What fraction...Right
2	Dawn	So it's three. The fraction. It's three, in't it?
3		Er. It's not three percent...
4		A third.
5		Is it a third?
6		So if you've got five, like that
7	Jackie	Yeah
8	Charlotte	[quietly in background] Three-fifths. And two-fifths.
9	Dawn	Yeah, I draw pies like that. You do that, don't you?
10	Ruth	I do that
11	Dawn	Do you?
12	Jackie	Do you?
13	Ruth	Yeah
14	Dawn	There's a pie, yeah,
15	Ruth	[reading] "What fraction of grey paint is white?"
16		So if you've got five
17	Charlotte	Colour three in

[M1:739-755]

Again, Dawn uses reverse polarity question tags (line 2) and poses a suggested answer as a question to invite evaluation (line 5). Like Judith in Extract 6.1, she is so unconvinced of one her suggestions that she poses it as a negative (line 3). However, in this extract the students go further and use their acknowledgement of uncertainty to share their metacognitive strategy of drawing a "pie" in order to visualise three-fifths.

Charlotte's "contribution" to the discussion is telling, as is the other students' (lack of) response to her. Charlotte is new to the group and is still a "peripheral" participant (see Chapter 5); moreover she is considerably younger than the other students. Her talk is not exploratory; she not only presents the correct answer without hedging, but also the answer to the second part of the problem, thus "giving away the ending". The other students' response is to ignore Charlotte's contribution and to continue to

construct their own understanding collaboratively. Mercer and Sams (2006) suggest that the use of exploratory talk needs to be learned. While most participants in the group seem already to have learned this practice, either outside the classroom or since joining it, Charlotte's contribution suggests that she is still learning.

Affectations of Uncertainty

Expressions of uncertainty did not always seem to indicate *genuine* doubt, but sometimes seemed instead to be *affected* in order to establish and maintain relationships within the group; for example, to invite other students to contribute to the discussion. Hedges even seemed to be used in order to project the level of under-confidence required for social acceptance within the class. Here, students in the Milltown class are undertaking a collaborative activity to spot multiples of three on a 100 square.

Extract 6.4: "So they're the threes ... I think"
The Milltown class are trying to spot the multiples of three on a 100 number square. Note the tell-tale pause before Ruth belatedly adds the expression "I think" in line 9.

1	Dawn	Three can go into that, so you keep that
2	Jackie	Oh, I thought that, oh right
3		I thought you were getting rid of the ones -
4	Ruth	Sixty-nine, seventy-eight
5	Dawn	You're good at these, aren't you?
6	Ruth	Eighty-seven.
7		So they're the threes
8		(.)
9		I think

[M2:103-8]

Although the activity is intended to be a collaborative activity, Ruth, the most mathematically confident member of the group, has started to dominate the discussion and little exploratory talk is taking place. In line 9 she belatedly adds the hedge "I think", the tell-tale pause suggesting that she has realised that she has taken over the activity and is attempting to repair the collaborative nature of the discussion.

Elizabeth, the teacher, also often used hedges for purposes other than expressing genuine uncertainty. This is illustrated in the following extract from the Farmton group, in which students and teacher make very different uses of reversed polarity question tags.

Extract 6.5: "It's not easy to count those, is it"
Elizabeth is helping Donna and Judith to work out the value of the divisions on a graph axis scale

1	Elizabeth	Well, can you see what it's going up at
2		How many gaps are there between nought to ten
3		How many intervals?
4	Judith	It's not two and a half
5	Donna	Two
6	Elizabeth	No, two. Each one's two
7	Donna	Cos that's not in the middle
8	Judith	Oh, that's not in the middle, is it?
9	Donna	So that must be –
10	Elizabeth	So if you look how many intervals there are and what's the difference between those two numbers
11	Donna	So that's seven then, isn't it?
12	Judith	So it is seven and twelve then
13	Donna	So that's – that must go with that one
14	Judith	We said it was and then we changed us mind
15	Elizabeth	Yeah. There should be one that doesn't match with anything, because these are incorrect, aren't they
16	Donna	Are they incorrect?
17	Judith	Oh, yeah
18	Elizabeth	Well can you see what's wrong with that?
19	Donna	It hasn't got the line across
20	Elizabeth	It's just put –
21	Donna	Yeah
22	Elizabeth	It's not easy to count those, is it
23	Donna	No

[F3/L2A: 591-611]

In line 11, Donna appears to be expressing genuine uncertainty in her question tag and to be seeking evaluation and confirmation of her interpretation of the number scale. In line 8 Judith uses the question tag slightly differently; both to express solidarity with Donna's suggestion in line 7, but also again to elicit confirmation from Elizabeth.

Elizabeth's use of question tags in this extract seems to have two purposes both of which differ from those used by her students, and neither of which express genuine uncertainty. The first (line 15) is rhetorical. Although

reverse polarity question tags invite agreement, *dis*agreement is not generally an expected response (Hasan 2004). Elizabeth uses this device frequently in her discussions and expository work with students. Despite the interrogative tag, the underlying mood of such utterances is declarative, and the student is being asked to agree with it. Elizabeth does not use interrogative inflexion here, and I have indicated this on the transcript by the deliberate omission of question marks. It is interesting but untypical that Donna fails to pick up on this cue on this occasion and genuinely questions Elizabeth's assertion (line 16). However, the question tag used by Elizabeth in line 22 appears to have quite a different purpose; like Judith, she uses it to express solidarity, and also empathy with her students' difficulties.

Expressions of Uncertainty as a Resource

It seemed that a disposition to express uncertainty was part of the linguistic habitus of the majority of the students in my study, and it is interesting to speculate whether this was due their negative experiences of learning mathematics in school (see Chapter 5). As illustrated above, the students used a diverse repertoire of modalising expressions to accomplish a range of functions: to engage in exploratory talk; to elicit evaluation; to acknowledge their own uncertainty and accept that of others; to articulate difficulties; to invite others to contribute to the discussion; and to express support. Although Mercer and Sams (2006) suggest that children need to be *taught* to use exploratory talk (see Chapter 2), most of the adult students here seemed to be "ready-equipped" for it.

The Role of Humour in the Classroom

At a recent seminar, I played extracts from my audio data to other researchers using linguistic ethnography. The first thing the listeners commented on was the prominence of laughter in the students' talk, and humour is indeed a dominant feature of all the recordings I made in the classrooms.

While humour includes jokes, it also takes many other forms, and a useful way to define humour is through intention to produce amusement (Coates 2007). The two main types of humour discussed here are *teasing* and *self-deprecatory* humour, both of which are classified as *affiliative* humour, which serves to strength bonds within groups (Clayman 1992; 1993). In teasing, any aggression expressed is only *ostensibly* aggressive (unlike disaffiliative humour, in which the speaker intends to be abusive or offensive). In self-deprecatory humour, the speaker is the butt of his or her own seemingly aggressive remark. In addition to its affiliative function, it may be used as a self-defence mechanism against potential criticism, or to skirt issues the speaker wants to avoid (Dynel 2008).

Humour, Anxiety and Self-Deprecation

Since much of the classroom humour was self-deprecatory, and seemed to be related to anxiety, I begin by discussing typical examples of the self-deprecation and anxiety expressed by the students, before moving on to the role played by humour in responding to these emotions.

The low self-esteem of many adults learning mathematics is well-recognised (for example Evans 2000b; Bibby 2002; Barton *et al* 2006; Swain 2007; Ward-Penny 2009), and stories similar to the account shared by Abigail, Donna and Judith in Extract 5.2 will be familiar to many who have worked with adult numeracy students. During their collaborative groupwork, the students frequently made expressions of self-deprecation such as: "I'm no good at maths"; "I'll still be doing this course when I'm seventy"; or (on being congratulated on a correct answer) "It was just a *guess*". One

student, struggling with ratios, wailed despairingly, "Oh, why can't I do it? Why isn't it going in?" [M1 60-61]

Anxiety is also reported to be common in many adult mathematics classrooms (Tobias 1978; Sewell 1981; Buxton 1981; Ashcraft and Kirk 2001), but anxiety was not so commonly expressed as self-deprecation by the students in my study. There may be two reasons for this. Firstly, the collaborative approaches and supportive atmosphere discussed earlier may have helped alleviate anxiety for many. Secondly, the students self-selected for collaborative groupwork, and the few that did not participate included one student who identified herself as anxious and others who felt deterred because of disability or learning support needs (see Chapter 5).

Jackie, a student in the Milltown class, was an exception to this. Her anxiety was sometimes so acute that it manifested in physical symptoms, but nonetheless she participated fully in groupwork. She did not attempt to conceal her anxiety from other members of the group; instead it became the subject of gentle and largely supportive humour from her fellow students, and self-deprecatory humour from Jackie herself. In the following, Jackie and Dawn have just checked an answer and found that – unusually – Jackie had the correct answer, while Dawn was incorrect.

Extract 6.6: "I'm not often right and then you knock me down"
Jackie and Dawn are working on a word problem about diluting concentrated juice in the ratio 1:4. Jackie suggests that the juice will be stronger if it is mixed in the ratio 1:3. Dawn initially rejects this answer, but then readily admits her mistake. (N.B.: In lines 19 and 20, Dawn and Jackie are referring to an additional weekly numeracy class which Dawn already attends, and which Jackie will be joining the following Thursday.)

1	Ruth	Yes, you're right, three parts
2	Jackie	Three
3	Ruth	Three parts water instead of four parts
4	Jackie	Yeah, to make it a bit stronger
5	Dawn	Oh, right, yeah
6		You was right
7	Jackie	You see I'm not often right and then you <u>knock</u> me down!
8	Other students and teacher	[Laughter]
9	Jackie	You know, sometimes I have to just... I <u>clam up</u> again then!
10	Other students and teacher	[Laughter]
11	Jackie	And I think, ooh
12	Dawn	You've not run off today, have you

13	Jackie	I'm going to go to t'toilet in a minute
14	Other students and teacher	[Laughter]
15	Jackie	It's the <u>shock</u>
16	Other students and teacher	[Laughter]
17	Dawn	You get a weak bladder in maths, don't you?
18	Other students and teacher	[Laughter]
19	Dawn	I'm dead behaved in the other class
20	Jackie	You won't be on Thursday, love

[M1:180-192]

In lines 7, 9 and 11 Jackie sets the tone of this exchange, which appears almost to be "performed" for the other students in the group (since she seems to be encouraged to continue by the other students' laughter). But to what extent do the responses made by Dawn in lines 12 and 17 constitute friendly teasing or disaffiliative mocking? Dynel (2010 forthcoming) suggests that the distinction is in the speaker's intention and the listeners' inferences, and although the speaker's intention cannot be observed, the response of the listener(s) can. In the above exchange, not only are the teacher and other students amused, but Jackie responds with further humour to Dawn's contributions (lines 15 and 20), thus suggesting that she infers these as affiliative teasing.

Such episodes appear to fulfil a variety of functions for Jackie. The humorous tone may help to diffuse tension and anxiety (Baynham 1996). However, the exchange perhaps also performs a more serious function of self-awareness and confrontation of these barriers to her learning, enabling her to share her anxiety with other members of the group and receive their support and encouragement.

Other forms of affiliative humour also reflected the self-deprecatory tendencies of the students, and sometimes seemed to be used to elicit encouragement or refutation of self-criticism. Other students often joined in the laughter, but again generally laughter seemed to be *with* rather than *at* the joker; the tone of the laughter is generally empathetic, as in these one-liners from Abigail and Roz.

Extract 6.7: "Do I do that in feet?"

The Farmton class is working in pairs or small groups on a worksheet which asks them to suggest the units they would use to make certain measurements. On several other occasions, Abigail's talk suggests that she is self-conscious about her weight.

1	Elizabeth	[To room in general] How are you finding this?
2	Abigail	[loudly] You know waist measurement? Do I do that in feet?
3	Other students and teacher	[Loud laughter]
4	Elizabeth	[laughing] I wouldn't have a clue what mine was

[F1/L2B: 48]

Extract 6.8: "Dumb blonde moment"

Roz, in the Farmton class, has made a mistake in her work which she considers to be stupid. The joke is not new but is given impact by the fact that Roz has very dark hair.

1		[The class is unusually quiet, with students working alone or whispering in pairs]
2	Roz	[loudly] I'm having a dumb blonde moment
3	Other students and teacher	[Loud laughter]

[F1/L2A: 272-274]

Both of these jokes were made loudly, suggesting that they were for the benefit of the whole room, and the laughter they elicit seemed to come from all the students and indeed staff in the room, rather than just from the students with whom they were working most closely. Thus again there was a clear element of performance in these jokes. Dynel (2010 forthcoming:18) points out some of the functions of self-deprecatory humour:

> Applying self-deprecation, the speaker displays his/her positive self-image and, in particular, one of the virtues in contemporary society, i.e. the ability to laugh at one's inabilities, shortcomings and problems. Able to poke fun at one's own foibles, incapabilities and misadventures, the speaker comes over as a quick-witted, and consequently, likeable person.

However, as well as making the joker appear more likeable, the self-deprecatory nature of these jokes also seemed to contribute to an atmosphere in which it was permissible to lack confidence, and in which it was not necessary to demonstrate high levels of competence in order to be accepted.

The humour is rather more ambiguous in the following extract from the Milltown class. Jackie, Dawn and Charlotte were working collaboratively on a percentages worksheet, and had paused to discuss how they would fare working individually in the coming examination (see Extract 5.1).

Presumably it was Jackie's reflections on her own anxiety about the exam which prompted her to recount this semi-humorous anecdote about her son.

Extract 6.9: "I don't want any breakfast"
Jackie, Dawn and Charlotte have been working together through a percentages worksheet, and have paused to discuss how they will fare in the coming examination.

1	Jackie	Ahh, our Connor this morning, he's er, "Oh, I don't want any breakfast."
2	Dawn	[sympathetic tone] Ahh
3	Jackie	Oh, you've got to have breakfast, but he's er
4		I make him have breakfast before he goes to school
5		So I make him cheese on toast
6		Then it dawned on me
7		He's got butterflies
8		He's got his SATs[18]
9	Dawn	[sympathetic tone] Ahh
10	Jackie	(...) He went to school thinking he's got his SATs and he's all worked up
11		Then he gets to school and it's not till next week
12	Dawn and Charlotte	[uncertain laughter]
13	Jackie	Poor lad (...)
14	Dawn	[ironically] Wonder where he gets all that from?
15	Jackie	Yeah, I know, he sees me in the house [laughs]
16	Dawn and Charlotte	[laughter]

[M2: 619-625]

The style and tone in which Jackie begins to present the story suggest that she intends it as a humorous anecdote (lines 1-11). Her son has been so anxious that he would not eat his breakfast, but it was all for nothing and he will have to go through it again next week. Jackie's delivery in line 11 has the tone of a punch-line. Yet Dawn and Charlotte respond with uncertain and sympathetic laughter, suggesting that they find this account poignant and troubling (as indeed I did on listening to the recording). In a classroom in which many participants experienced anxiety and failure at school, it is perhaps not surprising that response to such an anecdote will be mixed. Dawn successfully negotiates this awkwardness by deflecting the joke and making Jackie the butt again (line 14) and Jackie's acceptance of

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[18] Key Stage tests administered nationally to all children in state-funded education in England at ages 7 and 11. The original aim of the tests was to assess the performance of schools; however, many children regard the tests as an assessment of their own performance.

this as affiliative teasing is indicated by her response and laughter in line 15.

Burnett and Wichman (1997) suggest that anxiety about mathematics may be passed on from parents to children; but here I wonder whether there is influence in the other direction, with Jackie's reflections on her son's anxieties helping her to understand her own better. As discussed in Chapter 5, chatting about their children's education was common during the students' own work in the classroom. Pahl and Kelly (2005:92) describe how family learning creates a "third space" (Bhabha 1994) "where both discourses, of home and school, are present and can be recognised" to generate new meaning. Similarly, in the Milltown and Farmton classes, discourses of "the school gate" intersected with discourses of the adult numeracy classroom, and seemed to be used by the students to make new sense both of their own and their children's learning.

A further function of humour in both classrooms seemed to be to provide a moment's relief from the pressures of mathematical working, which the students often found quite tiring (see Chapter 5). The use of humour did not seem to distract students from their work, and they seem to be able to switch from enjoying a joke back to their work with ease.

Extract 6.10: "It's not a light sabre, you know"
Elizabeth has set out measuring instruments to enable the students in the Farmton group to make more sense of metric units of length, mass and capacity. Donna is wielding a metre rule in a small and crowded classroom.

1	Donna	[reading from worksheet] "The width of a washing machine'
2		The width (...) metres
3	Judith	Yeah
4	Donna	Yeah
5		But you could always (...)
6		But you'd sort of
7		[holding out a metre rule for everyone to see]
8		If you look, that's wider than a washing machine
9	Judith	Washing machine
10	Abigail	Be careful with that, you
11		[laughter]
12		It's not a light sabre, you know
13		[more laughter]
14	Donna	[still laughing] I'm going to put centimetres
15	Judith	Yeah

[F1/L2B: 31-37]

This easy switching back from "social chat" to mathematical discussion (line 14) without apparent detriment is also noted (in schools) by Pirie and Schwarzenberger (1988:465), who suggest that "such light relief may actually be necessary for most pupils to sustain discussion on a mathematical topic". In these "side sequences" (Jefferson 1972), members of a group momentarily leave the task they are working on for humour and then return to it refreshed and refocused.

Humour as a Challenge

Above I have described how affiliative humour was used to elicit and provide support in the classroom and to diffuse tension and anxiety. However, in the following episode from the Farmton class it is less clear whether the humour is affiliative, and what function it was intended to serve.

The students in the Farmton class had been working on card activities and worksheets about metric measures. To reinforce this learning, Elizabeth had put out a range of measuring instruments, including a set of metric free weights, on the large central table in the classroom. During the informal coffee break the students remained in the classroom (drinks were served from the attached kitchenette) and Elizabeth encouraged them to handle and discuss the measuring instruments. The extract below follows from Abigail weighing a one kilogram weight in her hand; she considered the weight to be much heavier than a standard bag of sugar.

Extract 6.11: "It's not like any bloody bag of sugar I've ever felt"
Abigail has picked up a 1kg weight, and finds it hard to believe that it is the same weight as a standard bag of sugar.

1	Abigail	That's mad, I can't – I'm sure they must have got that wrong
2	Donna	You'll have to come home and er (...) a bag of sugar
3	Abigail	It's not like any bloody bag of sugar I've ever felt
4		[laughs]
5		Are we sure this is right? [to Elizabeth]
6	Elizabeth	I hope it is! [laughs] It would be a bit –
7		What's it feel like?
8	Abigail	It's so bloody heavy
9	Other students	[shocked laughter]
10	Abigail	Yeah, but compared to

11		It's supposed to be like the same as a bag of sugar
12		I'm sorry but it don't feel like any bag of sugar I've ever bloody felt
13		...
14	Abigail	You know it's like that trick question where they say
15		There's a kilo of feathers and a kilo of, something else, you know, which is heavier?
16		And you know, you're like, well it can't be the feathers
17		But they're the same weight
18		So they've got to weigh the same
19		I don't know, I'm not happy with this [Elizabeth], I'm sorry
20	Students and teacher	[laughter]
21	Sally	Now, now [laughing]
22	Abigail	I demand a recount
23	Students and teacher	[laughter]
24		[F1/L2A: 454-493]

Abigail's challenge to the relationship between a kilogram weight and a bag of sugar is prolonged and disruptive, and might at first appear aggressive. She speaks loudly, seems to be performing for the whole room including students and staff (and indeed myself as observer), and has everyone's attention. Nonetheless, it is Elizabeth whom she is ostensibly addressing (lines 5 and 19). Is this to be interpreted as an aggressive challenge to Elizabeth? As discussed above, in deciding whether or not humour is aggressive, it is helpful to observe the addressee's response. Elizabeth's response is audible laughter, and from my fieldnotes she appeared genuinely to be enjoying Abigail's performance. Abigail's use of a swear-word in direct response to the teacher (line 8) shocks the other students, but Elizabeth takes it calmly. Thus Abigail seems less to be challenging Elizabeth's personal authority, but the mismatch between classroom mathematics and her own experience. Through her challenge she is perhaps asserting her entitlement to accept or reject official "knowledge", and her independence from the curricular discourses which dominate classroom activity. Wagner (2009:450) speculates that mathematicians feel a "sinful pleasure" in writing mathematically-impossible expressions (for example a fraction with a denominator of zero) and suggests that this is a form of rebellion or "swearing" which opens up new possibilities of thought. Further examples of Abigail's challenges to curricular discourse can be seen in Chapter 7.

Abigail's ostensible challenge to Elizabeth's authority needs also to be reviewed in the light of an unelicited comment she made to Elizabeth later in the same session. She and some of the other students had been talking about how much confidence they had gained through coming to Elizabeth's classes:

Extract 6.12: "No, but you are brilliant"
Abigail and other students have been chatting with Elizabeth about how much confidence they have gained in mathematics through coming to the classes.

| 1 | Abigail | [to Elizabeth] No, but you <u>are</u> brilliant |
| 2 | | Nothing ever stresses you and the way you explain things is fantastic |

[F1/L2A: 550-551]

Presumably it is this genuine regard that allows Abigail noisily to challenge Elizabeth without upsetting the teacher-student relationship.

Humour as a Resource

Coffield (2008) asks why there is not more research into the role of humour in the classroom. In the Milltown and Farmton classrooms, humour served to refresh and relieve the students when working on difficult problems and to create an environment in which learning was clearly enjoyable. Self-deprecatory humour allowed students to share doubts and difficulties, and to discover that others felt these too. Humour also seemed to create a "space" in which painful issues, such as acute anxiety, could be acknowledged and accepted, and support elicited in facing them. Baynham (1996) suggests that humour in adult numeracy classrooms should be regarded as a resource, and this certainly seemed to be the case in the classrooms I studied. Ivanič *et al* (2006:40) report how the *Skills for Life* classes they observed:

> All maintained a serious intent, but, within this, learning was conducted in relaxed, friendly and enjoyable ways. There was lots of humour, laughter and play: the students found learning fun. This is an important factor in countering previous negative experiences of learning as embarrassing and painful.

"They": Writers of Learning and Assessment Materials as "Other"

Speakers' use of pronouns can provide insights into their perceptions of where agency lies. In this section I examine how the students, and even the teacher, tended to refer to examiners and writers of other official learning and assessment materials simply as "they" or "them".

Use of the pronouns "they" and "them" (particularly when contrasted with "we" and "us"), is considered to have a role in reinforcing shared identity, closeness and belonging; serving to consolidate and unify a group's motivation for action (Berman, Berger and Gutmann 2000). Their use by dominant groups in order to marginalise minority or disempowered groups is perhaps most commonly recognised. However, an alternative use is evoked by Hoggart (1957:72) in describing how figures of authority (including teachers) were perceived by working-class individuals as:

> a shadowy but numerous and powerful group affecting their lives at almost every point: the world is divided into 'Them' and 'Us'

Dunne, Goddard and Woolhouse (2008:244) note how a tendency to "think and speak in terms of an invisibly present and controlling 'they' or 'them'" reflects a sense of passivity or marginalisation on the part of the speaker.

The following extracts exemplify two different ways in which the pronouns "they" and "them" were used to refer to writers of learning and assessment materials. In the first, both teacher and students seemed to perceive "them" as powerful but benign (or, at worst, neutral); and in the second the students (but not the teacher) seemed to perceive "them" as deliberately malevolent.

Elizabeth presented the examiners as benign but powerful when she introduced a new topic to the Farmton class, and spoke of the questions "they" would ask in an examination (and which the students must therefore practice).

Extract 6.13: "In the National Test they'll ask you"
Elizabeth is introducing a new data handling topic to the Farmton class.

1	Elizabeth	Right.
2		Today, I want to talk about data handling
3		Graphs and charts
4		Knowing often in the National Test
5		They'll ask you what is the best graph to use in a certain situation
6		So you'll need to know what different types of graphs and charts there are
7		And when you would actually use those

[F3/L1A:290-292]

Elizabeth implies that the students will only need to know about graphs and charts in order to pass the "National Test" (i.e. the *National Certificate in Adult Numeracy,* see Chapter 5), rather than to read such graphs and charts in their daily lives. While "they" are associated with no deliberate malevolence in this example, compliance, both by students and teacher, is assumed to be non-negotiable. If "they" will ask these questions, then students must learn how to answer them. The controlling power in this hegemony is not made clear to the students (and possibly neither is it to the teacher) and they appear to accept it without challenge.

However, some of the students, particularly those who were struggling with, or were resistant to, mathematical learning, seemed to regard "them" as more malevolent. Take for example, Pete and Roz's response to this "discovery" style task (Fig. 6.1) on a worksheet given to the Farmton group. The task required the students to work out how many mm^2 there are in 1 cm^2.

[4]   How many square millimetres make up one square centimetre? _____

•

•

•

This diagram shows **one square centimetre**

(1 cm^2) split into square millimetres.

[6]   Area of square in mm^2 = _____

So **1cm^2 =** _____ **mm**

Do you still agree with your answer to question [4] ?

NOT TO SCALE

1 cm

1 cm

10 mm

10 mm

SKILLSHEETS © COPYRIGHT L.Henry 2003
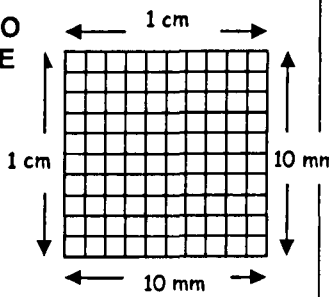
Fig. 6.1 Extract from *Skillsheet* Worksheet on Area (Henry 2003).

Extract 6.14: "But they've tried to confuse it"
The aim of the exercise shown in Fig. 6.1 is to challenge the misconception that because there are 10 mm in 1 cm, there are 10 mm^2 in 1 cm^2. However, Pete and Roz perceive this as a deliberate attempt to confuse learners.

1	Roz	[reading] "Do you agree with your answer to question 4?"
2	Pete	Hang on, we've got to do the area
3	Roz	Oh, right, the area of the square
4		So it's one by one
5		But they've tried to confuse it by saying that ten millimetres is one centimetre.

[F2/L1B:173-177]

I assume that the writer (Henry 2003) was aiming to illuminate through discovery rather than to confuse, yet the task seems to reinforce Roz's perceptions that the aim of mathematics is to "catch out" the unwary and that "they" are trying to confuse or catch them out by making questions difficult. This stronger perception of "them" as malevolent agents suggests a sense of alienation from the domain of mathematics which persists despite the supportive nature of this classroom. Note that Roz uses the anonymous "they" even though the name of the author (Linzi Henry) is printed on the worksheet (Fig. 6.1). (See also Extract 6.16 below, in which Abigail claims that "They just want to confuse you" by using mathematical terminology.)

As in the examples above, most uses of "they" and "them" seemed to represent a shared understanding by all the students that the pronoun referred to writers of learning and assessment materials, although "their" identity was not explicitly discussed. However, in a rare exception, this anonymous authority was challenged and "their" identity questioned. The students in the Milltown class were working collaboratively on a practice multiple-choice Test paper. Elizabeth had previously discovered that one of the answers given on the official answer sheet was incorrect.

Extract 6.15: "They've got C, but I think they're wrong"
The students in the Milltown group are working through a practice Test paper. Elizabeth has previously identified that the answer given to question 8 on the answer sheet is wrong.

1	Jackie	Take two off that, so what's that? Is it ninety-six?
2		...
3	Melissa	(...) ninety-six, yeah, ninety-six
4	Elizabeth	Which number question is it? 8?
5	Melissa	Yeah, ninety-six, we got.
6	Elizabeth	Which is?
7	Melissa	D
8	Jackie	D
9	Elizabeth	They've got C, but I think they're wrong
10	Jackie	Who's got C?
11	Elizabeth	The answer sheet

[M3: 533-543]

In line 9 Elizabeth hints at the fallibility of both herself as teacher and the writers of the assessment materials, possibly giving the students a passing glimpse of mathematics and its learning materials as constructed rather than absolute. Jackie's question in line 10 is a rare query as to "their" identity, and it is possible that Elizabeth's reference to "their" fallibility has disrupted Jackie's acceptance of this term and leads her to question "their" identity. Note how anonymity is reinforced once more by Elizabeth's response in line 11.

The students' use of the pronouns "they" and "them" seems to construct the writers of assessment and learning materials as other and alien. They represent an anonymous and sometimes malevolent agency which is ultimately in control. Elizabeth's own discourse constructs "them" as less malevolent, but still non-negotiably in control, and I suggest that this reflects teachers' decreasing agency within the regulative structures of

Skills for Life (See Chapter 5, and also Gregson *et al* 2005; Carpentieri 2008). In Chapter 9, I ask whether this suspicion that writers of learning materials are trying to "catch out" the unwary presents a challenge to current advice that learning activities should seek to "expose" students' misconceptions (DfES 2005a; 2007).

Uptake and Rejection of Mathematical Discourse

Zevenbergen (1998) emphasises the advantages of fluency in formal mathematical discourse in terms of linguistic capital (see Chapter 2). Collaborative groupwork seems to sit at an interface between personal and formal domains of discourse, and the tension which existed between the students informal discourses, and the more formal mathematical discourses used in examination papers, can be seen in the following example. The Milltown students were working together on a question from a practice Test paper (Fig. 6.2), in which they were asked to identify an error on a graph.

Extract 6.16: "The vertical scale is incorrect"
Gemma quickly spots the error on the graph shown in Fig. 6.2, but the students have difficulty in matching the error to the appropriate mathematical terminology.

1	Gemma	[reading from multiple choice options] "The axis labels are incorrect"
2		Um
3		What's the axis?
4	Charlotte	Um
5	Gemma	The numbers are – wrong
6	Charlotte	Yeah
7	Gemma	They go up in twos, and then ones
8	Jackie	Why, where're you looking?
9	Gemma	Look [pointing]
10	Jackie	Oh, right
11	Gemma	When it goes to there, it goes up
12	Melissa	[reading from multiple choice options] "The vertical scale is incorrect"
13	Gemma	I've put – yeah, that's what I've put
14		I don't know
15		It started off going 200, 200, 200
16		It's gone to 100, 100, 100
17		(...) I think it's the vertical scale
18		I'm not sure
19		I've put D anyway

[M3: 577-584]

10 The dairy presents the number of pints the milkman delivers each week in July on a graph.

Pints of milk delivered per week in July

What is wrong with this graph?

A The axis labels are incorrect

B There are data points missing

C The title is incorrect

D The vertical scale is incorrect
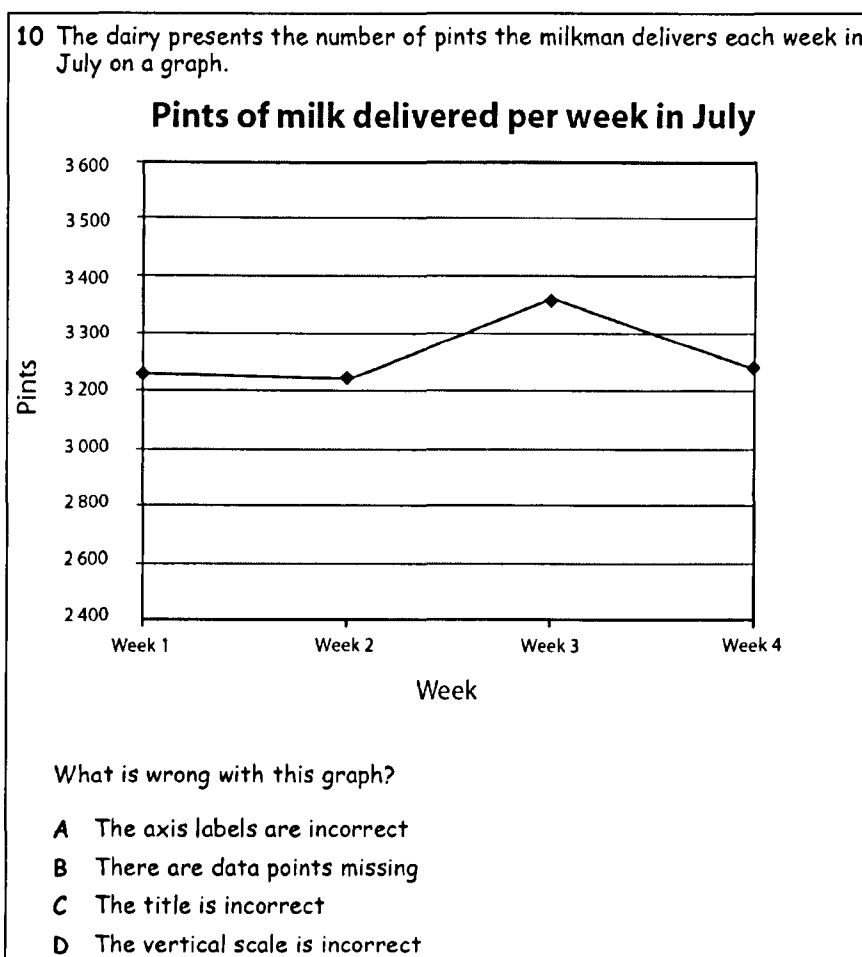
Fig. 6.2 Question from *National Certificate in Adult Numeracy Level 2 Practice Test "L"* (LSIS/Tribal 2008)

Gemma has quickly spotted the error, but struggles to identify which of the four multiple-choice answers corresponds to her own understanding. She expresses the error in her own terms (lines 5 and 7) and uses gesture to explain the error to Jackie (lines 9 and 11), but struggles with terminology such as "axis" and "vertical scale" (lines 3 and 17) and eventually has to guess at which of the multiple-choice answers to select (lines 13-19). This lack of fluency in mathematical discourse was typical in both the Milltown and Farmton classrooms, even for those students who were nearing completion of their studies. Rectangles were referred to as "boxes"; multiplying as "timesing"; dividing as "goes into".

Why did the students generally make so little use of mathematical discourse? To some extent this reflected Elizabeth's own commitment to making mathematics accessible. Occasionally she even modified her own discourse to match her students, for example by using "times" as a verb in

the place of "multiply". I suggest that such approaches are not unusual, and may even be seen as a Freirean determination by adult numeracy teachers not to privilege academic discourses over those of their students.

Another contributing factor is the suspicion with which mathematical vocabulary seemed to be viewed by the students. The students often seemed to see it as *imposed* on them by the writers of learning and assessment materials, and seemed to *choose* to reject it, as in the extracts below.

Extract 6.17: "They just want to confuse you"
Donna comes across the unfamiliar word "modal" on a data handling worksheet. Abigail and Judith view such terminology with suspicion.

1	Donna	Modal?
2		Is modal part of – mode
3		Oh, the mode or modal, right
4	Elizabeth	Yeah
5		If they talk about finding the mode, or the modal value
6		It's the same thing
7	Donna	The same thing
8	Abigail	They just want to confuse you
9	Elizabeth	[addressing whole class] Do you know why we have more than one kind of average?
10		Why we've got the median, and the mode?
11	Donna	[loud laughter] No
12	Abigail	They like us (enjoying things)
13	Judith	I didn't know we were doing French

[F3/L2A: 781-788]

Extract 6.18: "I'd call that a number"
Roz and Dan choose to reject the mathematical discourse of data handling, specifically the use of the word "frequency" in this context.

1	Pete	Frequency
2	Roz	Frequency
3	Pete	Or number
4	Roz	Number
5		Yeah, I'd say (...)
6	Pete	Yeah, I'd say number as well
7	Roz	(...) keep it simple
8		I'd call that a number
9	Elizabeth	Right
10	Roz	Frequency just (.) doesn't make sense to me
11	Dan	It can't be – it doesn't make sense
12	Roz	That's like computer speak, like that, don't they, as well

[F3/L1A: 515-522]

Nonetheless, there were occasions on which students demonstrated that they had access to more formal and mathematical discourses when they chose to use them. For example, in the Farmton class, Roz and Pete were working together through a worksheet on finding the areas of rectangles. A structured question prompted them to write down their working:

Extract 6.19: "Equals two"
Here Roz "translates" Pete's informal discourse into mathematical discourse as she writes.
1   Roz   [speaking slowly as she writes] One times two
2   Pete   Which is two
3   Roz   [speaking slowly as she writes] <u>Equals</u> two

[F2/L1B: 309-311]

The formality of the written medium seemed to prompt Roz to write in a more formal register, replacing Pete's "is" with "equals", perhaps because she has in mind a reader who will be evaluating her work.

Similarly, Jackie was usually one of the least confident members of the Milltown group, but on the following occasion she found herself in the high-status role of explainer, and this seemed to prompt her to switch to a more formal code as indicated by her use of the word "therefore" in line 2:

Extract 6.20: "So therefore you move the decimal point"
Jackie, unusually for her, finds herself in the high status role of explainer, and switches to a more formal code, using the word "therefore".
1   Jackie   First you've got to find your ten percent, don't you?
2   So therefore you move the decimal point

[M2: 529-530]

There were also examples of the students using more formal registers to express abstract or difficult ideas. Donna and Abigail in the Farmton group were working on a card-matching puzzle which required them to match written descriptions of shapes to their perimeters. This was a challenging exercise, since the students needed to visualise the shape from its description in order to calculate its perimeter, and the card-based nature of the activity seemed to deter them from sketching the shapes as they worked.

Extract 6.21: "A hexagon, we said, was six sides"

Donna and Abigail are working on a card-matching puzzle which requires them to match written descriptions of shapes to their perimeters.

1	Donna	[reading from a card] "This is a regular hexagon. Each side is 5 cm."
2	Abigail	A hexagon, we said, was six sides, didn't we?
3		So (.) it's (.) six fives again, isn't it?
4	Donna	Yeah
5	Abigail	Which is thirty.
6	Donna	[sound of cards being laid down] Okay

[F3/L2A: 101-106]

Abigail uses the subordinate clause in line 2 to establish agreement about what is meant by a hexagon, and her argument in lines 2, 3 and 5 is articulated in grammatically complete sentences which "stand alone" and can be understood fully by an outside listener. In these examples there are echoes of Bernstein's theories of elaborated and restricted code (Bernstein 1971). As described in Chapter 4, Bernstein describes restricted codes as context-dependent and particular, whereas elaborated codes are context-independent and universal. While restricted code is informal, and relies on speakers and listeners sharing background knowledge and understanding, elaborated code is sufficiently explicit to be understood by an outsider. At least some of the students seemed to be able to switch between *both* codes, and chose from them to suit the functions they wish to achieve through language (for example, compare Abigail's talk in Extract 6.21 with that in Extract 6.11 above). Whether or not the students chose to use a formal register seemed to depend on the intended audience, and the extent to which ideas could be expressed via shared meanings and mutually-understood language shortcuts. Here the students tended to use formal discourse when they were writing for an imagined third party, or when the concepts they wanted to explain seemed too abstract or complex to convey using familiar informal expressions.

Although I introduced this section with Zevenbergen's assertion that "legitimate participation is acquired and achieved through a competence in the classroom dialogic interactions" (2000:1), successful participation in the classrooms in my study did *not* seem to depend greatly on fluency in mathematical registers. Rather, the habitus of the students and the teacher had established the classroom as a field (see Chapter 4) in which the

linguistic capital associated with formal mathematical discourse was not valued so highly as other linguistic habitus, for example the use of humour and admissions of uncertainty. As Grenfell (2008:5) argues:

> In most social contexts, there is a dominant language form. This is most evident at a national level where there is 'received pronunciation' and other 'standard' language forms. However, it can extend to sub-levels and categories, and *field microcosms*. In each case, there is a 'right' way of using language. This rightness is defined by common social assent, or common acknowledgement (original emphasis).

Conclusion

In this chapter, I have analysed the diverse language practices which the students brought to the classroom. As discussed in Chapter 4, the disposition to speak in certain ways may be regarded as linguistic habitus, in which family background and experiences of schooling inevitably play a major part. For adult learners, however, linguistic habitus is also formed through interaction with, and negotiation of, adult social worlds, and schooled habitus may variously be transformed or confirmed through encounters with the new field of the adult classroom.

By enabling them to construct and maintain a safe and supportive classroom environment, certain aspects of the students' linguistic habitus seemed to *broaden* the possibilities of thought and action which they perceived to be open to them. Although uncertainty and lack of confidence are usually regarded as problematic, they had the linguistic competence to draw on a broad repertoire of ways to express their uncertainty, doubts and anxiety. They used these to enhance group cohesion, to invite contributions and evaluations from other students, and to formulate and articulate questions which could be answered by the teacher or by each other; often easing these interactions with appropriate and sensitive use of humour. Their diverse language practices allowed group discussions to be opened up, the possibility of uncertainty to be recognised and accepted, and dominant discourses to be challenged. In Chapter 8, I discuss whether these linguistic repertoires may be regarded as part of the students' funds of knowledge.

By contrast, however, there were other aspects of the students' linguistic habitus which seemed both to reflect and maintain a sense of disempowerment and marginalisation. The students expressed discomfort with, and suspicion of, formal mathematical registers, even though they sometimes demonstrated access to them, and the writers of assessment and learning materials were constructed by their talk as anonymous, powerful and even malevolent. It seems likely that negative experiences of schooling contributed to this sensed disenfranchisement and lack of agency amongst the discourses of mathematics education, and thus may perhaps be regarded as part of their schooled habitus. This part of their linguistic habitus seems rather to *narrow* the possibilities open to the students.

Chapter 7

"Actually, I'm thinner than Posh"
Relevance and the Curriculum

In this chapter I explore the relevance of classroom mathematics to the students' out-of-classroom numeracy practices, experiences and interests. In particular I address the second of my research questions "How might students' knowledge, practices and dispositions be used to develop teaching and learning approaches which are more meaningful and relevant to their numeracy practices outside the classroom?" by examining both how the students drew on informal practices in the classroom and how the classroom activities reflected numeracy as it is practised outside the classroom. I also analyse how the different types of knowledge which the students brought to their collaborative groupwork were legitimised and valued in the classroom, and the way in which the curriculum influenced which types of knowledge were constructed as valid.

Throughout this chapter, it is useful to keep in mind the two official discourses which, as described in Chapter 5, currently dominate pedagogic practice in numeracy classrooms: the regulative discourse of the curriculum and accreditation; and the social-constructivist discourse of collaborative groupwork.

Out-of-Classroom Numeracy Practices and Classroom Talk

In this section[19], I examine the students' talk for traces of the out-of-classroom numeracy practices that they brought to the classroom. I analyse which types of learning activity seemed to be most effective in drawing on these sources of knowledge, experience and interest, and what

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[19] Some of the findings reported in this section have already been published in Oughton (2009a).

features of these activities encouraged students to think outside the constraints of the classroom.

As described in Chapter 5, learning activities in Elizabeth's classrooms comprised both traditional worksheets (as preparation for formal assessment) and current, discursive-style activities based on social-constructivist principles, with approximately equal amounts of classroom time being spent on each. I begin this section by presenting examples of the way students responded to conventional context-based word problems. Later in this section, I discuss how alternative activities appeared more successful in encouraging students to draw on their out-of-classroom knowledge and experience.

Mathematical Word Problems: A "Willing Suspension of Disbelief"?

One of the underlying assumptions of current policy is that adult numeracy should be functional. This assumption is reflected in many learning and assessment materials, such as the *National Certificate in Adult Numeracy*, which rely greatly on mathematical word problems set in supposedly "real-life" contexts from the home, workplace or commerce (see Chapters 2 and 5).

As Elizabeth needed to prepare students for accreditation, there was considerable emphasis on conventional worksheets and practice "Test" papers. However, students were encouraged to work in pairs or small groups even when working on the traditional-style word problems these presented, and their discussions provide valuable insights into their responses to such problems and the real-life contexts they are supposed to portray.

Consider for example the following question (Fig. 7.1) from a worksheet given to the Milltown group, which presented word problems set in the context of diluting concentrated drinks. The sheet begins with a discussion and explanation of the dilution instructions:

INSTRUCTIONS

Dilute one part orange

with 4 parts water

Fig. 7.1 Extract from *Skillsheet* Worksheet on Ratio (Henry 2005:1)

The author of the worksheet (Henry 2005) appears to have attempted to make the context meaningful to adult learners. The dilution instructions are presented as though they are a label on a juice bottle, and there is a section at the bottom of the page which discusses a weaker dilution for toddlers.

However, the problems on the sheet conform to the word problem genre commonly found in school classrooms (see Chapter 2). The first problem is shown in Fig. 7.2. Note the anomalous use of the present indicative tense, and the typical three-part structure: a "set-up" to establish an arbitrary scenario; a number of items of numerical information; and a question.

[Question 1]

Selina is making **diluted** juice in a large jug.

She pours two cups of orange into the jug.

How many cups of water does she need to put in ?

Fig. 7.2 Extract from *Skillsheet* Worksheet on Ratio (Henry 2005:1, emphasis in original)

The following extract shows Jackie and Dawn's attempt to solve this word problem:

Extract 7.1: "How many cups of water does she need to put in?"
Dawn and Jackie are working together to solve a worksheet word problem involving the dilution of concentrated juice in a given ratio.

1	Dawn	[reading from worksheet] "Selina is making dilute juice (...) she pours two cups of (...) into the jug. How many cups of water does she need to put in?"
2		Oh, right so it's (.) four parts
3	Jackie	Just a minute [reading from worksheet indistinctly]
4		Sorry, I'm a bit slower than you
5	Dawn	How many cups of water does she need to put in?
6		Right, so

7		So it'd be four cups, wouldn't it?
8		Oh no, no, it's eight of water
9		[reading] "She pours two cups of orange into the jug"
10		Right, so that, that's just for one part
11	Jackie	Shall we work it out, on some paper or something?
12	Dawn	(...) Here, right, what you got here, it's four, four for one, yeah? That's water.
13	Jackie	Yeah
14	Dawn	Yeah, and that's orange
15	Jackie	Orange is one
16	Dawn	Yeah
17		Right, but she, she puts
18	Jackie	Two cups
19	Dawn	Two
20	Jackie	Two cups of orange, so that's eight parts
21	Dawn	Yeah
22	Jackie	Eight parts water
23	Dawn	[encouraging tone] Yeah?
24	Jackie	Is that right there?
25	Dawn	Yeah, eight parts water (.) to two parts
26	Jackie	To two parts of orange
27	Dawn	Right
28		So, how many cups of water does she need to put in, so it'd be eight

[M1: 2-30]

Dawn and Jackie's talk shows their acceptance of and familiarity with the word problem genre. They do not refer to any occasion on which they have diluted drinks for themselves or others, nor do they question whether exact measurement is the only satisfactory way to mix the drink. They do not ask each other who "Selina" might be, nor do they question the anomalous use of the present tense, but continue its use in their own talk. Their discussion demonstrates their understanding that they are expected to extract the arbitrary numerical information (which they do in line 12-18), and to perform a calculation which, if done correctly, will result in the "right" answer (which they successfully complete in line 28). Dawn and Jackie show that they possess the recognition and realisation rules required for this genre of classroom activity (Bernstein 2000) (see Chapter 4).

Dawn and Jackie's acceptance of this word problem interested me, because I suspected that most adults do not measure ratios accurately when diluting drinks. Later, in an informal focus group, I asked the Milltown students what methods they used to dilute drinks, particularly when mixing large

quantities of drink.   Between them, the students listed a wide range of methods, few of which bore any similarity to the one used by "Selina" on the worksheet.   The most commonly mentioned was approximating a quarter by eye or by markers on the squash bottle, but other methods included looking at the colour of the mixed drink, listening to the sound of the liquid filling an (opaque) container, and tasting the drink.   None of the students reported measuring accurately.   As Charlotte said: "I've more important things to do."

Many of the students mentioned additional social dimensions to diluting drinks. Charlotte acknowledged that she might be more precise if she was "counting calories".   Denise described the personal taste preferences of her children, and her young daughter's growing independence in choosing to mix squash for herself.   Dawn explained how she "goes mad" at her son because he pours in too much concentrate.   Christine referred to a childhood in which money and other resources were scarce:

> Christine   I'm thinking back to what my Mum did, because I come from five sisters, and my mum used to keep an eye on everything. So she'd say: Oi, you've had too much and there's not enough for everyone else. So it's like sharing as well.
>
> [M4: 85]

As they solved the diluting drinks word problem, Dawn and Jackie did not appear to draw on any of these real-life practices or considerations, but on their understanding of what is expected of them when working with word problems of this genre. Although the word problem is presented as "realistic", they demonstrated their understanding that they must not allow it to become too real.   For example, they are not expected to consider whether the people who will be drinking "Selina's" juice are dieting, or have preferences for stronger or weaker drinks, or concerns about additives and artificial sweeteners. I suggest that this may be regarded as a "willing suspension of disbelief" (Oughton 2009a).

My second example of how participating students responded to word problems is taken from a percentages worksheet which was also given to the Milltown group, and which included the following problem (Fig. 7.3):

Question 4.

> Over 2004 there were 220 fatal accidents in the Construction Industry.
> 55 of them were on building sites.
> **What percentage of the total fatal accidents was on building sites?**

Fig. 7.3   Extract from *Skillsworkshop* Worksheet on Percentages (Skillsworkshop 2007, original emphasis)

The worksheet is marketed to a UK audience, but according to the Health and Safety Executive (HSE 2005), there were 220 fatalities across *all* occupational sectors in the UK in the year 2004/5, only 72 of which were in the construction industry. Thus the figure on the worksheet is around three times higher than the real figure (and was presumably chosen to result in a tidy percentage).   The same HSE press release reminds us that "behind these figures are enormous personal tragedies involving the unexpected loss of family and friends" (HSE 2005).

I have purposely included below the students' entire discussion on this problem in order to illustrate a pattern which recurred throughout the data I collected; that the students extracted numerical information from the word problem and carried out their calculations, without appearing to respond at any point to the "context" in which this problem is set:

Extract 7.2: "Two hundred and twenty fatal accidents"
Ruth, Dawn, Gemma and Jackie are working together from a percentages worksheet. The following transcript presents their entire discussion on this problem from their first reading of the question through to their obtaining the answer as a percentage.

1	Ruth	[paraphrasing from worksheet] Right, two hundred and twenty fatal accidents, fifty-five of 'em building sites.
2		[reading from worksheet] "What percentage of the total fatal accidents?"
3	Dawn	Right, so you've got two hundred and twenty
4		Over (.) fifty-five
5		No, no, it's the other way round isn't it?
6	Gemma	Is it the other way round?
7	Dawn	I don't know
8	Ruth	[reading from worksheet] "What percentage of the total fatal accidents?"
9	Dawn	Yeah, it's – I think it's that way
10	Jackie	Which way?
11	Gemma	Is it the other way round, yeah?
12	Dawn	I think so
13	Ruth	Fifty-five, yeah, over two hundred and twenty

14	Dawn	Yeah, so you've got to cancel that down
15	Ruth	And how d'you do that then?
16	Dawn	Five'll go in to it, won't it?
17		[whispered] Five, ten, fifteen, twenty
18	Ruth	(...) is eleven
19	Dawn	Yeah. How many fives into two hundred and twenty?
20	Ruth	Well fifty's ten, a hundred is twenty
21		[laughing] One hundred and fifty is what, thirty?
22		Forty, forty-four
23		Forty-four?
24	Charlotte	Yes
25	Ruth	So it's eleven forty-fourths? [laughs]
26	Jackie	Oh, no
27	Ruth	We surely can get lower than that
28	Dawn	Yeah
29	Charlotte	Because eleven
30	Dawn	Yes, eleven'll go into forty-four
		So it'll go in one, and four, so it's a quarter
31	Charlotte	Yeah
32	Ruth	Hang on a minute, whoa, whoa, whoa
33		Now you've got me now
34	Gemma	Do you know your eleven times table?
35	Ruth	Eleven, twenty-two, thirty-three, forty-four.
36	Charlotte	Yeah
37	Dawn	So eleven'll go in –
38	Ruth	Hang on, hang on
39		How do we suddenly –
40		Because I would have been thinking, what does that, and that, go into?
41		What goes into both of them?
42	Dawn	Yeah, yeah
43	Gemma	Eleven
44	Jackie	So it'll just be one, won't it? Because only one eleven goes into eleven.
45	Ruth	Yeah, I'm with you, I'm with you
46		The bottom is forty
47	Dawn	Eleven'll go into itself once
48		And it'll go into the bottom (...)
49		It's a quarter
50	Ruth	Yeah I'm with you
51		(...)
52	Charlotte	So that's 25%

The students then move on to the next problem on the sheet.

[M2: 710-750]

Lines 1-13 are concerned with reading the word problem to extract the relevant numerical data and mathematical relationships. Although Ruth

reads aloud the potentially emotive words "fatal accident" three times during the episode (lines 1, 2 and 8), the students focus only on the numbers, grappling with the difficulties of which number is the denominator.   Although Ruth's paraphrasing of the question in line 1 suggests her understanding of the narrative, she does not reflect aloud on the significance of the context.   It seems that the students disregard the context of the word problem here completely, even when that context might be expected to provoke concern, shock, or at least a query as to its validity.

From line 14 onwards, the students respond to the problem merely as an instruction to find 55 as a percentage of 220. Once Gemma has made her case that 220 should be the denominator rather than the numerator, the students' discussion is solely of arithmetic from line 14 through to the correct solution at line 52, centring largely on the identification of eleven as a common factor. Again the students have "suspended disbelief" and concentrate only on getting the "right" answer.

As before, the students demonstrate their possession of the recognition and realisation rules associated with the word problem genre and its conventions of simplified and tidy numerical relationships.   For example, in line 27, Ruth recognises that 11/44 is an unlikely answer, even though she has not yet spotted the equivalence to a quarter.

Word Problems and Schooled Habitus

I have shown examples of the students applying the recognition and realisation rules associated with the word problem genre.   For example, they understand how realistic word problems are expected to be, and that a fraction like 11/44 is unlikely to be the final answer. How, and when, have the students acquired these rules? Many of the students seem to have a sophisticated, subtle and unspoken understanding of the rules from the outset of their participation in the class.   For example, in Extract 7.2, Charlotte is attending only her third session in the Milltown class when she shows understanding of the expectations of the percentages word problem.

In school, children learn to conform to "a set of behaviours that results in praise for good performance, minimal conflict, fitting in socially" (Schoenfeld 1991:340). Gravemeijer (1997:392) suggests that "it is not a cognitive deficit that causes the abstention from sense-making, but rather that the children are acting in accordance with a typical school mathematics classroom culture."

I suggest that for many of my participants, understanding of such rules – and the associated disposition to conform to the discourse of the word problem genre – were acquired as durable characteristics while learning (or attempting to learn) school mathematics. This type of knowledge is not of use outside the classroom; it is only of use in the recontextualised world of mathematical learning. It seemed to be brought to the adult classroom as part of the students' *schooled habitus*, first imposed on them in their school mathematics classrooms, and later confirmed for them in the new field of adult learning. Within this schooled habitus, the idea of questioning the contexts of word problems is perceived as aberrant. This type of knowledge seems to restrict, rather than widen, the students' perceptions of the possible.

Alternatives to Word Problems: Relevance and Meaning

As described in Chapter 5, in addition to word problems, Elizabeth made extensive use of alternative activities designed to promote discussion. These included the *Thinking Through Mathematics* resource (DfES 2007) and activities she had designed herself along the same social-constructivist principles, such as card activities used to match, categorise and evaluate mathematical statements. Here I report on three examples of alternatives to word problems during which students related classroom mathematics more effectively to out-of-classroom practices, using mechanisms which included the sharing of mathematical knowledge; spontaneous role play; and an animated discussion which drew on their "popular cultural capital" (Fiske 1988).

Card Activity: Discussing Out-of-Classroom Measurement Practices

The first of these alternative activities was taken from the *Thinking Through Mathematics* resource (DfES 2007). Fig. 7.4 shows six cards from a set of 24 similar cards (see also Fig. 7.6 below). Students are asked to match these cards to appropriate units of measurement (displayed on another set of cards in the resource). The text on the cards does not resort to the fictional narrative devices used by traditional word problems and, rather than the anomalous use of the present tense characteristic of word problems, the conditional mood is used to relate the activity directly to the learners' own practices:
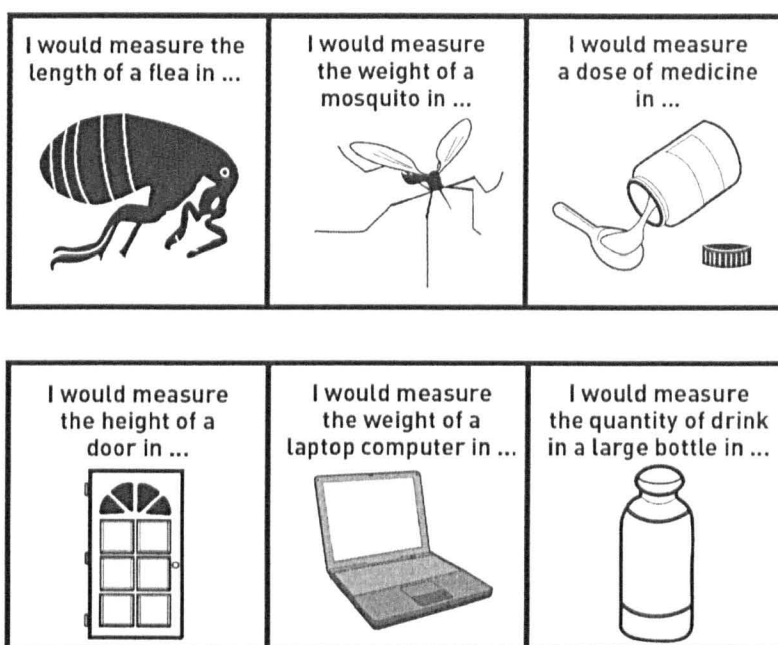
Fig. 7.4 Sample of *Thinking Through Mathematics* Objects Cards (DfES 2007) (see Appendix H for full set)

When the Farmton Level 2 group undertook this card activity, they engaged in one of the very few discussions recorded during my study during which students spontaneously drew on numeracy knowledge from outside the classroom in order to scaffold their formal learning. The following is one example; other practices discussed during this activity included filling cars with fuel and mixing concrete (see Extract 7.7 below):

Extract 7.3: "Wine bottles have centilitres on them, don't they?"
The card activity illustrated in Fig. 7.4 above prompted students to discuss their out-of-classroom measurement activities.

1	Donna	I tell you what I always struggle with
2		You know, like litres
3		How many millilitres are there (...) Is it a thousand?
4	Abigail	Mmm
5	Donna	I get confused, because you think like "mil" is a million
6	Abigail	[showing her water bottle which is on the desk]
7		Yeah, well, if you think, one of them is five hundred millilitres
8		So two of them is a litre
9	Donna	A litre
10	Abigail	So, like, obviously if you do it in CL it's like, um
11	Donna	Centilitres (.) A hundred? No
12		Is it a cent – centilitre. A hundred, isn't it?
13	Abigail	Forgotten
14	Donna	[laughs]
15	Abigail	Some of them do have "CL" on them, most of them have millilitres on
16	Donna	Wine bottles have centilitres on them, don't they? [laughs]
17		(...) centilitres (...)
18	Judith	A hundred centilitres is a litre, so it's right
19	Donna	Oh, right. So a thousand millilitres is one litre
20	Abigail	With water, sometimes you can buy it and it says five hundred mil
21		Sometimes you buy it and it says centilitres
22		I think it depends if it's foreign water,
23		Or different places measure it in different ways, don't they, like –
24	Donna	Oh yeah. So, half a litre is fifty centilitres.

[F1/L2A: 44-65]

Both Donna and Abigail draw on out-of-classroom experiences of metric measures in this example. Abigail shows Donna the 500ml bottle of commercially-bottled water she has on her desk, bringing meaning to an otherwise abstract concept (line 6-7) and invites Donna to consider how two of the bottles would constitute a litre. She also points out that some bottles are labelled in centilitres rather than millilitres (lines 10 and 15) and it is perhaps this reference that triggers Donna's memory of the labelling she has seen on wine bottles (line 16). It is interesting to compare Judith's contribution to the discussion to that of Abigail and Donna. Judith makes no reference to her own out-of-classroom experiences, but evaluates Abigail and Donna's tentative conclusion as "right". It is therefore hard to conclude whether Judith is drawing on knowledge from inside or outside the

classroom (though in extract 7.9 below, Judith seems more clearly to be drawing on schooled mathematics).

When I played this extract to a group of student-teachers, they laughed at what they perceived to be Abigail's suspicion of "foreign water". However, I consider Abigail's speculation that capacity may be labelled differently according to source to be one of the most interesting and potentially useful parts of their discussion; offering the opportunity to explore how mathematical information is constructed differently by different societies.

Whole Group Activity: Analysing Salary Distributions

The second of these alternatives to word problems was an activity developed by Elizabeth to demonstrate how the mean salary in a small company might be distorted by outlying values such as the director's salary. While this example is often used in adult numeracy classrooms, here Elizabeth gave it extra immediacy by randomly distributing a card to each student in the Farmton class showing a salary which was to be regarded as theirs.

The cards showed salaries alone, ranging from £10,000 to £100,000. No details of job titles or roles were provided. Despite this, and although not directed to do so by the teacher, the students spontaneously seized on the chance to role-play:

Extract 7.4: "Miss Moneybags here"
All the students in the Farmton group have been given cards with a salary (but no job title nor any other details) on them. They spontaneously seize on the opportunity to role play.

1	Elizabeth	If I give you each one of these
2		They're meant to be your wage
3		We're all working in a factory or something
4		...
5	Donna:	[receiving her card] Oh yeah. I'm the cleaner.
6		[laughter]
7		...
8	Elizabeth:	I'm going to calculate what a typical wage (...)
9		...
10		So what have you got there? Donna?
11	Donna:	Ten thousand [pounds]
12	Sally:	Twelve thousand
13	Judith:	Miss Moneybags here

14		[laughter]
15	Abigail:	[in "posh" sing-song voice] I have one hundred thousand
16	Donna:	The director. You're the director.

<div align="right">[F3/L2A:797-825]</div>

The spontaneous way in which the students began to role-play suggests that they felt far less constrained by the expectations and dispositions associated with a schooled habitus during this activity than while working on word problems. Judith's mocking remark in line 13 is not, of course, directed aggressively at Abigail, but at individuals who earn high salaries, and the shared laughter allows all students to show solidarity in envying higher earners. In line 15 Abigail ostensibly imitates a happy complacency which those on high salaries might be supposed to feel, while at the same time the overtly stylised tone serves to distance her from those she is imitating.

The students demonstrate a level of playful, critical knowingness about salary distribution which belies unhelpful comparisons between adult numeracy learners and children, and the role-play enables them to make more sense of the eventual conclusion about how the mean has been distorted (Extract 7.5). Note the students' knowing laughter in response to line 16, as they identify themselves and each other with the salaries on their cards:

Extract 7.5: "Somebody getting a lot more than everyone else"
The Farmton class now work out the mean of the salaries on their cards (see Extract 7.4). Elizabeth does not previously know the answer, which depends on the distribution of cards each time.

1	Elizabeth	How would we calculate the mean?
2	Abigail	Add them up
3	Elizabeth	Yeah, so, add all these values up. What does that actually add up to?
4	Students	(...) A hundred and eighty-seven
5	Abigail	Divide by seven
6	Elizabeth	Seven, we've got. Right, divide that by seven.
7		What do we get?
8		We're not going in exactly, is it
9		...
10		But it will be over twenty-six thousand, it's saying
11		Well looking at those wages, how many people are actually over twenty-six thousand pounds?
12	Students	One
13	Elizabeth	Only the one
14		So that mean's been distorted, by an extreme value,

15		Somebody getting a lot more than everyone else
16	Students	[laughter]
17	Elizabeth	So that's the problem with the mean
18		If there are very small numbers or very big numbers it distorts it
19		And makes it look that the, um, the typical wage is bigger than it actually is
20	Judith	Mm, it's a lot bigger

[F3/L2A:837-866]

Note also how this activity does not have a pre-defined "right" answer; it depends on how many students are participating and the salaries they are allocated through random distribution of the cards.   In consequence, Elizabeth must work together with the students to calculate the mean value (lines 1-10), and also that the mean value is not an exact figure but the result of a slightly messy calculation (line 8), as are solutions to numerical problems in real-life.

Small Group Discussion: Body Measurements

My final example of alternatives to word problems demonstrates how some topics are of intense interest to the students – in this case, body size and body image.   The Farmton Level 2 group were working on a worksheet which asked them to estimate various measurements of length, including their own waist measurement:

Extract 7.6: "Actually, I'm thinner than Posh"
The Farmton Level 2 group have been working on a worksheet which requires them to estimate their waist measurement.

1	Sally	Did you put your waist measure in?
2	Donna	I put twenty-four inches
3	Abigail	In your dreams [laughs]
4	Donna	["prim" voice] Actually, I'm thinner than Posh[20]
5		The waist measurement of a boy, an eight-year-old boy
6	Judith	Probably our leg measurement
7	Abigail	Wouldn't want to be like her anyway
8	Judith	[disparagingly] She's going to be ill, she is
9		(...)
10	Abigail	She's just stupid
11		I just don't get why people would want to copy her and all that, that people do
12		I've never been like that, never

[F1/L2B: 160-170]

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[20] Victoria Beckham, formerly "Posh Spice" of the pop group the Spice Girls, and now married to footballer David Beckham.

Donna deflects Abigail's teasing remark about her waist being unlikely to be only 24 inches by jokingly comparing her waist to that of celebrity Victoria Beckham, whose extreme thinness has attracted media attention. Like Abigail in the previous extract, Donna's use of a stylised "prim" voice and her ironic use of "actually" (line 4) serve to distance her from her claim and make it clear to her listeners that she does not believe it to be true. It is interesting that Donna and Judith both compare Victoria Beckham's waist measurement to other body measurements rather than speaking in terms of centimetres or inches; presumably these comparisons are more meaningful to them despite the theme of the worksheet. In both comparisons there is a tone of mocking disparagement. Judith and Abigail's subsequent remarks again demonstrate their critical understanding of the politics of body-image and the compulsion felt by some women to be dangerously thin (Grogan 2008). Their intense engagement in this subject suggests that it is of much more interest to them than current policy emphasis on relevance to employability (DfES 2001; DIUS 2007; 2008).

The extract also underlines the usefulness in the classroom of a knowledge of popular culture. In Chapter 6, I suggested that full participation in the classrooms I studied did not seem to depend on mathematical linguistic capital. By contrast, "popular cultural capital" (Fiske 1987) did often seem valuable for full participation.

Alternatives to Word Problems: Critiquing Context

In contrast to the "willing suspension of disbelief" shown when solving conventional word problems, the students seemed to feel entitled to critique relevance during alternative types of tasks. For example, in the activity discussed in Extract 7.3 above, another card asked them to suggest units for measuring the capacity of a concrete mixer. Donna shared her concerns that this did not match her out-of-classroom experience.
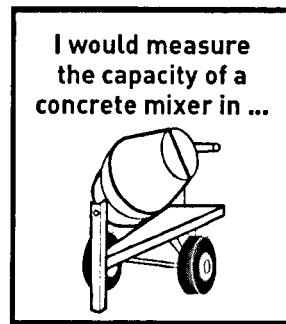
Fig. 7.5 *Thinking Through Mathematics* Objects Card (DfES 2007) (see Appendix H for full set)

Extract 7.7: "It would be a bit of both"

The students are discussing another card from the activity discussed in Extract 7.3. Donna, who has worked in the construction industry, is puzzled that they are expected to measure the *capacity* of a concrete mixer, as in her experience some of the materials are measured by *weight*.

1	Donna	A concrete mixer, you'd put water in it as well
2		So it would be a bit of both, wouldn't it?
3		It'd be a bit of, like, litres
4		(...) Mostly it'd be in kilograms, for the cement
5		And the sand
6		But for the water you'd put in, you'd put litres
7	Elizabeth	[coming over] Have you done it now?
8		Are there any that you've – ?
9	Donna	The concrete mixer sounds a bit –
10		(...)
11	Elizabeth	Yes, you'd probably –
12		[in tone of genuine interest] Do you weigh the things that you put into it
13		Or do you just sort of do so many buckets full?

[F1/L2A:275-285]

In this activity, Donna has the confidence to challenge the assumption, made by the writers of the card, that materials placed in a concrete mixer would be measured by capacity when, from her experience, sand and cement would be measured by weight. Note that Elizabeth's question in lines 11 and 12 is in a tone of genuine interest, rather than rhetorical. Elizabeth at this point is learning from Donna's knowledge of numeracy practices in the construction industry.

In conclusion to this section then, the students paid little attention to the supposedly real-life contexts of word problems, but instead brought to them a 'willing suspension of disbelief' and a familiarity with the recognition and

realisation rules of this genre which seemed to be part of their schooled habitus. By contrast, certain alternative activities seemed occasionally to encourage students to resist their schooled habitus and relate learning more effectively to out-of-classroom practices. In Chapter 9, I examine what features of these alternative activities encouraged students to do so, and how this might inform practice.

It important to emphasise, however, that even when students did not relate their learning to out-of-classroom practices, this did *not* mean that they found this learning meaningless or uninteresting. However, the meaning and interest it held for them seemed to be related to intellectual engagement and their wish for examination success rather than the immediate relevance they could see for everyday applications.

Discourse and the Curriculum

As described in Chapter 5, activities in the classes I studied were driven by the *Adult Numeracy Core Curriculum* (BSA 2001; LSIS 2009), both in its relationship to the qualifications for which the students were required to prepare, and the requirement for teachers to relate their written planning to Core Curriculum content. In this section I examine what the students' classroom discourse suggests about their sense of agency within the regulatory structures imposed by the Core Curriculum and the *Skills for Life* strategy, and the extent to which they were aware of the (often arbitrary) constraints of the curriculum.

The discourse of the Core Curriculum permeated the classroom talk. The recontextualisation of the curriculum content appeared to have been internalised by the students and was reinforced by the teacher throughout the discourse of the classroom. Mathematical learning activities were labelled using the terminology of the curriculum:

Extract 7.8: "Common measures"
At the end of each session, the students are required the record the sessions activities on their Individual Learning Plans, together with their plans for the following week.

| 1 | Abigail | Have we done common measures now? |
| 2 | Elizabeth | Yes |

3		(...)[overlapping talk]
4	Abigail	What we doing next week?
5	Donna	We're doing –
6	Elizabeth	Area and volume

[F1/L2B: 306-311]

Abigail's use of the phrase "common measures" in line 1 seems particularly telling here. Echoing curriculum terminology, it has a formal register which is very much in contrast to Abigail's usual informal style of talk in the classroom. Line 6 shows how this discourse is reinforced by the teacher.

A further example of this is the way that "ratios", "fractions", "decimals" and "percentages" are referred to as separate subject areas or topics, by the curriculum, by the teacher and by learning materials such as widely-available worksheets. In higher levels of mathematics, these terms merely refer to different ways of expressing a quotient of two numbers and would not be regarded as "topics". Although it is currently considered good practice for teachers to make "connections" between these topics (Askew *et al* 1997; DfES 2007), even this recommendation reinforces the view that such topics are separate until the connections are made.

The use of curriculum discourse does however appear to afford convenience and precision, both between students and teacher, and within the teaching profession. Gregson *et al* (2005) suggest that the introduction of the Core Curriculum has reinforced teachers' identities as "part of a professional community of practice with a shared vocabulary". Nonetheless, the structure imposed upon classroom activity by the strongly classified and framed curriculum did seem further to insulate classroom discourses from out-of-classroom practices, as illustrated in the following example.

"There isn't a right or wrong answer": Hidden Expectations

The role of the curriculum in constraining students' discourse is illustrated by the response of the Farmton Level 2 group to a card sorting activity involving units of measure. Elizabeth gave the group a set of fifteen cards showing measuring instruments (the *yellow* cards in Fig. 7.6) and asked

them to sort the cards into categories in any way that seemed appropriate to them.
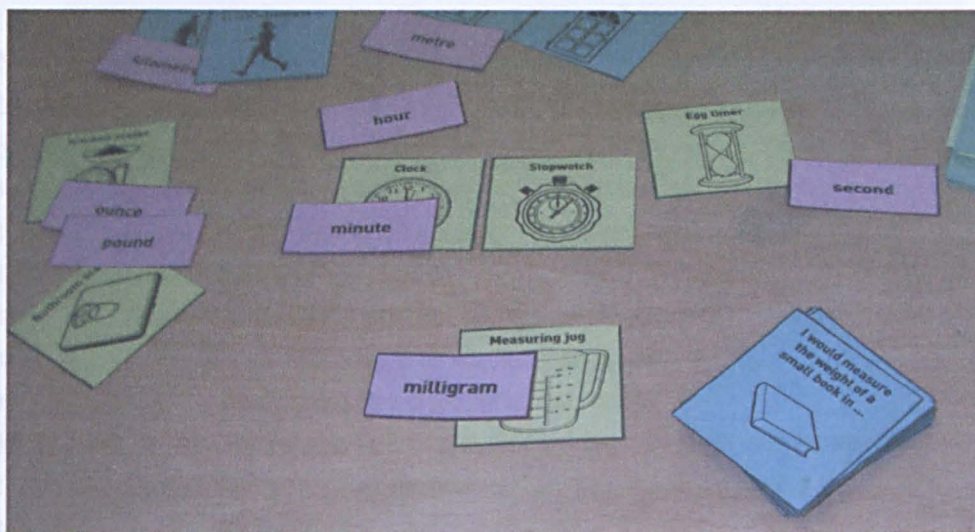

Fig. 7.6 *Thinking Through Mathematics* Measurement Cards in Use (DfES 2007) (see Appendix H for full set)

Extract 7.9: "Or are we going to do it a bit different?"
Elizabeth gives the group a set of 15 cards showing measuring instruments (the *yellow* cards in Fig. 7.6) and asks them to sort the cards into categories in any way that seems appropriate to them.

1	Elizabeth	[Introducing activity] There isn't a right or wrong answer
2		...
3	Abigail	Well, obviously, the stopwatch and the clock are going to go together, aren't they?
4	Donna	Yeah, so if we put that with that stopwatch
5		And put them together
6		And then – weight –
7	Sally	What about the scales?
8	Donna	Scales – That's probably weight, right?
9		Scales [placing card]
10	Abigail	That's the same isn't it, cause it's – you're measuring
11	Donna	Measuring. And that –
12	Abigail	Or are we going to do it a bit different?
13	Donna	No that's fine. No that's fine
14		Er, then measuring the
15	Sally	Length
16	Donna	That would be (.) That petrol pump would go with that, then, wouldn't it.?
17	Sally	Yeah, so would the measuring spoon
18	Donna	That one would go there
19		Pedometer would go there
20	Sally	There you go
21	Donna	What you thinking? [to Judith] I mean you could
22	Judith	(...)

23	Abigail	We don't want to do it big amounts or small amounts, do we?
24	Donna	No
25	Judith	(Definitely want to do) capacity and weight
26		(...)
27	Donna	[to Abigail] I know what you're saying. So things that you put on, on scales
28		Like these
29	Abigail	Well, yeah
30	Donna	And then, then
31	Abigail	They are going to be used for – for people, aren't they?
32	Donna	Yes
33	Abigail	So they could kind of be put together, couldn't they
34		There both going to be like, heavy amounts
35		Really, aren't they, d'you know what I mean?
36		Compared to that and that, they're going to be totally different aren't they?
37	Donna	I think that yeah, you could sort of separate them off like that, couldn't you, cos
38		[to Judith] What do you think?
39	Judith	A bit like capacity – liquids
40		And then weights – solids
41	Donna	Yeah
42	Judith	If that makes sense
43	Donna	Yeah, no, yeah, I think that's a good way – er
44		A good way of doing it
45	Judith	I think we've done it right
46	Donna	Yeah, she did say there was no right or wrong way
47		It was just how we felt we could group them

[F1/L2A: 1-43]

The nature of this activity, and indeed, even the way it is introduced, begs parallels with Holland's study of the ways in which children chose to categorise various types of food, described in Chapter 4. As in Holland (1981), it was emphasised that the students could categorise their cards in any way that felt appropriate to them, and the emerging attempts at categorisation reflect both local, informal discourses, and general, abstract discourses.   Here,   however,   I   analyse   the   difference   between   the participating students' contributions, not, as Holland and Bernstein did, by social class, but by the different categories of knowledge they bring to this activity.

Two students, Abigail and Judith, contribute two very different types of knowledge.   Abigail   contributes   her   knowledge   of   out-of-classroom measurement practices, suggesting that the measuring instruments might

be used for "big amounts or small amounts" (line 23) or that some of them are going to be "used for people" (line 31). By contrast, Judith contributes her understanding that they are expected to categorise the measuring instruments into the curriculum-based categories of weight and capacity and, particularly in line 25, expresses an unusually high degree of certainty. The source of this expectation is not made explicit: at no point in the discussion do the students make any reference to the curriculum, nor to categorisations they may have seen in learning or assessment materials. Nonetheless, Judith's suggestion is evaluated by Donna as a "good way" (lines 43-44), and Judith herself expresses her belief that they have "done it right" (line 45). Donna's role becomes that of mediator and evaluator of the two contributions. While she (with quite skilful tact and diplomacy) acknowledges Abigail's contribution (lines 27 and 37), her repeated elicitation of Judith's opinion (lines 21 and 38) suggests that she feels that Judith's contribution is more valid. Relating this analysis to Bernstein's models of pedagogic discourse (see Chapter 4), Judith possesses both the recognition rules and the realisation rules to put the cards together as a "legitimate text" for evaluation; Donna possesses the recognition rules to support Judith's contribution.

Judith's belief that they have "done it right" is vindicated when Elizabeth introduces the follow-on task. In this follow-on task the students are given cards labelled with metric and imperial units of length, weight, capacity and time (the *pink* cards in Fig. 7.6), and are asked to match these units to their categorised piles of measuring instruments. Elizabeth's instructions will only be meaningful if the students have chosen to categorise the instruments as expected of them:

Extract 7.10: "Whether it's the weight, the length, the capacity or a time"
In this follow on task the students are asked to match cards with units of length, weight, capacity and time to their categorised piles of measuring instruments.

1	Elizabeth	There you go.
2		A number of different situations
3		Now (...) the same areas
4		Whether it's the weight, the length, the capacity or a time
5		But also which sort of units you would use to measure those in

[F1/L2A: 287-290]

Despite her assertion that "there isn't a right or wrong answer", Elizabeth reveals her expectations that they will have categorised the cards into weight, length, capacity and time, as classified by the *Adult Numeracy Core Curriculum*, and her talk nowhere suggests that she was aware that the students considered other categorisations of the cards. My concern here is not that Donna and Abigail were disadvantaged by their lack of the relevant recognition and realisation rules (after all, Judith steered them in the right direction) but that such expectations are not made explicit; and thus the range of knowledge legitimately available to the students becomes restricted; an example of Bourdieu (1977:168) describes as a "recognition of legitimacy through misrecognition of arbitrariness"[21].

"Right" Answers and the "Test": Constructivist Learning and Schooled Habitus

Earlier in this chapter, I discussed activities in which the absence of a conventional "right" answer seemed to be a contributory factor in encouraging students to relate their learning to out-of-classroom numeracy practices. However, students nonetheless expressed some discomfort at the freedom offered by the absence of a single right answer. In this section I discuss the importance which students seemed to attach to obtaining the "right" answer to a problem.

Concern has been expressed that students and teachers are over-preoccupied with finding a single right answer to mathematical problems, and that a focus on examination regimes reinforces this preoccupation (Johnston *et al* 1997; Maguire and O'Donaghue 2002; Coben 2005; Ivanič *et al* 2006). Gal (2000) contrasts the situation in classrooms, where mathematical problems have answers that are known and can be verified by the teacher, with situations outside the classroom, in which problems are not "solved" but are "managed":

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[21] Curricular arbitrariness is particularly evident here, since capacity is not a fundamental unit of measurement, and is interchangeable with volume.

> When faced with a real-life situation, adults identify and choose one of several courses of action, based on considerations of personal goals, situational demands, severity of consequences, personal and situational resources, and so forth (p. 16).

As described in Chapter 5, the *National Certificate in Adult Numeracy* (or "the Test") is offered throughout the year at both the Milltown and Farmton Centres, and presents candidates with multiple-choice word problems to which there is only one right answer (see Fig. 6.2 in Chapter 6 for an example). It is completed under examination conditions, and candidates are not allowed to use calculators. Preparation for the Test dominated activities in both the classes I studied, and areas of mathematics other than those required to pass the Test were rarely focused on. The adverse effects of the pressure to prepare students for examinations is recognised by Ofsted (2006:4)

> Focusing heavily on examination questions enabled students to pass examinations, but did not necessarily enable them to apply their knowledge independently in different contexts.

In the following, I examine the tension between the new social-constructivist pedagogies, which emphasise "open questions" with "many right answers" (Swan 2006a; DfES 2007; De Geest 2007), and the pressure for students to prepare for the Test. I also consider how the students' historically-shaped ideal of a single "right answer" may be part of their schooled habitus, influencing the way they respond to open question activities.

Finding the "Right Answer"

When working from mathematical worksheets, the students in Elizabeth's classes were provided with answer sheets in order to check their own answers. They tended to use these conscientiously and almost ritualistically, checking the answer only when they felt they had completed a problem. Extract 7.11 below presents Dawn and Jackie's evaluation of their answer to the diluting drinks word problem, previously discussed in Extract 7.1:

Extract 7.11: "Oh, no, she's put twelve"

Dawn and Jackie correctly calculate the number of cups of water needed to dilute the concentrated juice, but evaluate their answer only in terms of whether or not it matches the answer on the answer sheet.

1	Dawn	So, how many cups of water does she need to put in, so it'd be eight
2	Jackie	Yeah
3	Dawn	[quietly, checking answer sheet] I think its eight
4		Is it eight?
5		[more loudly, dismayed] Oh, no, she's put twelve
6	Jackie	Why've you put –
7	Dawn	[relieved] Oh no, it is eight, eight, yeah
8	Jackie	Did she?
9	Dawn	Yeah, it is eight.

[M1: 30-35]

Note how Dawn and Jackie have agreed on a possible answer by line (2). However, they do not *self*-evaluate their answer, for example, by considering whether the resulting total of ten cups might fit in the "large jug" mentioned in the question (Fig. 7.2). In fact, they do not talk of having made ten cups worth of diluted drink at all, but instead turn directly to the answer sheet. As she checks the answer sheet, Dawn's tone is very quiet, suggesting a lack of commitment to their answer, and she uses the hedge "I think" as a plausibility shield (Lakoff 1973; Rowland 1995) (see Chapter 6). There is a moment of dismay and confusion when Dawn accidently reads the wrong answer off the sheet (line 5), and no indication that either of them are preparing to defend their own answer against the one on the answer sheet; rather, Dawn associates the answer with the teacher's authority by her use of the pronoun in "*she*'s put twelve." There is relief when Dawn realises that they have the correct answer after all, although Jackie's remaining anxiety is expressed by her asking Dawn to verify once more that they have the correct answer (line 8).

For Dawn and Jackie, the ritual of checking the answer seemed to be the culmination of their mathematical task and they appeared not to regard the task as complete until the answer had been checked and found to be correct. There are similar examples throughout the data, especially when the students are working on traditional word problems. While the imminent Tests may partially explain the students' preoccupation, there is also often a note of satisfaction and resolution expressed during this ritual (as for Dawn and Jackie above) which suggests that obtaining a right answer also has an

emotional importance for the students. Swain, Baker, Holder, Newmarch and Coben (2005:86) report that many adult numeracy learners are motivated by their desire to "prove that they can succeed in a subject where they have previously experienced failure", and obtaining a right answer seemed to be highly rewarding for the students.

This reliance on the resolution of obtaining a right answer was also apparent in the students' evident discomfort when problems did *not* have a single right answer. As outlined earlier in this section, current developments in adult numeracy pedagogy encourage teachers to explore alternative approaches such as open questioning, in which more than one answer may be valid, and Elizabeth used several such activities during the sessions I studied.

Similar discomfort was evident in activities which involve matching of corresponding concepts, often through exercises such as domino games and "Tarsia" jigsaws. Here students sometimes expressed discomfort with the ambiguity about which was the "question" and which the "answer". For example, in Extract 7.12, Pete and Dan in the Farmton Level 1 group were attempting to match domino cards showing the dimensions of rectangles and cuboids to corresponding cards showing their areas and volumes (Fig. 7.7):
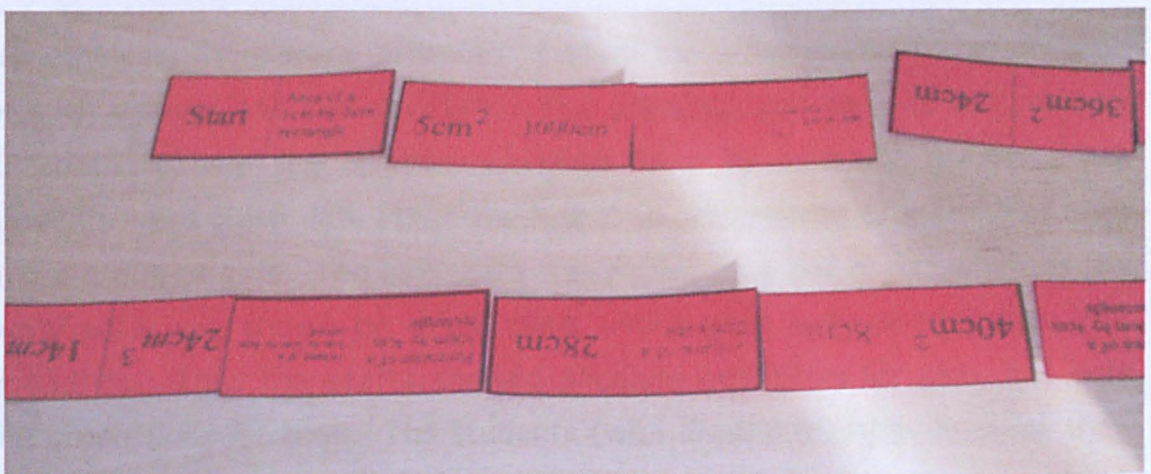

Fig. 7.7 Area and Volume Dominoes

Extract 7.12: "When it gives me the answer, what's the question".
Dan and Pete find that card matching activities raise ambiguity about which is the question and which is the answer.

1	Dan	So it gave you the answer and you had to work out what the question was
2	Pete	I'm alright with the question – it's just when they give you the answer [laughter]
3	Elizabeth	You've got to look at all the other questions and see which one matches up
4	Pete	I'm not too bad at working out the answer.
5		It's when it gives me the answer (...) what's the question.

[F3/L1A: 197-200]

In a traditional mathematics task, students would be given the dimensions of the shape and would multiply them to find the area or volume. In this activity, however, Pete and Dan sometimes start with a card showing the area or volume and attempt to find a card showing the corresponding dimensions. They regard this as starting with the "answer" and trying to find the "question"; a perspective reinforced by Elizabeth (line 3). However, none of the domino cards actually show a "question". Pete's discomfort at this ambiguity is expressed through his nervous laughter (line 2), and he persists in trying to categorise the pairs into "question" and "answer".

The example illustrates a pattern of students seeking the validation or resolution of obtaining a right answer, even when mathematical activities have been designed to be open-ended. Finding the right answer seems to be important in making mathematics meaningful and rewarding to the students, and I suggest that this disposition is part of the schooled habitus they bring to the classroom (see Chapter 8).

Nonetheless, there were instances in which the potential for transformation of such dispositions was revealed. The following activity was designed by Elizabeth to help the Milltown students learn to interpret graphs. The students were given data about the fast-food preferences of a group of boys and a group of girls. The girls' data was shown on a bar chart; whereas the boys' data was shown on a pie chart which gave only percentages, not quantities. Thus the charts showed *absolute* quantities for girls, but only the *proportions* for boys. The students (with Elizabeth's help, because they found this exercise very difficult) were given a series of statements about the data, which they had to say were true, false, or whether they did not have enough information to answer:

Extract 7.13: "We can't, can we?"

Dawn, Charlotte, Denise and Christine are participating in this teacher-led exercise. The information provided on the graphs is not sufficient for the students to state whether the statement read out by Dawn in line 1 is "true" or "false".

1	Dawn	[reading statement from card] "More girls than boys chose pizza"
2	Elizabeth	But we said that we only –
3	Dawn	But we can't, can we?
4	Elizabeth	No, we can't. We don't know how many boys
5		We've only got the proportion.
6		So we don't know that one.
7		Okay
8	Dawn	Right, you don't always have to have the figures to work it out
9		Cos you haven't got the figures there, have you?
10	Elizabeth	No
11	Dawn	But you can still work something out

[M4A: 437-456]

The exercise Elizabeth has designed is unusual, because for some of the questions, the response "we don't know" is a *correct* answer (i.e. the correct answer is "there is not enough information provided"). Dawn generally finds mathematics learning very difficult, yet in this extract she demonstrates understanding of some profound mathematical insights. Her use of the inclusive "we" (line 3)[22] indicates her sudden, Gestalt moment of understanding (Wertheimer 1923) that she cannot give an answer, *not* because of a lack of ability on her own part, but because the answer is *unknowable*, and Elizabeth reinforces this by also using the inclusive "we" in her response (line 4). In lines 8 and 9 Dawn generalises this moment of understanding that there is not "always" a knowable answer, and in line 11 recognises a principle that underpins mathematical modelling at many levels. Dawn's intense and carefully thought-out engagement with this exercise suggests that, given a certain amount of scaffolding and encouragement, students can find it rewarding to work mathematically without a "right" answer as a goal.

More generally, however, it seemed that the existence of a knowable right answer was important to students and they expressed discomfort in other situations. The new social-constructivist pedagogies have been

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[22] It is worth noting that reliance on personal pronouns is considered to be a characteristic feature of "restricted code" (Bernstein 1971), yet Dawn uses one very powerfully here to express an abstract concept.

enthusiastically embraced by many teachers, but González *et al* (2001) remind us that they appeal to the culture of mathematics teachers, rather than their students. In Chapter 9, I suggest that such approaches need to take more account of adult students' schooled habitus.

Conclusion

In this chapter I examined how the students related their classroom learning to out-of-classroom practices, and the different types of knowledge and habitus they brought to the classroom.

I have shown that the students took very little notice of the "contexts" offered by conventional word problems; that they rarely drew on their out-of-classroom numeracy practices when solving such problems; and that their response to word problems and preoccupation with right answers, appeared to be shaped by a schooled habitus. However, a number of alternative activities – including those which encouraged the students to imagine participating in real-life numeracy practices, and those which related to the students' cultural interests – did draw more effectively on knowledge and experience from outside the classroom. During these alternative activities, students seemed to be less constrained by their schooled habitus, and to perceive a wider range of possibilities of thought and discourse to be open to them.

It is important to emphasise once more that a lack of relevance to out-of-classroom numeracy practices did not detract from students' engagement in mathematical tasks. The students clearly enjoyed their classes, they expressed satisfaction at their progress and achievement, and retention rates were excellent in a sector where dropout rates are high (Rhys Warner and Vorhaus 2008). Similar observations are noted by Ivanič *et al* (2006:43):

> Maths class students worked assiduously on worksheets – not what some may see as an engaging activity – because of the way they were framed and mediated by the tutor, and because of their trust in her. These adult

learners seemed to have a high degree of tolerance for uncertainty as to the ultimate purpose of activities.

I have also shown how certain types of knowledge seemed to be valued more highly within the classroom, particularly knowledge which conformed to curriculum expectations, and again this seemed to reflect and maintain schooled habitus.

In my discussion in the next chapter, I draw together my analysis by considering how some aspects of the students' knowledge, practices and dispositions served to broaden their learning and make it relevant to their out-of-classroom practices, while others tended to constrain it to curricular and examination expectations.

Chapter 8

Discussion: "Disruptive" and "Conformative" Knowledge Contributions

In Chapters 6 and 7, I analysed the rich and diverse repertoires of knowledge, practices and dispositions which the Milltown and Farmton students brought to the classroom and contributed to their collaborative groupwork. As described in those chapters, I found that some types of contribution seemed to serve to *broaden* students' learning and make it relevant to their out-of-classroom practices, whereas others *constrained* students' learning to curricular expectations.

In this discussion chapter, I draw together my analysis by considering these two categories of contribution and how they were valued within the different discourses which prevailed in the classroom, and I return to my question of "what counts" as funds of knowledge.

Different Types of Knowledge Contribution

In Chapter 4, I discussed the strengths and limitations of using funds of knowledge as an analytical framework. While acknowledging the power of the concept to disrupt deficit discourses and to transform teachers' attitudes and practice, I was concerned about how teachers and researchers are to decide what to categorise as funds of knowledge.

I described how Baker's (2005) broader definition of funds of knowledge – which includes interpersonal skills, dispositions and previous experiences of learning mathematics – appealed to me in taking account of the wide range of resources which students might bring from their adult lives into the classroom, yet its very scope presented challenges during analysis, since it seemed possible to argue that almost any type of interaction could be classified, in this definition, as drawing on students' funds of knowledge.

From the early stages of my analysis, I felt that *only some* of the students' knowledge contributions matched what I had originally understood by the term "funds of knowledge". Other types of contribution, while valuable in scaffolding formal learning *within* the classroom, were less relevant and useful *outside* the classroom. I felt that this kind of knowledge had less transformative potential, but needed to analyse more clearly why.

Throughout the previous two chapters, I have found it useful to apply the concept of habitus as an interrogative tool, and in particular its use by Reay (1995; 2004) and Barton *et al* (2007) who suggest that habitus can limit an individual's perceptions of the possible (see Chapter 4). Here I apply this idea to classify the knowledge, practices and dispositions brought by the students to the classroom into two categories: those which *broaden* students' perceptions of what is possible in terms of thought, discourse or classroom activity; and those which *limit* or *constrain* students' perceptions of what is possible.

I would encourage readers to refer back, at this point, to Extract 7.9, since this extract clearly demonstrates the concepts I want to present here. I described how two of the Farmton students, Abigail and Judith, brought different types of knowledge to the exercise of categorising measuring instruments. Abigail brought her knowledge of out-of-classroom measuring practices, whereas Judith brought her knowledge of the recognition and realisation rules dominant in adult numeracy classrooms. Abigail's knowledge tended to *disrupt* the expectations of the curriculum; Judith's knowledge tended to *conform* to these expectations. This extract has been key to my analysis because it illustrates both types of knowledge in tension (and eventual resolution in favour of Judith's conformative knowledge), but I have also found it useful to apply the same categorisation to other examples of the knowledge students brought to the classroom. I have termed these two categories "disruptive" and "conformative".

Disruptive Knowledge Contributions

Types of knowledge contributions which I have categorised as "disruptive" were generally based on out-of-classroom practices, interests and habitus.

These included: familiarity with popular culture; the use of humour; the ability and willingness to express uncertainty and anxiety; a critical awareness of issues important to the students; and their understanding and use of informal numeracy practices. These seemed to *broaden* the possibilities of thought and action which the students perceived to be open to them in the classroom, and allowed them to think outside the constraints of the curriculum, formal worksheets and accreditation requirements.

For example, the participating students had a broad repertoire of linguistic devices to express their uncertainty, doubts and anxiety. They used these to enhance group cohesion, to invite contributions and elicit evaluations from other students, and to formulate and articulate questions which could be answered by the teacher or each other; often easing these interactions with affiliative humour. Some learning activities also encouraged students to draw on out-of-classroom practices, demonstrating a critical playfulness regarding issues of social inequality and of body size; an awareness of popular culture which they used to add meaning to their mathematical discussions; empathy with their children's difficulties at school; and a willingness to critique the relevance of "contexts" presented in classroom learning materials when they did not reflect real-life practices such as mixing concrete. By constructing and maintaining this supportive yet creative learning environment, these diverse knowledge and practices allowed group discussions to be opened up, the possibility of uncertainty to be recognised and accepted, and dominant discourses to be challenged.

I have termed this type of knowledge contribution as "disruptive", not because it disrupts the informal, self-imposed order of the classroom, but because it disrupts and challenges the regulative discourse of the curriculum and of learning and assessment materials. Nor do I mean to imply that the students offer disruptive knowledge contributions as a conscious act of transgression[23]; rather it is the knowledge contribution itself which disrupts regulatory discourse. Note also that it is the *contribution* which is disruptive, rather than the knowledge itself. In Extract 7.9 it can probably be assumed that Judith and Abigail *both* possessed

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[23] The term "transgressive" is often offered as an antonym to "conformative" but for this reason I chose not to use it in this case.

knowledge of out-of-classroom measurement practices; it is their different choices about whether to *contribute* this knowledge to the discussion which is of significance here.

Students tended to respond to disruptive knowledge contributions in ways which were playful, critical or innovative, taking their discussions beyond the expectations and requirement of the classroom, and they also seemed more likely to use this knowledge to relate their mathematical learning to interests outside the classroom. As described in Chapter 2, we can regard this type of discussion as a fertile "third space" in which the discourses of work, family and popular culture meet the discourse of classroom, resulting in productive, critical creativity which reaches beyond the constraints of the curriculum, and displays the "innovative energy" which characterises third space discourse (Bhabha 1994:220).

Conformative Knowledge Contributions

By contrast, other types of knowledge, practices and dispositions brought by the students to the classroom included for example, a preoccupation with "right" answers, familiarity with curriculum expectations and a grasp of "exam technique". An understanding of the expectations of word problems seemed to discourage students from critiquing their contexts, and instead they accepted them in a "willing suspension of disbelief". These knowledge contributions were useful in the recontextualised world of mathematical learning, but would be much less so outside the classroom. Students' linguistic practices also at times reflected and maintained a sense of disempowerment. Students expressed discomfort with formal mathematical registers, even though they occasionally demonstrated access to them, and writers of assessment and learning materials were constructed as anonymous, powerful and attempting to catch out the unwary.

I have categorised these as "conformative" knowledge contributions, as they seemed to *narrow* perceptions of discursive possibilities, and encouraged students to think *within* the constraints of the curriculum.

Conformative knowledge contributions seemed to be related to schooled habitus, developed either at school or in later learning. As Bourdieu and Wacquant (1992) suggest, such habitus may be durable, with a "hysteresis" effect which may make it hard to undo earlier influences. Thus the schooled habitus is likely to persist even when students enter the new field of the adult numeracy classroom, with its unfamiliar discourses of constructivist learning.

Students' Knowledge Contributions and Official Discourses

In Chapter 5, I introduced the two officially-endorsed, and sometimes conflicting, discourses which currently prevail in adult numeracy classrooms in England: the regulative discourse of the curriculum and accreditation; and the social-constructivist discourse of new pedagogical approaches. Here I reflect on how students' different types of knowledge contributions are valued within these two discourses.

Clearly, conformative knowledge contributions (by the very way I have defined them) are valued within regulative discourse. Conformative knowledge is very useful in helping students to successfully negotiate classroom expectations, and to deliver the required answers to word problems presented in formative and summative assessment materials. It thus could be regarded as having "exchange-value", as it can be used to gain qualifications which provide cultural capital and can be "exchanged" for employment opportunities. By contrast, disruptive knowledge does not contribute straightforwardly to examination success; it distracts from the expectations of word problems and encourages students to ask challenging questions about relevance and application.

However, it would be an over-simplification to suggest that, conversely, disruptive knowledge contributions must be more valued than conformative ones within social-constructivist discourses. Rather, social-constructivist discourses create a space in which *both* types of contribution can be shared with the group. While regulatory discourse tends to reinforce "schooled

habitus", social-constructivist discourse provides opportunities to transform it. Nonetheless, such opportunities may not be taken up, and in some cases, a group engaged in social-constructivist discourse might choose to favour conformative knowledge over disruptive knowledge.

For example, the measuring instruments activity discussed in Extract 7.9, which I have used to demonstrate the two types of knowledge contributions in tension, is taken from the *Thinking Through Mathematics* resource. It is accompanied by teacher guidance which suggests that students may group their measuring instruments in a variety of categories other than those defined by the curriculum, and advises teachers to accept those alternative categorisations:

> They may also have sorted them according to whether they measure "big" or "small" items, the type of scale or display they have or where they are commonly used (in the home, workplace, and so on). With some choices of categorisation learners may have an eclectic group of instruments that do not fit into their main chosen categories. This is not a problem as long as they can justify why they have put a card in a given set (DfES 2007:11-3).

The conflicting pressures which teachers must negotiate are demonstrated in Elizabeth's assumption, despite this guidance reproduced above, that students will have categorised the cards according to curriculum topics. Just as Abigail's disruptive knowledge was eventually rejected by the students in favour of Judith's conformative knowledge, the pressure on teachers to follow the curriculum and prepare students for examinations may often win out over social-constructivist thinking.

What "Counts" as Funds of Knowledge?

I have explained that, during my analysis, I felt that not all of the knowledge, practices and dispositions brought to the classroom by the students matched what I had originally understood by the term "funds of knowledge". As described in Chapter 4, I had taken this term to refer to knowledge that would not usually be recognised or valued by official discourse; and would not generally be regarded as part of cultural capital. In particular, I felt that resources celebrated through a funds of knowledge approach should be transformative in their contribution to the classroom, and should widen the educational possibilities open to students. Thus I

would regard the knowledge contributions which I have categorised as "disruptive" as being closest to my original understanding of funds of knowledge.

This is not to say that more conformative knowledge contributions are not extremely valuable in current adult numeracy classrooms, helping students to achieve goals such as obtaining a numeracy qualification, which in turn can lead to wider opportunities of work or study. Nonetheless, I would suggest that this knowledge is only *arbitrarily* valuable, and is of less *intrinsic* use – for example, when applied to numeracy practices outside the classroom – and therefore I regard the value placed on conformative knowledge contributions as part of a cycle of social and educational reproduction.

Conclusion

In this chapter, I have described how some types of knowledge contributed to classroom discussions by the students *disrupted* the regulatory discourse of the curriculum and accreditation requirements, while other types of knowledge contribution *conformed* to it. Disruptive knowledge contributions tended to broaden the possibilities of thought and discourse which students perceived to be open to them, and encouraged them to relate their learning to out-of-classroom practices. Conversely, conformative knowledge contributions tended to narrow the possibilities perceived by the students, but were nonetheless of value in helping them meet expectations required to gain qualifications. In the next chapter, I discuss the implications my findings might have for teachers' practice, and also for wider policy considerations.

Chapter 9

"Or are we going to do it a bit different?"[24] Implications for Policy and Practice

As a teacher-educator and former numeracy teacher, I am committed to research which has relevance to classroom practice. In this chapter I discuss the implications my findings might have for numeracy teachers' practice, and also for wider policy.

Consisting of small-scale ethnographic research in just two classrooms, my study is not intended to be generalisable. Rather I have sought to produce "telling cases" with which to challenge and interrogate prevailing generalisations and unexamined assumptions (Bloome and Green 1996; Mitchell 1984). Thus the suggestions I make here are tentative, and are intended as starting points for further research and reflective practice.

I begin this chapter by emphasising the role that schooled habitus seemed to play in students' dispositions towards different types of classroom learning, and the importance of taking this into account when proposing pedagogical reform for adult learners. Having presented this caveat, I argue the case for reduced use of conventional word problems in assessment materials, and recommend features of alternative activities which seemed most effective in encouraging students to relate their learning to out-of-classroom practices and interests. Next, I review what my findings suggest about the affordances and limitations of collaborative groupwork in adult numeracy classrooms, and what makes it work better in some classrooms than others. Finally, I discuss how the simple and effective data collection methods used in this study might by used by teachers for their own professional development.

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[24] Abigail's question (Extract 7.9 line 12) seemed particularly apt as a title for this chapter, as she uses it to suggest to other members of the Farmton group that they might consider alternative ways of categorising measuring instruments other than those prescribed by the curriculum.

Taking Students' History and Values into Account

Although it is tempting, in this chapter, to propose reforms which would displace arbitrarily-privileged discourses and instead promote classrooms in which all activity is relevant to out-of-classroom numeracy practices, such reform would fail to take into account the learners' schooled habitus. Gal (2000) suggests that adult numeracy teachers may need to undo prior "maths abuse" (Johnston 1992) and students' expectations about what learning mathematics should be like. Unless school mathematics itself is reformed, adult classrooms must respond to the effects of earlier schooling.

So while radical reforms depend on "blue skies" thinking, transformative ideals nonetheless need to sit in tension with the historically-situated nature of numeracy as a social practice, and the habitus which adult learners bring to the classroom. Therefore, the most appropriate practice in any classroom will depend on the learners' previous experiences of schooling and their values and beliefs about mathematics.

Barton and Hamilton (1998:8) propose that literacy as a social practice is historically-situated, and I suggest this applies equally to numeracy:

> We need a historical approach for an understanding of the ideology, culture and traditions on which current practices are based. The influences of one hundred years of compulsory schooling in Britain, or several centuries of organised religion, can be identified in the same way as influences from the past decade can be identified ... A person's practices can also be located in their own history of literacy. In order to understand this we need to take a life history approach.

The students' negative experiences of mathematics lessons at school, which they recounted to each other in their discussions (Chapter 5), were set against their cultural perception of mathematics as an important subject in which they wished to succeed. Academic mathematics is associated with cultural capital, status and power (Harris 2000), and Swain (2005:312) found that for many adult numeracy students: "Rather than avoid school maths, they wanted to do school maths again, but this time succeed in it."

The majority of students in my study shared certain aspects of their life history. They were mature adults, had English as a first language, and had been educated within the English school system. Most had had negative

experiences of learning mathematics at school and all had *chosen* to return to study numeracy. The recommendations I make below are therefore most applicable to similar classrooms, to which students will bring similar habitus. Other students in other settings are likely to have different values and beliefs. Formal mathematical education can have different status in different cultures, and students may have widely differing life histories[25]. The key point is that within a social practice model, these different values, beliefs, interests and aspirations are taken into account.

Making Classroom Learning Relevant to Out-of-Classroom Practices

Like many adult numeracy teachers in England, funding arrangements put Elizabeth under pressure to ensure that all her learners achieved qualifications (Cara *et al* 2008). Her teaching therefore tends to focus on preparing students for the "Test", rather than relating mathematics to out-of-classroom practices. Her priorities are, in my experience, typical of those held by many *Skills for Life* teachers, and ones which she achieves more successfully than most.[26]

Elizabeth did not specifically encourage the students to draw on their funds of knowledge, although she was interested and receptive on the occasions when they did so spontaneously. She clearly enjoyed listening to "disruptive" knowledge contributions when they occurred, and certainly did not try to suppress them. However, such spontaneous occasions were rare, and it seems that such opportunities may need to be deliberately fostered. Moje *et al* (2004) found that high-school science students only rarely drew

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[25] For example, young people in Further Education colleges, keen to feel that they have moved on from school, but obliged to study mathematics as part of their chosen vocational courses, might feel less strongly than mature adults about the social and cultural importance of mathematics, but conversely might be more receptive to innovative pedagogical approaches.

[26] While my sample cannot be regarded as statistically significant, the qualifications gained at Entry Level, Level 1 and Level 2 by the Milltown and Farmton students (shown in Appendix A) do appear to be well above the national rate of 50% for adult numeracy achievements by enrolment (2004/5 figures) (Rhys Warner and Vorhaus 2008).

on out-of-school funds of knowledge, and that the extent to which they did so depended largely on the attitude of the teacher.

As the studies reviewed in Chapter 2 demonstrate, it is certainly possible to develop teaching approaches which encourage learners to draw more effectively on their out-of-classroom practices and funds of knowledge (for example Civil 2003; 2006; González, Moll and Amanti 2005; Diez-Palomar *et al* 2006). As a teacher-educator I have observed some inspiring teachers who succeed in this, such as the prison-educator who used young male prisoners' difficulties in maintaining physical fitness within the prison regime as a starting point for a numeracy discussion, or the teacher who began every session with a "word cloud" on the whiteboard in which she collected her students' everyday knowledge and experience of the topic they were to work on that day.

In Chapter 8, I categorised the knowledge contributions that students bring to the classroom into "disruptive" contributions, which widen the possibilities of thought, action and discourse which students perceive to be open to them in the classroom, and "conformative" contributions, which constrain them to curriculum and accreditation expectations. While conformative knowledge contributions seemed more often to be valued and privileged by classroom discourse, I suggest that teachers should create opportunities for *both* conformative *and* disruptive knowledge contributions to be legitimised and celebrated. Conformative knowledge contributions are undoubtedly useful in scaffolding students' learning for short-term goals such as gaining qualifications. Yet disruptive knowledge contributions promote critical awareness and make learning more meaningful, enjoyable and relevant to out-of-classroom practices.

How can such opportunities be fostered? In the following sections I discuss the effectiveness of different types of classroom activities in promoting both conformative and disruptive knowledge contributions, and in encouraging students to relate learning to out-of-classroom practices.

The Limitations of Word Problems

In Chapter 7, I described how the students paid little attention to the "contexts" in which conventional word problems were set, and did not relate the problem to out-of-classroom practices. My findings resonated with similar findings from research in schools (for example Mukhopadhyay and Greer 2001; Cooper and Harries 2002). While this may seem problematic enough in schools, it is surely even more problematic for adult learners. These tasks fail to draw on the richer life experiences which adults are seen to bring to other types of classroom activity. Adult numeracy is increasingly constructed as a "Functional Skill" (DIUS 2009); therefore why should it be taught in ways which students do not relate to everyday practices? This is of particular concern because current adult numeracy qualifications at Level 1 and 2 in England are composed entirely of context-based word problems, and thus teachers are currently obliged to include word problems in classroom activities, as preparation for the "Test".

At the time of writing, various approaches to assessment for the new Functional Skills qualifications are being piloted and the replacement of the *National Certificates in Adult Numeracy* by these new qualifications is under review. Now is an ideal opportunity to consider alternatives to conventional word problems for assessing and accrediting adult learners' numeracy practices.

Types of Activity Which Encourage Students to Relate Learning to Out-of-Classroom Practices

Alternatives to word problems seemed to offer promising potential for encouraging learners to relate classroom tasks more effectively to everyday numeracy practices. Further exploration and development of such approaches can be done at the classroom level through reflective evaluation by innovative teachers like Elizabeth, and also nationally through continuing research into innovative teaching approaches.

In Chapter 7, I showed how the students responded to three alternatives to word problems: a *Thinking Through Mathematics* card activity about

measurement (Extracts 7.3 and 7.7); a whole-group task in which students were randomly assigned different salaries (Extracts 7.4 and 7.5); and an informal discussion about body size (Extract 7.6). During these activities, students seemed to resist their schooled habitus, and related their discussions creatively and spontaneously to out-of-classroom practices.

In the following I discuss features of these activities which seemed to be key to the students' response to them, and which might potentially be applied to further activities. These are: the use of the conditional mood; the lack of a pre-defined "right" answer; and the focus on practical, tangible uses rather than difficult and abstract mathematical concepts.

Use of the Conditional Mood

Unlike word problems, the alternative activities do not use the present indicative to present students with non-negotiable scenarios, but instead use the conditional mood to invite the students to *imagine* participating in a certain practice, for example:

> "I **would** measure the weight of a mosquito in ..." (DfES 2007:12-7, my emphasis)

> Elizabeth   They're **meant** to be your wage   [my emphasis]

This feature also seemed to allow students to critique the relevance of examples to their lives, as for example in the extract below. Note how Sally maintains the conditional tense used on the card:

Extract 9.1: "The weight of a mosquito"
The Farmton Level 2 group are working through the card activity illustrated in Fig. 7.1.

1	Judith	[reading from card] "I would measure the weight of a mosquito in"
2	Sally	I wouldn't
3	Students	[laughter]

[F1/L2A: 202-203]

It is perhaps not surprising that students are more likely to relate learning to their own practices if a mathematical task begins with a question of the type: "What would you do if..." rather than the anomalous use of present indicative and fictional narrative used in traditional word problems. This feature would appear to merit further attention when developing pedagogical activities for adult numeracy classrooms.

Palm (2008) found that students responded more realistically to mathematical word problems when the wording of the question invited them to imagine themselves in the situation described, although in this case, this was achieved by use of the second person ("you") rather than by the conditional tense.

Lack of a Pre-defined "Right Answer"

Whereas word problems usually had a single answer, fixed in print on an answer sheet available for checking on completing the problem, solutions to these alternative activities tended to be negotiable and not previously defined. For example, there was no answer sheet to contradict Donna's claim in Extract 7.6 that her waist measurement was 24 inches (though Abigail was able to tease her for it).

Even in the wages activity (Extract 7.5), in which correct algorithms were needed to calculate the mean, mode and median wages, the actual values obtained depended on the number of participants in the session, and Elizabeth was obliged to work out the answer along with the students. The mean value was messy, and involved dividing 187 by 7; a "real" number rather than the artificially neat answers usually obtained in conventional word problems. Contrast this with the word problem discussed in Extract 7.2, in which Ruth quickly recognised that 11/44 was likely to cancel down to give a more familiar fraction, even before spotting that 11 was a common factor. Although, as discussed in Chapter 7, the students sometimes expressed discomfort with activities which lacked a conventional "right" answer, this challenge to their expectations did seem to engage them more fully in the meaning of their answers.

Practical or Tangible Applications

Thirdly, these activities related to practical applications such as measurement and data handling, rather than more abstract conceptual understanding (such as ratio, fractions, decimals and percentages). Further examples of practical applications included a whole-group discussion on tally charts at Farmton, in which Judith whispered to Donna that she used tally

charts for stock-taking when helping out at her children's school, and several students expressed familiarity with bar and line graphs through using computer spreadsheet packages.

Initial speculation might suggest that these curriculum areas are more relevant to students' out-of-classroom practices. However, this seems insufficient explanation when, for example, the relevance of percentages in personal finance is considered.

Instead, I suggest that concepts such as ratios, fractions and percentages are widely recognised as being "hard to teach and hard to learn" (Coben *et al* 2003:64, and as illustrated by Extracts 7.1 and 7.2). The participating students often seemed to regard them with a certain amount of awe and dread, and they were thus more likely to become preoccupied with algorithms and "right answers", and less with considering how they might be used outside the classroom. One strategy that might be worth exploring is allowing students to use calculators for at least some of their activities in these topics, thus allowing them to focus on their practical applications rather than getting "bogged down" in the arithmetic – as indeed they might be able to do in *real* "real-life" situations.

Above I have outlined features which seemed to encourage students to relate their learning to out-of-classroom practices. Some newer learning materials do indeed seem to incorporate similar principles. One example, although I have not yet observed it in use, is the teacher guidance on preparing students for the new Functional Skills qualifications (DCSF 2007) which includes exemplar activities such as that shown in Fig. 9.1.

Although the initial question conforms to the traditional word problem genre, the follow-up questions make use of the conditional tense, do not always have a single right answer, and appear intended to encourage students to relate learning to their own out-of-classroom practices and interests. However, it should be emphasised that this is *guidance* material for teaching and learning; it is not an example of assessment materials, and

thus teachers may still feel obliged to teach more traditional word problem techniques to prepare students for accreditation.

Question 1

It takes 1.75 metres of denim to make a pair of jeans. Denim costs £3.50 per metre.

(a) How much will the material for the jeans cost?

(b) If the price of denim rises by 5%, how much will the material cost?

What other questions could you ask about this situation?

- If the denim can only be bought in an exact number of metres, how much extra will you pay for the denim you do not use?

- How many pairs would you need to make to ensure that there is no wastage of denim?

- What is inflation at the moment? What would happen if you used that figure instead of 5%?

- How much discount would you need to get the price back to where it was before the price increase?

- What would the discount need to be if the increase was 10%, or 20%?

- Can you generalise from these examples?

- The actual price of the jeans is double the cost of the denim because of trimmings, labour and profit. How much will the maker charge for the jeans?

- Would you ever choose to have jeans especially made for you? If so, why, and if not, why not?

- How do you decide where to buy your jeans?

Fig. 9.1 Extract from *Resources to support the pilot of functional skills: Teaching and learning functional mathematics* (DCSF 2007:33)

The introduction of Functional Skills in England (QCDA 2009) has been seen by many as an opportunity to make mathematical problem-solving more relevant to real-life numeracy practices (for example Wake 2005; Burkhardt and Bell 2007; FitzSimons 2008); at the time of writing it remains to be seen whether or not this will indeed be the case.

In Chapter 8, I concluded that although collaborative groupwork and social-constructivist discourses do not necessarily privilege disruptive knowledge contributions over conformative ones, these approaches do seem to create a 'space' in which both types of contribution can be shared with and evaluated by the group. Collaborative groupwork thus also seems to have a

role to play in making learning more meaningful to adults, and I consider this aspect of classroom activity next.

Collaborative Groupwork: Affordances and Limitations

As discussed above, collaborative groupwork seemed to play an important role in providing opportunities for the students in my study to resist schooled habitus and in making learning meaningful through the different contributions they brought to their discussions. Benefits extended beyond the direct outcomes of mathematical learning, ensuring that the classes were enjoyable and helping the students to deal with anxiety and low self-confidence, and seem likely to have contributed to the high retention and achievement rates attained in these classes.

While students' expressions of uncertainty have traditionally been regarded as problematic, I suggest that teachers should instead regard them as a *resource* which promotes a supportive and safe environment. Expressions of uncertainty contributed more to the classroom environment than just their role in exploratory talk. They were used by the students to elicit evaluation; to acknowledge their own uncertainty and to accept that of others; to articulate difficulties; to invite others to contribute to the discussion; and to express support. By recognising these additional functions, teachers can be encouraged to accept and promote expressions of uncertainty from their students. Rowlands (1995) suggests that uncertainty in mathematical learning should be expected, welcomed, and made explicit:

> Uncertainty is a valid, indeed an honest and honourable, state to be in. One could go further, and insist that uncertainty is a productive state, and a necessary precondition for learning. For once we believe we "know", we are no longer open to the possibility of further knowing (Rowlands 1995:328)

Collaborative groupwork has only recently been promoted widely in adult numeracy classrooms in England, and the process of officially-endorsed reform is still only partly underway (see Chapter 5). It is not always easy to achieve, and the Milltown and Farmton classes were chosen specifically

because most of the students in those classes had responded well to it. Elizabeth herself taught several other classes in which students had not embraced the new approaches, and even the students in the participating groups had taken some time to adapt. Other recent research suggests that this initial resistance to collaborative groupwork is widespread (Rhys Warner and Vorhaus 2008; Cara *et al* 2008). Nonetheless its successful uptake in the two classrooms I studied suggests that it can be well worth the effort to overcome this resistance.

However, the substantial benefits of collaborative groupwork apparently enjoyed by the majority of students make it a matter of great concern that students with disabilities and additional learning needs may be excluded from it. In Chapter 10, I discuss the need for urgent research in this area.

Other Aspects of Social-Constructivist Pedagogy: Some Reservations

Collaborative groupwork is just one strand of the *Thinking Through Mathematics* guidance, which recommends a number of additional approaches designed along social-constructivist principles, including the 'exposing' of students prior misconceptions, and the use of open questions to which there are many right answers. These approaches have been rigorously evaluated with 16-19 year olds in Further Education colleges (Swan 2000; 2006a; 2006b), but I am not convinced that they transfer unproblematically to older adult learners. My analysis suggests some important reservations, related to schooled habitus, which require reflexive sensitivity on the part of the teacher and a possible review of the guidance.

One such recommendation is that learning activities should be designed so that students' mathematical misconceptions are "exposed":

> Teaching approaches that encourage learners to explore misconceptions through discussion result in deeper, longer-term learning than approaches that try to avoid mistakes by explaining, from the start, the "right way" to see things (DfES 2007:2-19).

I express my reservations with some hesitancy, since an evaluation of *Thinking Through Mathematics* by its authors acknowledges that many

teachers are resistant to this recommendation, and urges that this resistance should be overcome (Swain and Swan 2009). Nonetheless, I feel that this recommendation does not sufficiently take into account adult learners' schooled habitus, and particularly their perception of writers of learning and assessment materials as malevolent, and trying to "catch out" the unwary. For example, in Extract 6.14, Roz and Pete gain little from an exercise intended to expose the misconception that 1cm^2 equals 10mm^2 (rather than 100mm^2) through cognitive conflict, and instead come away with an increased suspicion that the writer has tried deliberately to confuse them; an experience which I suspect served only to confirm earlier habitus.

Similarly, while open questions and questions for which there is no "right answer" can be stimulating and encourage students to relate learning to out-of-classroom practices, many students do seem initially to feel uncomfortable with such challenges, and teachers may need to be aware and accepting of this. The potential for transforming this aspect of schooled habitus is illustrated by Dawn's successful engagement with such a question in Extract 7.13. Nonetheless, the students did seem to gain particular satisfaction from obtaining a "right answer" (for example Extract 7.11). I would argue that those engaged in mathematical activity at any level enjoy the resolution of a right answer, and we should be careful not to deny adult numeracy learners this intellectual reward.

As I stated in my introduction to this chapter, students' schooled habitus needs to be taken into account when planning all adult learning programmes; and it should be remembered that teachers with a well-intentioned commitment to social-constructivist pedagogies may not have the same priorities as their students. As González *et al* (2001:128) argue:

> Constructivist approaches support a perception of mathematics as a creative art form, as a form of playfulness. Yet, these are constructs of adult mathematicians, not of novice users.

Pedagogical Glimpses:
Potential for Teacher Professional Development

Although these were not always directly relevant to my research questions, the data I collected yielded rich pedagogical insights that I believe would be of practical interest to teachers, and so my final recommendation in this chapter is that this research method should be explored as an approach for continuing professional development (CPD).

As part of a drive towards enhanced "professionalisation", teachers in the post-compulsory sector in England must now undertake a certain amount of CPD per year (Institute for Learning 2009). The ease with which I obtained the rich data presented here suggests that teachers might also record collaborative groupwork in their own classrooms in order to reflect on their teaching as part of their CPD. No specialist equipment is required beyond a mobile phone with a recording function and a storage card. Naturally, students' permission must be sought, but in my experience the majority were willing to give it.

Below, I briefly outline some glimpses of pedagogy obtained in my own study; other, and equally useful, observations might be made in different classrooms. I do not attempt to give a full analysis of the pedagogical implications here; merely to illustrate the potential of the method to provide pedagogical insights.

Informal Calculation Strategies

Tomlin, Baker and Street (2002) and Coben (2006b) point out difficulties in researching informal calculation strategies because these are often carried out invisibly in one's head. However, when working collaboratively, students tend to "think aloud", making "invisible" practices audible. I found that informal calculation strategies, such as counting on for addition, and repeated addition for multiplication, predominated greatly over formal written methods, as for example in Extract 9.2, in which Roz, Dan and Pete, in the Farmton Level 1 group, were attempting to calculate areas of rectangles.

Extract 9.2: "Twenty sixes"

Roz, Dan and Pete are attempting to calculate the area of a rectangle with dimensions 20cm by 6cm.

1	Roz	Yeah, so it's twenty sixes
2		So it's (...)
3	Dan	Yeah
4	Pete	That's one-forty isn't it
5	Roz	No, it's a hundred isn't it?
6	Pete	Twenty, forty, sixty, eighty, one hundred – and twenty.

[F2/L1A: 384-389]

Later in the same session, Pete and Roz were struggling to use repeated addition for a more difficult multiplication. Elizabeth, circulating through the class, noticed their difficulty and demonstrated a formal written method of long multiplication. The recording reveals that Pete and Roz reverted to repeated addition as soon as Elizabeth moved on to the next group.

Benefits of Multi-modal Representation

Amongst principles currently regarded as effective practice are "multiple representations of mathematical concepts", and activities which involve categorising, sorting and matching such concepts (DfES 2005a; 2007). The recordings provide insights into the effectiveness of such activities, and might be a particularly useful tool for teachers developing their own multi-modal resources.

For example, the *Tarsia* puzzle in Fig. 9.2 involves matching perimeters and areas of shapes to statements of their dimensions. When correctly matched, the puzzle will form a complete triangle. The recordings revealed how the students used the structure of the puzzle, including the knowledge that the outer sides of the triangle are blank, to scaffold their calculations of area and perimeter.
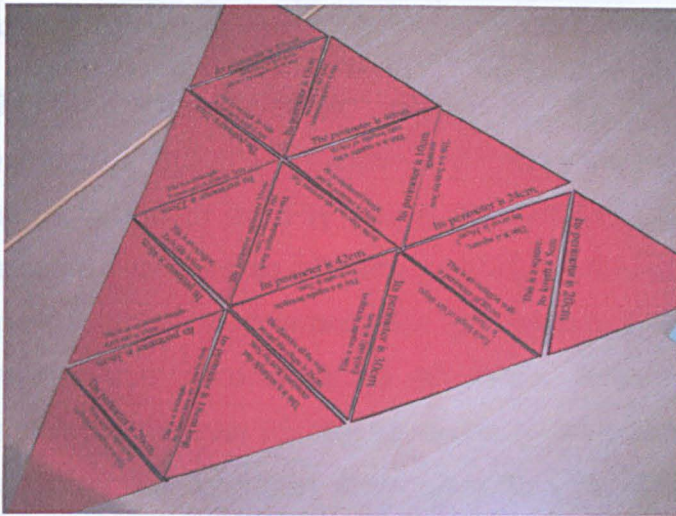
Fig. 9.2 Tarsia Puzzle

The use of colours also seemed very helpful to students. The activity below (DfES 2007) required them to match different representations of the same decimal fraction, with numerical representations on pink cards, number lines on blue cards, and shaded visual fractions on green cards. The students used the colour names as signifiers, enabling them to reference abstract concepts for which they perhaps lacked formal vocabulary:
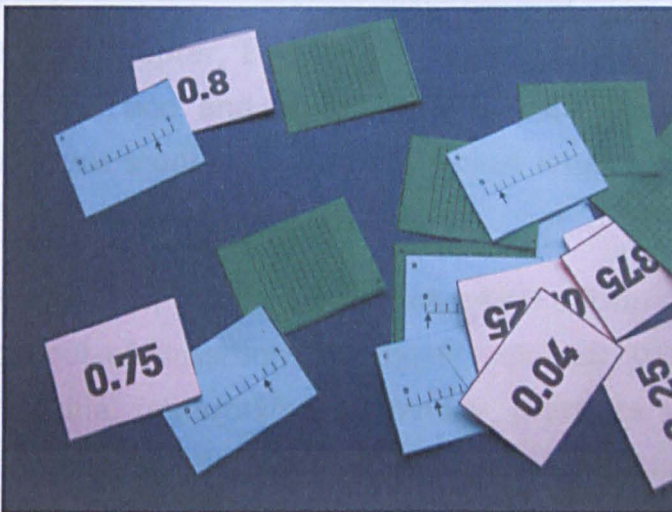

Fig. 9.3 *Thinking Through Mathematics* Fractions Cards in Use (DfES 2007)

Extract 9.3: "Still not got a green"
In this card activity the students use the colour names as signifiers, to enable them to reference abstract concepts for which they lack formal vocabulary.

1	Ruth	All these are mixed up, I think.
2		Still not got a green
3		We've not got a green for nought point four
4		I don't know why, but we haven't

[M2: 297]

Other Glimpses

I found that "Gestalt" moments (Wertheimer 1923) were sometimes rendered audible – often with the expression "Oh!" Analysis of the explanation or activity which led to such moments of understanding might enable teachers to identify successful strategies for future use. Students' participation in collaborative groupwork can also be evaluated. Teachers might use recordings to establish whether the task had been at an appropriate level for the students to use peer scaffolding appropriately, and whether all students were able to contribute, or some were dominating discussions while others were excluded.

In conclusion, I suggest that this research method has promising potential for practitioner-research and CPD, and I would like to explore its use as a reflective and evaluative tool for practicing teachers (see Chapter 10).

Conclusion

In this chapter, I have tentatively outlined some implications of my findings for practice and policy, whilst stressing the importance of taking into account students' schooled habitus when developing innovative pedagogies for adult classrooms.

Features of learning activities which encouraged students to relate learning to out-of-classroom practices included: those which invited students to imagine undertaking numeracy practices (for example by use of the conditional mood); the absence of a pre-defined right answer; and subjects of intense interest to the students, such as body image or popular culture, rather than abstract and difficult concepts. Collaborative groupwork was used highly effectively by those students who participated in it, suggesting that it is worth the effort to overcome initial resistance. Nonetheless, it is of concern that students with disabilities, learning difficulties or English as a second language may be deterred from participating, and research in this area is urgently needed. Finally, I suggest that my research method has

potential for teacher CPD, and illustrate this with examples of the glimpses it can provide of pedagogical processes in the classroom.

In my final chapter, I look back reflectively on my research journey. I also discuss the limitations of my methodology, and possible future directions for research.

Chapter 10

"So what was the question?"
Reflections and Future Research Directions

Extract 10.1: "So what was the question?"

Denise and Dawn are struggling with a task which gives data about the fast food preferences of a group of young people (including the information that 12 out of 60 girls preferred pizza), and asks for a comparison between the fraction of girls and the fraction of boys who prefer pizza.

1	Denise	And then twelve out of
2	Elizabeth	Sixty
3	Denise	Sixty
4	Elizabeth	Yeah
5	Denise	Which is one – so it's five
6	Dawn	Twelves into sixty, is that what you've got to do?
7	Denise	It's a fifth
8	Elizabeth	Yeah
9	Denise	So what was the question?
10	Students and teacher	[laughter]

[M4A:176-185]

Denise's query in line 9 above will be familiar to many adult numeracy teachers. The Milltown group had been given data about the fast food preferences of a group of young people, and asked to compare the fraction of girls and the fraction of boys who prefer pizza. By the time she had worked out the first fraction, Denise had lost sight of the overall question she was trying to answer. In this final chapter I, too, need to remind myself of my original questions and aims in order to reflect on my research. I review my methodology, and the extent to which it has suited my research aims. I then discuss the limitations of my study, and the opportunities these suggest for similar research in future. I also report on how I have disseminated my methodology and findings so far.

My first research question was: "What knowledge, practices and dispositions do students bring to the adult numeracy classroom?" In Chapters 6 and 7 I have described how learners brought to the classroom their familiarity with popular culture; their use of humour; an ability and willingness to express uncertainty and anxiety; a critical awareness of issues important to them;

and – occasionally – their understanding and use of informal numeracy practices. Students also seemed to bring a schooled habitus which included familiarity with the curriculum, assessment requirements, and the expectations of word problems.

While I was perhaps disappointed to find how rarely students drew upon numeracy practices from outside the classroom, it was useful to examine those activities which were effective in encouraging them to do so on those rare occasions, and these have suggested some possible answers to the second of my research questions: "How might students' knowledge, practices and dispositions be used to develop teaching and learning approaches which are more meaningful and relevant to their numeracy practices outside the classroom?" In Chapters 7 and 9 I have considered whether alternative types of classroom activity were more effective than traditional word problems in encouraging students to relate learning to out-of-classroom practices. I have suggested features which made these effective included: activities which invited students to imagine undertaking numeracy practices; the absence of a pre-defined right answer; and subjects of intense interest to the students.

It was necessary to keep questioning what I understood by the term "funds of knowledge". I felt that the concept needed to be subject to critical reflection and deconstruction, and so I regard the development of my analytical framework as one of my outcomes. An article based on this has been accepted for publication (Oughton, forthcoming). I found that recognition of schooled habitus, and my categorisation of the students' knowledge contributions as "disruptive" or "conformative", helped overcome some of the difficulties I encountered during my analysis, and I hope that this framework may be helpful to others undertaking similar research. I also hope that my analysis of the varied, creative, sophisticated and humorous resources brought to the classroom by the students serves to challenge deficit models of *Skills for Life* learners currently prevalent in policy discourse.

I also consider my findings to contribute to an understanding of the role of schooled habitus in influencing students' dispositions and expectations in

the classroom.   Collaborative groupwork and other social-constructivist approaches are strongly promoted as "good practice", but have not yet been as thoroughly evaluated for adult learners as for younger students. Much of my research supports the effectiveness of collaborative groupwork, but it is the role of ethnographic research to challenge unquestioned generalisations, and I have also warned of some limitations of these new pedagogies, including the tendency for certain students to be deterred from participation (discussed in more detail below).

For me, an important additional research aim was to represent the voices of adult numeracy students by applying the emerging methodology of linguistic ethnography to the under-researched setting of the adult numeracy classroom.   I have loved listening to the recordings of the students' discussions, and I have attempted, in my transcription, to represent the poetry I heard in them (Hymes 1981; 1994). I hope that the transcripts have allowed the students' voices to speak for themselves to the reader. This brings me the third of my research questions, which I discuss in the following section.

Methodological Reflections

My final research question was: "What can recording and analysis of naturally-occurring classroom discourse reveal about adult students' experiences of learning numeracy?"   In this section, I reflect on the effectiveness of linguistic ethnography as a research methodology in adult numeracy classrooms, and also on the limitations of my study.

My data collection methods were simple, but yielded large quantities of useable and very rich data. I found that mobile phones provided sufficient quality of recordings for the small groups involved, particularly when combined with observation and fieldnotes (although another researcher attempting to transcribe my data did comment that the mono-recording gave only a limited sense of space, making it difficult to interpret interactions when he could not visualise the classroom layout).

The phones had the advantage of being very unobtrusive, and my use of them was described as methodological "gem" by one journal editor (Taylor 2009:4). Although it is not possible to say for sure how naturalistic my data is, I personally believe that the students' discussions would *not* have been very different had I and my recording equipment been absent. As discussed in Chapter 3, the students were intensely engaged in their mathematical problem solving and seemed quickly to forget they were being recorded. Several times when I went to collect the recording equipment at the end of the session they would tell me, usually with a laugh, that they had forgotten it was there. There were one or two occasions, particularly during humorous exchanges, on which I suspected that students were performing for my benefit as well as that of staff and other students (for example Extracts 6.6 and 6.11) but, in my absence, it seems likely that staff and students would have constituted an ample audience.

Analysis of my data was the most challenging – and, at times, frustrating – stage of my research. A repeated and iterative process of listening to the data and revising the transcripts was essential, as for example when analysing Extract 6.3, in which all the Milltown group except Charlotte are engaging in exploratory talk. Charlotte's premature contribution of the answers was made so quietly that in early listenings I had dismissed is as background talk. It was only on careful and detailed re-listening that this was picked up and used in analysis.

Extract 7.9, in which Abigail and Judith contribute different types of knowledge to the categorisation of measuring instruments, was pivotal. I recognised its importance on the first occasion I listened to it, but during the early stages I was focusing only on Abigail's disruptive contributions. It was not until I also started to look at Judith's conformative contributions in tension with these that my analysis began to fall into place.

The rich data I collected could have been interrogated using many different analytical frameworks. Although the scope of this thesis required me to focus on my original research questions, other areas that could have been pursued include: the social capital outcomes of attending adult numeracy

classes (Bourdieu 1986; Tett and Maclachlan 2007); the application of activity theory to analyse how the students worked together in groups (Engeström 2001; Kanes 2002); Bakhtinian notions of dialogue, heteroglossia, speech genres and the carnivalesque (Bakhtin 1965; 1981; 1986); and the role of the teacher's own habitus in her responses to official discourse (Marsh 2006; Grenfell 2008). The data also provided pedagogical insights which could have been explored in much more detail, and which are only touched on in Chapter 9.

Naturalistic Research or Intervention?

As stated in Chapter 1, this study was originally planned as a funds of knowledge approach, which generally involves teacher-ethnography, followed by an active and transformative attempt to draw upon students' funds of knowledge in the classroom, and to make learning more relevant to their out-of-classroom practices or interests.

When I first realised that my new role in teacher-education would preclude practitioner-research, I discussed with Elizabeth the possibility of an action-research project, with interventions such as focus groups in which students could reflect on everyday numeracy practices, followed by activities specifically designed to draw on those funds of knowledge. However, after pilot sessions in which I both collected naturalistic data and held a short focus group (the "mixing squash" discussion presented in Chapter 7), I realised that what fascinated me was the students' *spontaneous* contributions. Rather than transform those contributions, I wanted to study in more detail how the students themselves used them, and so I decided not to attempt any further intervention.

It would certainly have been illuminating to discover whether further intervention, involving Elizabeth and the students as co-researchers, might have had a transformative effect on collaborative groupwork otherwise dominated by the regulative discourse of *Skills for Life*. However, this would have been a different kind of project, and a model I am considering for future research.

Transcripts and Recordings: To Share or Not to Share?

As reported in Chapter 3, the students asked me not to play back to them the recordings of their collaborative groupwork. A reluctance to listen to one's own voice is widespread (Karpf 2006), and seems likely to be exacerbated in situations where participants might feel that their talk is inadequate or insufficiently formal, and there was reason to believe, from comments made by the students, that many of them had low self-confidence.

I had also decided, after much deliberation, not to share transcripts with the students unless they asked me to. None of the participants did ask to see the transcripts, and on balance, I think this was the right decision. The recorded talk was informal, hesitant and exploratory, full of repairs and repetitions, and it was necessary for the purposes of my study to represent this informality in transcription. I was concerned that the students might perceive their talk, as I transcribed it, as insufficiently formal; that subsequent talk might be constrained and less naturalistic than before; and that they might then aim for what they believed to be the expected, formal register of the classroom.

While this decision felt right for naturalistic ethnographic research, in a different, more interventionist study, there were points at which it would undoubtedly have been revealing to discuss the transcripts with the students. For example, in the construction fatalities word problem (Extract 7.2), it would have been very interesting to discuss the transcripts with the students, and ask them how they had felt about the information presented in the problem. Wagner (2003) suggests that both teacher and high-school students can benefit from analysing their own mathematical discourse, although whether adult numeracy students would feel comfortable doing so remains open to question.

However, I did share some recordings with the participating teacher, Elizabeth, as I valued her views on whether making similar recordings might be useful for teacher-research (see Chapter 9). I made the mistake of selecting a sample of talk in which the students were struggling with a task

which was beyond their current level. Elizabeth expressed some mortification at giving the students work which was too hard for them, and I needed to reassure her that the majority of the students' talk had been productive and successful. Nonetheless Elizabeth thought that recordings of collaborative groupwork might be a valuable professional development mechanism for practitioners. She commented:

> It's nice to be able to hear what goes on in class when I'm not standing over them and to see that they do seem to enjoy themselves. It's given me an insight into the part of the session I didn't get to see (or at least a bigger picture of the session) and has got me thinking. [E-mail correspondence 27.10.09]

Other Methodological Limitations

Of concern to me throughout has been the ethnic homogeneity of my sample[27]. While the classes were representative of the semi-rural towns in which my study took place, in other settings adult numeracy classes contain more diversity. The absence of students with English as a second language seemed to be of particular significance in a study of classroom discussion, as these students may have additional barriers to joining in collaborative groupwork but, conversely, a richer cultural diversity to contribute to such discussions.

A further methodological limitation was my decision to collect only audio-data, as less obtrusive and presenting fewer issues of confidentiality and anonymity. Although I was able to partly compensate for the lack of visual data by making careful fieldnotes, there are some aspects of classroom interaction that would have been illustrated much more effectively through video-recording. Gesture played a significant role in the collaborative groupwork I observed. For example, in card-matching activities, the student holding the cards had additional control over group decisions, and

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[27] I also identified and made pilot recordings in an urban adult education centre with students of diverse ethnicities. Unfortunately the experienced teacher with whom I was hoping to work had allocated her classes to a student-teacher who lacked the confidence to allow students to participate in collaborative discourse without her intervention. In the pilot recordings the majority of the talk comes from the student-teacher, and very little from students themselves. I therefore felt that these classes were unsuitable for the nature of the current study, although my recordings might have usefully served to illustrate some challenges of attempting to introduce collaborative groupwork.

could be said to "chair" the group. Similarly, the placing of a card sometimes acted as a non-verbal suggestion of the "answer" to a problem, which could only be inferred from the audio-data. Nonetheless, I felt that the focus on audio-data alone did provide a helpful structure for fine-grained analysis. As Mercer (2010:10) comments:

> Language remains for me the prime cultural tool of the classroom. Spoken language enables, in unique ways, the development of relationships amongst teachers and learners ... so I would not subscribe to an analytic approach which diluted its significance to that of just one of several modes.

A more profound concern is the voicelessness (and thus the invisibility in my data) of students who did not participate in collaborative groupwork. Wagner (2005:6) describes how his awareness of silences in school mathematics classrooms "*emerged* from the experience of attending critically to speech" (original emphasis). Focused as I was on my audio-recordings and transcripts, I did not notice how absent some students were from my data until the start of my analysis, when I was writing up details of my sample and realised that some students had not yet been assigned a pseudonym because there had been no recordings of their talk to transcribe. Learning to "hear" their silence was an important part of my research journey. Linda, the deaf student, had declined to be audio-recorded, so I was aware from the outset of her absence from the data, and instead interviewed her about her experience of collaborative groupwork. With hindsight I now feel it would also have been valuable to interview Richard and Ameena to find out how they felt about their levels of participation in the classroom community.

Dissemination of Research

One of my aims has been to make this research relevant to practice and accessible to practitioners. To date, I have had two journal articles reporting on this study accepted for publication: one describing how the students responded to word problems (Oughton 2009a), and one based on my analytical framework in Chapter 4 (Oughton forthcoming).

I have also presented emerging findings at the *Adults Learning Mathematics* international conference in London (Oughton 2009b) as well as at internal conferences within the University of Bolton and the University of Sheffield. Practicing teachers and teacher-educators have made up a significant part of my audience at these conferences and have expressed considerable interest in my methodology, commenting on how my findings resonated with their own experiences. During presentations, I have played excerpts from my audio-data (with permission from the participants), and these have been received with noticeable smiles of recognition from practitioners. Many expressed an interest in using a similar approach in their own classrooms, and this led me to consider its possible use as a continuing professional development mechanism for teachers (see Chapter 9). I have been invited to make a further presentation to practitioners by a consortium of teacher-education institutions in Wales.

My audio-data has been presented to a different kind of audience at a methodological seminar organised by the UK Linguistic Ethnography Forum (LEF). Not all the delegates were education specialists, and they commented with some surprise on how much the students seemed to be enjoying themselves during collaborative groupwork. The methodological focus of this seminar gave me new insights into subjectivity in transcription and analysis, as some delegates heard the recordings in different ways than I had done. While some of these differences seemed to be due to unfamiliarity with my students' northern English dialect, others were useful in helping me refine my transcriptions. The resulting discussion informed my analysis of Extract 6.11.

I hope to disseminate more of my findings in future publications, including those intended for practitioners as well as scholarly journals.

What Next? Future Research Directions

It is in the nature of ethnographic studies to challenge unjustified generalisations and to generate further research questions (Howe 2008). In this concluding section I look ahead by discussing how the questions raised by my study might be addressed in future research.

Having found my research methods to be simple yet powerful, I hope to use similar methods in other classrooms in future, including groups with wider ethnic diversity, and younger students studying Functional Skills as part of vocational qualifications. I would envisage again using naturalistic data collection methods, although if students had language difficulties which presented a barrier to collaborative discussion, some intervention with students and teacher as co-researchers might be needed.

Secondly, as a teacher-educator, I am interested in the uses of my data collection methods in teacher education. As described in the last chapter, audio-recording of collaborative groupwork has potential as a methodology for continuing professional development, and I would like to investigate this further in partnership with in-service teachers.

However, the area I consider to be most urgently in need of research is the exclusion of certain students from collaborative groupwork. Although this was not one of my original research questions, it is one of the findings which causes me most concern, and so I discuss possible research directions in some detail below.

Researching Ways to Make Collaborative Groupwork More Inclusive

In Chapter 5, I reported that some students, including a deaf student and those with learning support needs, did not attempt to participate in collaborative groupwork, and worked only with their signer and support workers. I emphasised that such students were not deliberately excluded from such activities; but I was nonetheless concerned that the nature of the activities deterred them from joining, especially as their wider participation

in the classroom community also seemed to be affected; for example they did not seem to join in humorous exchanges or informal coffee break discussions.

Elizabeth was aware of the difficulties experienced by these students, and strove to include them in a wider range of group activities. However, she described three types of barriers to their participation: their willingness to participate in group activities; their ability to join in group discussions; and the different mathematics topics studied by students working at Entry Level rather than Levels 1 or 2.

Although collaborative groupwork is currently endorsed by Ofsted as "good practice", it is hard to find guidance on how to make it more accessible to students with learning difficulties, physical disabilities, sensory impairment or English as a second language. For example the teacher-guidance accompanying the *Thinking Through Mathematics* resource contains no references to the needs of such students (DfES 2007).

I suggest that the most powerful way to seek more inclusive learning opportunities would be in partnership with the excluded students themselves. For example Linda, the deaf student in the Farmton class, already had ideas that she thought might be helpful, such as deaf-awareness training to make her fellow students more responsive to her needs and more willing to conduct collaborative groupwork at a pace suited for signing and lip-reading. A cycle of action-research, involving teacher, support staff and all students in the group as co-researchers, seems to me the most appropriate way forward in examining such questions.

Conclusion

In this final chapter I have reflected on my methodology, its successes and its limitations. I have reported on the dissemination of my findings to date and the valuable feedback obtained from it. Finally I have considered the research directions I would like to pursue in future.

Reflecting back on my research journey, it has not been linear and has taken some unplanned twists and turns. In particular the necessity of undertaking research in another teacher's classrooms meant that obtaining naturalistic talk became a methodological aim, and this has yielded many unexpected but valuable insights. Later, I found myself questioning what could be categorised as funds of knowledge, and reviewing my research aims in the light of this conceptual crisis. Despite these diversions, however, I feel that I have arrived not far from my originally-intended destination – perhaps closer than I expected when I was half-way through. Although this study has not strictly followed a funds of knowledge approach, by giving a naturalistic account it is, perhaps, more generalisable; and it not only shows why a funds of knowledge approach might be challenging and problematic, but also why it might be worthwhile.

It has been extremely challenging to undertake this research alongside the demands of my university teaching and the needs of my family, but it has nonetheless been fascinating, engaging and intensely rewarding. I consider myself to be very privileged to have worked with Elizabeth and her students, who generously welcomed me into their classrooms. I have found myself becoming fond of Elizabeth's students in the way I used to be fond of my own. One reason that Elizabeth was my first choice of teacher to work with in this research is that she shows a respect for her students which is similar to the respect I also feel, and which inspired this research in the first place.

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Appendix A
Profiles of Participating Groups

Name	Level (during fieldwork) Gender Age band	Additional notes	Outcomes if known[28]
Milltown Group Fieldwork Period: April-June 08			
Charlotte	Level 2 Female Under 25	Already has a degree and GCSE maths. Wants to "brush up" skills before teacher training.	Not known due to change of teacher
Christine	Level 2 Female 45-54	Very nervous so chose to work alone rather than in a group at first	Not known due to change of teacher
Dawn	Level 2 Female 35-44		Passed Level 2 after several attempts
Denise	Level 1 Female Not provided		Passed Level 1
Gemma	Level 2 Female 25-34	Studying Mathematics as part of an Access to Higher Education programme	Passed Level 2 after several attempts. Will start University next year.
Melissa	Level 1 Female 45-54		Passed Level 1
Ruth	Level 2 Female 35-44		Passed Level 2
Jackie	Level 1 Female 35-44	Studying Mathematics as part of an Access to Higher Education programme	Passed Level 2 after several attempts

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[28] The outcomes for some students are not known, since some moved on to other groups, and the Milltown evening class itself was taken over by another teacher when Elizabeth's timetable was reviewed at the end of the academic year.

Name	Level (during fieldwork) Gender Age band	Additional notes	Outcomes if known
Farmton Group Fieldwork Period: November-December 08			
Abigail	Level 2 Female 25-34	Completed NVQ childcare shortly before fieldwork period. Helps out at local school.	Passed Level 2
Donna	Level 2 Female 35-44	Studying NVQ childcare during fieldwork period	Passed Level 2 Now working as a Teaching Assistant
Judith	Level 2 Female 35-44	Helps out at local school.	Passed Level 2
Sally	Level 2 Female Under 25	Expecting new baby during fieldwork period	Failed her first attempt at Level 2. May not be able to resit due to lack of crèche
Sylvia	Level 2 Female 35-44		Passed Level 2
Roz	Level 1 Female 35-44	Expecting new baby during fieldwork period	May not be able to return if crèche does not re-open
Dan	Level 1 Male 35-44		Passed Level 1 Now working towards Level 2
Pete	Level 1 Male 25-34		Passed Level 1 Now working towards Level 2
Linda	Level 1 Female 45-54	Deaf learner, works with signer	Passed Level 1 Now working towards Level 2
Ameena	Entry 3 Female 25-34	Works with learning support assistant	Passed Entry 3 Recently started an animal welfare course
Richard	Entry 3 Male 35-44	Has been attending the centre for many years. Works with learning support assistant.	Passed Entry 3 Can only return to class at Level 1

Appendix B
Informed Consent Documentation

Participant Consent Form

Title of Project: <u>Using Discussion in Adult Numeracy Classrooms</u>

Name of Researcher: Helen Oughton

Participant Identification Number for this project:

Please initial box

1. I have read and understand the information sheet dated Nov 2008 for this project and have had the opportunity to ask questions.

2. I understand that I do not have to take part and that I can withdraw at any time without giving any reason.

3. I understand that my responses will be kept anonymous and that I will not be able to be recognised from the project report.

4. I agree to take part in this research project (tick those parts that you agree to):

   To be observed participating in classroom discussion activities

   To be audio-recorded participating in classroom discussion activities

   To be interviewed about my maths history, my experiences of learning and my use of numeracy outside the classroom

   For recordings of classroom discussion activities in which I took part to be shared with other education professionals

I am: My age is:
□ Male   □ Under 25 yrs   □ 35-44 yrs   □ 55-64 yrs
□ Female   □ 25-34 yrs   □ 45-54 yrs   □ 65 yrs or older

_____   _____   _____
Name of Participant   Date   Signature
(*or legal representative*)

_____   _____   _____
Researcher   Date   Signature
To be signed and dated in presence of the participant

Copies:
Once this has been signed by all parties the participant should receive a copy of the signed and dated participant consent form, the letter/pre-written script/information sheet and any other written information provided to the participants. A copy of the signed and dated consent form should be placed in the project's main record (e.g. a site file), which must be kept in a secure location.

Participant Information Sheet

Using Discussion in Adult Numeracy Classrooms
Researcher: Helen Oughton

You are being invited to take part in a research project. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read this information carefully and discuss it with others if you wish. Ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

What is the project's purpose?
As part of my research degree at University of Sheffield, I am finding out how adult numeracy learners use discussion activities in the classroom. These activities might include working together in small groups, in pairs, or in a class discussion – any situation in which you talk to other students about the maths you are learning.
I am interested in whether and how these activities help you learn the maths (numeracy) you need to meet your learning goals (such as gaining a qualification or helping your children).

Why have I been chosen?
This class has been chosen, after consulting your tutor, because it is suitable for discussion activities. Everyone in this class has been invited to take part in the project.

Do I have to take part?
You can decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep (and be asked to sign a consent form) and you can still withdraw at any time without it affecting any you in any way. You do not have to give a reason.

What will happen to me if I take part?
If you decide to take part, you will continue to attend your adult numeracy classes and participate in activities in the usual way. I will watch activities and take notes during 3-5 sessions.
In addition to this, there are some further activities which you can agree to:
  • Being audio-recorded taking part in a discussion activity
  • Allowing me to photograph work which you and your fellow students have produced
  • Talking to me about your reasons for returning to study maths (numeracy), your experiences of learning, and the way you use numeracy outside the classroom.

What do I have to do?
To take part, you just attend your maths (numeracy) class as usual and participate in the usual activities provided by your tutor. You will not need to attend any additional sessions.

How will recorded media be used?
If you have agreed to me making audio recordings of your activities, these will be used only for my research and reporting what I find. They will not be used in any other way without your written permission, and no one outside the project will be allowed access to the original recordings.

Participant Information sheet (Continued from overleaf)

What are the possible disadvantages and risks of taking part?
Occasionally, some people feel anxious about maths. If this affects you, you can stop taking part in the project. Also, if you feel uncomfortable about being recorded, you can stop at any time.

What are the possible benefits of taking part?
The results of the project will help us to understand more about effective ways for adults to learn maths and numeracy.

Will my taking part in this project be kept confidential?
All information which is collected about you during the research will be kept strictly confidential, and you will not be able to be identified in any reports or publications. Any information about you which is shared with other people will have your name and any other details removed so that you cannot be recognised from it. The report will **not** specify the name of the centre you are studying at, and pseudonyms (false names) will be used.

What will happen to the results of the research project?
The results of the project will be written up in a thesis which will be marked by my supervisor and examiners for University of Sheffield.
The results may be published if we think that they would be useful in helping to develop more effective ways of teaching numeracy to adults. In either case, you will not be able to be identified in any report or publication.

What if something goes wrong?
If you have a complaint or concern about the project, or your treatment by me as researcher, you can first talk to me.
If you want to take your complaint further, you can contact my supervisor, Dr Kate Pahl, at the address below. The University's Registrar and Secretary is the designated official person at the University responsible for receiving complaints brought against the University.

Who has ethically reviewed the project?
This project has been reviewed by the University of Sheffield School of Education Ethical Review Panel.

If you have concerns, you can contact my Supervisor for further information
Dr Kate Pahl
University of Sheffield
School of Education, 388, Glossop Road, Sheffield, S10 2JA
(0)114 222 8112   k.pahl@Sheffield.ac.uk

This Participant Information Sheet and your signed Participant Consent Form are yours to keep for your records.

Thank you for your interest in this project.

The University Of Sheffield.

The School Of Education.

Helen Oughton

Head of School
Professor Peter Hannon

Department of Educational Studies
The Education Building
388 Glossop Road
Sheffield S10 2JA

20 February 2010

Telephone: +44 (0114) 222 8096
Fax: +44 (0114) 279 6236
Email: jacquie.gillott@sheffield.ac.uk

Dear Helen

Re: Using discussion in adult numeracy classrooms

Thank you for your application for ethical review for the above project. The reviewers have now considered this and have agreed that your application be approved
(please see below reviewers' comments)

7. Approved with the following suggested, optional amendments (i.e. it is left to the discretion of the applicant whether or not to accept the amendments and, if accepted, the ethics reviewers do not need to see the amendments):
Participant Info sheet and application form. I supervised a PhD student who allowed her respondents to choose their own pseudonyms. Unfortunately, however, they subsequently discussed their pseudonyms with each other, destroying the attempt to maintain confidentiality. The student then had to devise pseudonyms afresh.
I therefore advise Helen to allocate pseudonyms herself and not to discuss with respondents, to prevent this situation arising.

This is subject to receipt of a signed hard copy of Part B (Declaration) of the School of Education Research Ethics application form which is available at http://www.sheffield.ac.uk/education/ethics. This hard copy is then held on file. This ensures that we comply with university requirements about signatures

Yours sincerely

**Mrs Jacquie Gillott
Programme Secretary**

	Session date	Topic	Participants featured in recordings (Other students present shown in grey)	Recording and length		Other data and artefacts
Milltown Tues 7.00pm 9.00pm	29 Apr 08	Ratio	Ruth, Dawn, Jackie, Elizabeth Melissa, Charlotte, Gemma	Audio recording M1	32:33	Fieldnotes Diluting Drinks worksheet
	6 May 08	Percentages	Ruth, Dawn, Jackie, Charlotte, Gemma, Elizabeth	Audio recording M2	60:00	Fieldnotes Percentages worksheet
	13 May 08	Practice Paper	Jackie, Melissa, Charlotte, Gemma, Elizabeth Ruth, Dawn	Audio recording M3	60:00	Fieldnotes Practice 'National Test' paper (Level 2 Paper 'L')
	11 Jun 08	Pie and bar charts Individual revision	Dawn, Charlotte, Denise, Christine, Elizabeth	Audio recording M4A 28:50 Audio recording M4B 19:57 Audio recording M4C 08.39		Fieldnotes Focus group (mixing squash) Photographs of card activity
	2 July 08	Negative numbers Temperatures	Ruth, Dawn, Jackie, Denise , Elizabeth	Equipment failure		Fieldnotes Photographs of card activity
Farmton Thurs 9.30am 11.30am	6 Nov 08	Metric units	Donna, Judith, Abigail, Sally, Elizabeth (Pete, Dan, Roz)	Audio recording F1/L2A 42:15 Audio recording F1/L2B 41:01		Fieldnotes Photographs of card activity Metric Units worksheets
		Individual and portfolio work	Linda, Ameena, Richard, LSAs			
	13 Nov 08	Area and perimeter	Pete, Dan, Roz, Elizabeth	Audio recording F2/L1A 60:00 Audio recording F2/L1B 23:08		Field notes Photographs of card activities Perimeter and area worksheets
		Area and perimeter	Donna, Judith, Abigail, Sally, Sylvia, Elizabeth	Audio recording F2/L2 39:43		
		Individual and portfolio work	Ameena, Richard, LSA			
	20 Nov 08	Area and perimeter revision, then data handling	Pete, Dan, Roz, (Donna, Abigail), Elizabeth	Audio recording F3/L1A 40:49 Audio recording F3/L1B 40:45		Field notes Photographs of card activities Data handling worksheets
		Area and perimeter revision, then data handling	Donna, Judith, Abigail, Elizabeth Pete, Dan, Roz	Audio recording F3/L2A 60:00 Audio recording F3/L2B 60:00 Audio recording F3/L2C 15:02		
		Individual and portfolio work	Ameena, Richard, LSA			
	12 Mar 09	Area and volume (practical investigation)	Abigail, Pete, Dan, Roz, Sally, Sylvia, Elizabeth, Richard	(Follow-up visit only)		Fieldnotes

Appendix D
Transcription Conventions

As described in Chapter 3, I have tried to keep transcription conventions to a minimum. Those used in the extracts reproduced in this thesis are[29]:

Convention	Meaning
[description of gesture]	Gesture, action or other non-verbal semiosis
(.)	Pause
?	End of apparently interrogative utterance (i.e. rising intonation)
.	End of utterance (falling intonation)
–	Interrupted or broken-off utterance
<u>emphasised word</u>	Stress placed on underlined word by speaker
(guessed utterance)	Indistinct utterance; content of brackets represents "best guess"
(...)	Untranscribable utterance; unable to make guess (usually due to overlapping talk from other speakers)
...	Lines transcribed in full transcript but not reproduced in extract for clarity or concision (usually overlapping talk from other speakers)
[F1/L2B: 31-37]	Reference to source basic transcript, for example in this case: Farmton class, fieldwork session 1, Level 2 group, recording B, lines 31-37.
	Note that line numbers on original transcripts do not correspond directly with lines in extracts presented in the thesis, as ethnopoetic transcription was not applied until the closer analysis stage.

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[29]Following, for example, Bucholtz (1999); Davies (2003); Barwell (2003a); Maybin (2007)

Appendix E
Coding Table

Description	Code
Classroom as community of practice	**com**
strategies for seeking/gaining acceptance in group	com g
strategies for maintaining acceptance in group	com m
Mutual support and encouragement	com s
Humour (links to FOK humour)	com h
Shared discourse	com d
Self-deprecation	com sd
Roles within group	com r
Hierarchy (position) within group	com p
other community	com o
Funds of knowledge	**fok**
Numeracy from outside the classroom	fok n
Other practical/ideational knowledge from outside the classroom	fok p
Interpersonal/communication skills	fok i
Use of humour (links to com humour)	fok h
Metacognitive skills	fok m
other FOK	fok o
Ways of expressing degrees of uncertainty	**unc**
Modalising expressions	unc m
Reverse question tags – to express genuine uncertainty	unc rg
as a rhetorical/pedagogic device	unc rr
as a democratic device	unc rd
Expressing genuine uncertainty	unc g
As a democratic device	unc d
Anxiety	unc a
Self deprecation	unc s
other Uncertainty	unc o
Self deprecation and anxiety	**Self d**
Anxiety	Anx

Description	Code
Degree of agency over learning	**age**
passive acceptance of contexts, tasks and materials	age w
critical challenging of contexts, tasks and materials	age c
classification and framing of mathematical 'topics'	age f
length of turns: teacher v student	age l
importance of finding the 'right' answer	age r
Writers of learning and assessment materials as 'they'	age t
other agency	age o
Linguistic codes	**lin**
Code switching	lin s
Mathematical/elaborated/pedagogic code	lin p
Length of turns	lin l
other linguistic codes	lin o
Home/ family as sites of learning	**hom**
Relating own learning to their children's learning	hom c
Experiences of taking classroom work home	hom w
other home	hom o
Maths pedagogy	**ped**
Gestalt moments	ped g
Multi-modal representation	ped m
Calculation strategies	ped c
Other pedagogy	ped o
Mercer's styles of group discussion	**sty**
Cumulative	sty c
Disputational	sty d
Exploratory	sty e
Constructivist theories of learning	
All group within ZPD	zpd a
Some of group within ZPD	zpd s
None of group within ZPD	zpd n
Other constructivist theory	zpd o
Use of metaphor	**met**
maths learning a jointly undertaken journey	met j
amaths as a mystery	met m
other metaphors	met o

Appendix F
Sample of Coded Transcript

The following sample from the basic transcripts used for initial analysis shows how comments and then codes were applied to the data, and also how colour-coding was used to facilitate analysis.

			Comments	Code
198	Judith	What next.? [reading] I would measure the **width** of a door in	Using emphasis to interpret the card for others	fok i
199	Sally	metres?		
200	Donna	Yeah		
201	Abigail	Or inches. Again, it depends how (...)		
202	Judith	I would measure the weight of a mosquito in	Critiquing relevance of context – this is very rare in these transcripts	age c
203	Sally	I wouldn't [laughter]		
204	Donna	Grams	Donna briefly tries to carry on despite Sally's subversion of question. Abigail joins in	age c
205	Judith	[reading] the weight of -		fok h
206	Abigail	Depends how much blood he'd had		
207	Judith	[more laughter]		
208	Judith	[reading] The weight of a paper clip?		
209	Abigail	It's not going to weigh very much is it?		
210	Donna	Grams or kilograms? What do you think? Shall we go kilograms?		unc d
211	Judith	[reading] The weight of a cat		
212	Donna	[with much more confidence] Kilograms. My cat's huge. [Laughs]		fok p
213	Judith	[reading]I weight of a laptop computer		
214	Judith	[reading next card] I would measure the capacity of 2 (full) teaspoons in	presumably the previous card was placed here without need for discussion	com r
215	Abigail	It would be capacity for that (...)		
216	Donna	Well that would be the same as a measure, then, isn't it		
217	Sally	Yeah, it would (...)		
218	Judith	Are they the same? Are they the same? (...) two teaspoons		
219	Sally	They're tablespoons		fok n
220	Abigail	It's the same thing though, isn't it, I'd have thought		unc r r

Extract taken from Farmton Level 2 Group, Session 1, Recording A.

Note that passages of talk selected for more in-depth analysis were listened to and the transcriptions refined repeatedly, so the extracts presented in the full analyses in Chapters 6 and 7 may differ slightly from the basic transcription presented here.

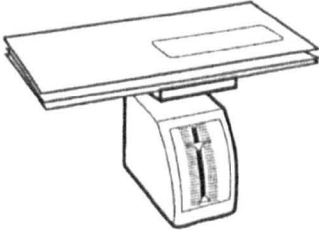|			Comments	Code
221	Judith	Right. [reading] I would measure the capacity of a concrete mixer		
222	Donna	Ton. Would that be tonn(ee)	[attempt to pronounce metric tonne?]	lin o
223	Donna	Well I don't know. (...) that thing where		
224		I think that will be kilograms		
225		Kilograms, yeah		
226	Abigail	I think that will be kilograms		
227		Because it's like one bag to:		
228	Donna	(...) put on 2.5 kilogram bags to -		
229		(...)[overlapping talk]		
230	Judith	[reading] The capacity of a bucketful in	Again, the conclusion seems to be being reached by the placing of the card, presumably by Judith. So does she have more control over the situation than audible through talk alone?	com p
231	Abigail	litres		
232	Judith	[reading]The amount of paint in a large can		
233	Abigail	Litres?		
234	Donna	Yep		
235	Judith	The distance walked in 10 minutes		
236	Donna	Would it be, um time?		
237	Judith	its, the distance walked -		
238	Donna	-in ten minutes. Oh, sorry no, um, miles.		
239	Judith	Which in		
240	Sally	miles		
241	Judith	She said do it in metric, didn't she		unc r g
242	Donna	Kilometres		
243	Abigail	Kilometres		
244	Judith	[reading] I would measure the distance jogged in 10 minutes		
245	Donna	Kilometres		
246	Judith	[reading] I would measure the length of a key in		
247	Sally	Millimetres	This recognition of two equally valid answers possibly reflects Elizabeth's teaching style	
248	Abigail	Or centimetres, you could do.		age r
249	Sally	Depends how big the key is, doesn't it	Not much defensive tone here – s is v. quietly spoken but is defending her contribution	com r
250	Judith	Have we got centimetres		fok p,
251		Yes there		fok n
				unc r r
252	Judith	(...) put it (...) [it's interesting how holding the cards has put j in charge]		
253	Abigail	Put it in between		
254		We'll cheat		
255		[laughter]		
256		It could be either though,		
257	Sally	To the left of the flea		
258	Abigail	that would have to be millimetres, though		
259	Judith	[reading] The weight of an elephant	Judith uses a mock serious tone	age c,
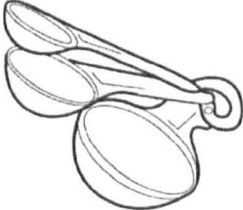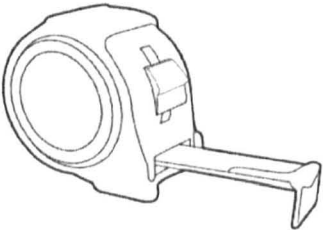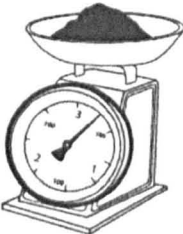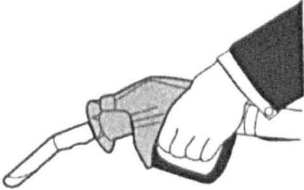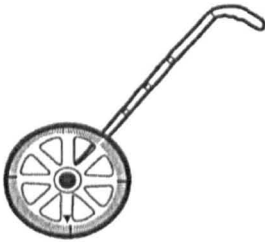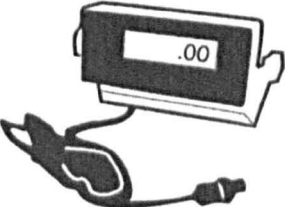
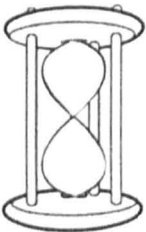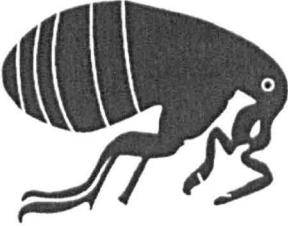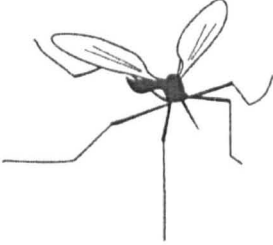|			Comments	Code
260		[laughter]	here which causes the other students to laugh – again they are mocking / critiquing the relevance of the context, which they rarely seem to in more conventional classroom activities	com h, fok h
261	Abigail	Not the right kind of ton		
262	Donna	We asked and she said that was the imperial and that was the metric.		
263	Abigail	That means absolutely nothing to me	There does seem to be a failure in maths teaching to locate units of measure in a historical context – and what are the connotations of "imperial" in a post-colonial world?	age o
264	Donna	That's the old measurement and that's the new measurement.		
265	Abigail	Again (…) means absolutely nothing		
266	Judith	[reading] I would measure the weight of a car in		
267	Abigail	tonnes	tone suggests certainty	fok p fok n
268	Judith	I think we're done, aren't we?		unc r d
269	Donna	Looking at that (…) It looks right now [laughs]		
270	Abigail	We'll have to keep waiting for that one (…)		
271		[mostly silent, waiting for other group to finish. We can hear other group working in background]		
272	Roz	[working in other group, but at this point addressing the whole room] I'm having a dumb blonde moment	(she is very dark haired)	com d, com h
273		[Laughter from whole room]		
274		(…)[overlapping talk]		
275	Donna	A concrete mixer, you'd put water in it as well, so it would be a bit of both, wouldn't it	This is referring back to her discussion with e quite a lot earlier – she has obviously been reflecting on it since	fok n fok p unc r d
276		It'd be a bit of, like, litres		
277		(…) Mostly it'd be in kilograms, for the cement		
278		And the sand		
279		But for the water you'd put in, you'd put litres		
280	Eliz	[coming over] Have you done it now		
281		Are there any that you've –		
282	Donna	The concrete mixer sounds a bit-		
283		(…)[overlapping talk]		
284	Eliz	Yes, you'd probably		
285		Do you weigh the things that you put into it or do just sort of do so many buckets full	Tone of voice suggests genuine question, not rhetorical – e is calling on Donna's FOK Knowledge not known to teacher	fok n fok p

Ways of expressing degrees of uncertainty

- As a pedagogic/ rhetorical device
- As a democratic device
- other Uncertainty
- Expressing genuine uncertainty
- Anxiety
- Modalising expressions
- Reverse polarity mood tags

Mercer's styles of talk
- Exploratory
- Cumulative
- Disputational

Funds of knowledge
- Interpersonal/communication skills
- other FOK
- Use of humour
- Numeracy from outside the classroom
- Metacognitive skills
- Other practical/ ideational knowledge from outside the classroom

Degree of agency over learning
- critical challenging of contexts, tasks and materials
- passive acceptance of contexts, tasks and materials
- Existence or 'right' answer
- length of turns: teacher v student
- other agency
- classification and framing of mathematical 'topics'
- 'They' – writers of assessment and learning material

Classroom as community of practice
- strategies for maintaining acceptance in group
- strategies for seeking/gaining acceptance in group
- other community
- Self-deprecation
- Roles within group
- Humour (links to FOK:humour)
- Mutual support / encouragement
- Hierarchy (position) within group

Home/ family as sites of learning
- Experiences of taking classroom work home
- Relating own learning to their children's learning
- other home

Handwritten annotations:
- FOK ICT
- Self Deprecation
- Schooled habitus
- "Chair"
- Rarity of use of these in solving maths problems
- Disruptive
- THIRD SPACES
- Interruptions
- students' turns much longer when talking about other (non-maths) topics.
- Ped codes/ Linguistic codes
- Exam
- students need to construct themselves as having even less agency than structure actually allows them – issues of self-concept ?

Appendix H

Sample of *Thinking Through Mathematics* Materials

Ruler	Pipette	Measuring spoon
Tape measure	Kitchen scales	Measuring jug
Pedometer	Bathroom scales	Petrol pump
Trundle wheel	Forklift weighing device	Letter scales
Egg timer	Stopwatch	Clock

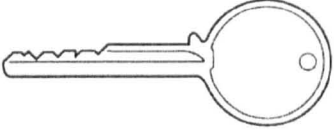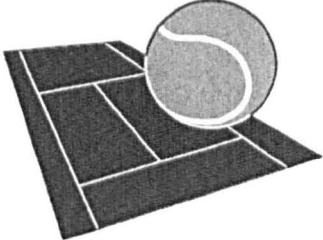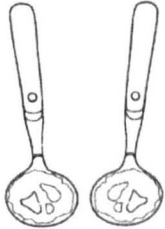*Thinking Through Mathematics* Measuring Instruments cards (DfES 2007), discussed by the students in Extract 7.9
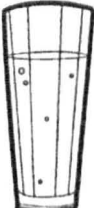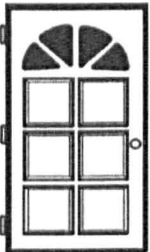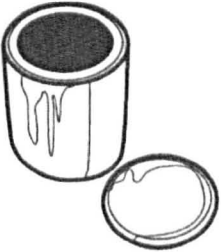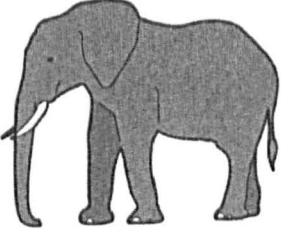
millimetre	milligram	millilitre
centimetre	gram	centilitre
metre	kilogram	litre
kilometre	tonne	cubic metre
inch	ounce	fluid ounce
foot	pound	pint
yard	gallon	hour
mile	ton	second
minute		

Thinking Through Mathematics Units of Measurement cards, discussed by the students in Extact 7.10.

I would measure the length of a flea in ...	I would measure the weight of a mosquito in ...	I would measure a dose of medicine in ...
I would measure the thickness of a finger in ...	I would measure the weight of a paperclip in ...	I would measure the capacity of 2 teaspoons in ...
I would measure the height of a door in ...	I would measure the weight of a laptop computer in ...	I would measure the quantity of drink in a large bottle in ...
I would measure the distance walked in ten minutes in ...	I would measure the weight of a car in ...	I would measure the capacity of a concrete mixer in ...

Thinking Through Mathematics Objects cards, discussed by the students in Extract 7.3 and 7.7 (1 of 2)

Card set B – *Objects* (page 2 of 2)

I would measure the length of a key in …	I would measure the weight of a tennis ball in …	I would measure the capacity of 2 full tablespoons in …
I would measure the length of a magazine in …	I would measure the weight of a small book in …	I would measure the amount of water in a large glassful in …
I would measure the width of a door in …	I would measure the weight of a cat in …	I would measure the amount of paint in a large can in …
I would measure the distance jogged in ten minutes in …	I would measure the weight of an elephant in …	I would measure the capacity of a bucketful in …

Thinking Through Mathematics Objects cards (2 of 2)

Appendix I
Chapter Titles

As described in Chapter 1, many of the chapter titles in this thesis are taken from extracts from the students' talk, reflecting some of the parallels between their learning journey in the adult numeracy classroom, and my own in researching and writing this thesis. The context of the lines quoted in chapter titles are summarised in the table below.

Thesis Title "We all play teacher"	Dawn in the Milltown class, when members of the group have shared ideas for solving a ratio problem	M1:144 (Extract 1.1 line 10)
Chapter 3 "Don't let me hear myself"	Roz in the Farmton class, on my collecting the microphone at the end of the first recorded session in which she participated.	F2/L1B:469
Chapter 5 "Can we all work together in the exams?"	Jackie in the Milltown class, when members of the group have each contributed to solving a particularly difficult problem.	M2:612 (Extract 5.1 line 7)
Chapter 6 "I'm not often right and you knock me down!"	Jackie in the Milltown class, on finding that she had the right answer when other members of the group had tried to tell her she was wrong.	M1:182 (Extract 6.6 line 7)
Chapter 7 "Actually, I'm thinner than Posh"	Donna in the Farmton class, on being challenged by another student on her estimation of her own waist measurement.	F1/L2B:163 (Extract 7.6 line 4)
Chapter 9 "Or are we going to do it a bit different?"	Abigail in the Farmton class, as she attempts to offer alternative ways of categorising measuring instruments.	F1/L2A: 11 (Extract 7.9 line 12)
Chapter 10 "So what was the question?"	Denise in the Milltown class, on becoming so absorbed in a calculation that she forgot the original multi-step problem she was trying to solve.	M4/A:184 (Extract 10.1 line 9)

Appendix J
List of Abbreviations

AS-Level	Advanced Subsidiary Level
BIS	Department for Business, Innovation and Skills
BSA	Basic Skills Agency
CPD	Continuing Professional Development
DCFS	Department for Children, Schools and Families
DES	Department of Education and Science
DfEE	Department for Education and Employment
DfES	Department for Education and Skills
DIUS	Department for Innovation, Universities and Skills
DTI	Department of Trade and Industry
DWP	Department for Work and Pensions
FENTO	Further Education National Training Organisation
GCSE	General Certificate of Secondary Education
HSE	Health and Safety Executive
IALS	International Adult Literacy Survey
IFL	Institute for Learning
ILP	Individual Learning Plan
LLUK	Lifelong Learning UK
LSA	Learning Support Assistant
LSC	Learning and Skills Council
LSIS	Learning and Skills Improvement Service
NCETM	National Centre for Excellence in the Teaching of Mathematics (UK)
NCTM	National Council of Teachers of Mathematics (USA)
NIACE	National Institute of Adult Continuing Education
NRDC	National Research and Development Centre for adult literacy and numeracy
OECD	Organisation for Economic Co-operation and Development
Ofsted	Office for Standards in Education
QCA	Qualifications and Curriculum Authority
QCDA	Qualifications and Curriculum Development Agency
SFL	Systemic Functional Linguistics (also used elsewhere for *Skills for Life,* but not in this document)
WO	Welsh Office