"We all play teacher": naturally-occurring student discourse as data in adult numeracy classrooms

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This paper presents findings from a study of student-student discourse in adult numeracy classrooms in England. The study takes advantage of the increased use of discursive groupwork in such classrooms, and students are audio-recorded as they work collaboratively on mathematical activities with little intervention from the teacher. The paper aims to illustrate the potential of the methodology to afford privileged insights into students' experiences of learning which would not be apparent through teacher-led interaction. Themes emerging from analysis of the recordings include: the classroom as a cohesive community of practice; the linguistic devices the students use to express uncertainty and to negotiate meaning; and the students' perceptions of their own agency within wider educational structures. In particular, the findings challenge commonly-held assumptions about relevance and context in adult numeracy learning. This methodology also provides pedagogical insights: for example, the recordings capture "gestalt" moments and students' informal calculation methods.

Introduction

> The facts of greatest value for the study of education are those constituted in classroom interaction, and … most readily displayed in classroom talk. (Edwards and Westgate 1994:55)

Language, whether spoken or written, is the medium through which most educational activity is accomplished. Collaborative groupwork, in which small groups of learners work together to solve mathematical problems with little intervention from the teacher, is currently promoted in England as good practice. This study takes advantage of this recent increase in the use of collaborative groupwork, and the discourse it generates, as an opportunity to find out more about adults' experiences of learning numeracy.

In this paper I report on findings from the recording and analysis adult numeracy students' naturally-occurring discussions as they worked collaboratively on such mathematical activities. The analysis generally took a social rather than cognitive perspective, focussing on the students' relationships with each other, with mathematical learning, and with wider social structures imposed by the curriculum and accreditation. A number of themes emerged, which are reported in full elsewhere (Oughton 2009; 2010; Oughton *forthcoming*). Rather than focus on a single theme in

depth, I aim in this paper to illustrate the potential of this research method to reveal privileged insights into students' experiences of learning, by giving a broad overview of the main themes emerging. These include: the adult classroom as a community of practice; the ways in which expressions of uncertainty were used by the students to create a supportive and successful learning environment; the relevance of classroom mathematics to the students' out-of-classroom numeracy practices; and the scope for similar research methods to be used by practitioners in their professional development.

The title of this paper comes from a comment made by a participating student, and for me sums up the way the students supported each other and shared strategies and experiences as they worked together on mathematical problems.

Ruth So what goes into five hundred – five hundred four times?

Dawn So it'll be a hundred – a hundred

Ruth Always go back to this four

Dawn Yeah

Ruth So what goes into five hundred four times?

Dawn A hundred and fifty?

Ruth No

Dawn Well it's not a hundred

Hundred and twenty five.

We all play teacher, don't we?

Background: *Skills for Life* and alternatives to the deficit model

Adult numeracy provision in England is currently driven by the *Skills for Life* agenda (DfES 2001; DIUS 2009) and the new impetus given to it by the recent *World Class Skills* and *Campaign for Numeracy* strategies (DIUS 2007; 2008). While these policies have raised the profile of, and funding for, adult literacy and numeracy provision, they have been critiqued for their emphasis on economic effectiveness and workforce development, and for the deficit view presented of adult learners (Papen 2005; Oughton 2007). In particular, the strategy compares the literacy and numeracy skills of over seven million adults to "those we would expect of an 11-year old" (DfES 2001:2). An aim of the study reported in this paper was to question this deficit view by allowing the voices of adult learners to be heard. An influential concept has been Moll et al's (1992) notion of "funds of knowledge"; learners' repertoires of informal practices and know-how which may not be evidenced by formal qualifications but have the potential to be valued and drawn on in the classroom. Baker (2005:16) has developed Moll et al's idea specifically for adult numeracy learners, and suggests that funds of knowledge to be drawn on in the classroom might 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

A further influence on my analysis has been the concept of numeracy as social practice, in which numeracy is seen to be practised differently in different domains, only one of which is the formal mathematics of the classroom (Street 1984; Barton and Hamilton 1998; Baker 1998; Street, Baker and Tomlin 2005). Thus a further aim of this study was to look for ways in which classroom learning can be made more relevant to everyday numeracy practices.

Methodological background: collaborative groupwork and classroom discourse as data

Collaborative groupwork is strongly promoted by official discourses in England and is rapidly gaining acceptance in adult numeracy classrooms, its proponents welcoming the opportunity to break with the tradition of teacher-led activity (Swan 2006, Swain and Swan 2007). Such approaches have been legitimised as "good practice" by the education standards authority in England, Ofsted, 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)

In my research I draw on an emerging set of methodologies and epistemologies known as linguistic ethnography, which 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). Traditionally, recording and analysis of classroom talk have tended to focus on teacher-led discourse, but recordings of discourse generated by groupwork provide insights which would not be available by observing teacher-led interaction. This approach also helps overcome one of the difficulties in researching the numeracy practices of adults; the invisibility of many informal practices, such as calculating in one's head (Tomlin 2002, Coben 2006). In explaining their methods together through exploratory talk (Mercer 2004; Barnes 2008), the students "think aloud", and many of their invisible practices are made audible.

My aim was to obtain discourse which was as naturalistic as possible, so the primary data collection method was unobtrusive audio-recording (with the students' informed consent), supported by field observation. Interviewing and focus groups were occasionally used to clarify issues arising from initial analysis of the recordings, but these were kept to a minimum to avoid making subsequent talk less natural. Photographs were also taken of learning resources such as card activities.

Mobile phones were used as recording devices, placed on the classroom tables used for collaborative groupwork. Since the students also tend to place their own mobile

phones on table-tops during classes, they have become "part of the furniture" in these classrooms and participants tended to ignore them. Labov (1972) also suggests that speakers' discourse tends to become more natural when they are intensely engaged in the subject under discussion, as the students were in their mathematical problem-solving. Students seemed quickly to forget that they were being recorded, and the data appears to be as naturalistic as can reasonably be expected.

The classrooms, the teacher and the students

My fieldwork was carried out during weekly, two-hour numeracy classes in two adult community education centres in the north of England. The participating teacher had strong subject knowledge, including a first degree in mathematics, and a commitment to a variety of participatory approaches to teaching and learning. I worked with her to select those of her classes in which the students had responded well to collaborative groupwork. The students in the classes were predominantly women, white-British[1] and aged between 20 and 50 years old. Although classes were also open to men, the predominance of women was not unusual at the centres, where many of the students were women "returners", hoping to gain qualifications in order to return to work or further study as their children grow older. The ethnic homogeneity of the groups was representative of the semi-rural towns in which the adult education centres were based. All names used in this paper are pseudonyms, and ethical approval for the research was obtained from the University of Sheffield, UK. Fieldwork took place over nine sessions, and around eleven hours of usable audio data were recorded.

The classes were funded by the Learning and Skills Council (LSC), and thus students were required to work towards a recognised numeracy qualification (typically the National Certificate in Adult Numeracy). Enrolment for the classes was flexible, allowing students to join at any time, and opportunities to sit tests for qualifications were offered throughout the year.

The classes were small (fewer than twelve students per class) and the students usually worked in groups of between two and five, on a variety of mathematical activities which included card matching and card sorting activities, practice examination papers, and traditional worksheets. It was rare for a student to work alone, although students with disabilities and learning support needs generally worked with learning support assistants rather than their fellow students.

Most of the students generally expressed their motivation for attending classes in terms of gatekeeper qualifications to careers or further study, or a wish to help their children with school work. Very few spoke of wanting to improve numeracy skills for use in everyday life. However, a dominant feature of the recordings made in these classrooms was laughter, and the students clearly found attendance rewarding. I would therefore suggest that a major additional motivation was also social and intellectual enjoyment.

The adult numeracy classroom as a community of practice

The idea of learning as a process of legitimate peripheral participation in a community of practice provides a useful alternative to traditional notions of teaching as the

[1] Standard UK Categories

transmission of acquired knowledge (Lave and Wenger 1991; Wenger 1999; Sfard 1998, Barton and Tusting 2005). Within this model, mathematical learning 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 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 discourses, 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.

Because of the flexible enrolment arrangements, the participating classes contained some students who 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 the students' learning trajectories, from the newer students tentatively beginning to contribute to groupwork via legitimate peripheral participation, while the "old-hands" moved on as they completed their qualifications.

Nonetheless there were some students who did *not* participate in the community of practice, including students with learning support needs and a deaf student. These students did not attempt to participate in groupwork, and worked only with their support workers and signers. It should be emphasised that such students were not deliberately excluded from these activities; but it is nonetheless of concern that the nature of such activities deterred them from joining. Linda, the deaf student, 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. As well as not benefiting from learning activities regarded as "good practice", such students also seemed to miss out on the social networking opportunities offered by the classes. The teacher was aware of these students' difficulties, and was seeking ways to include them more in group activities, but little guidance was available to her on how best to do this.

This seems a significant cause for concern. Such students are excluded not only from mathematical learning activities but also from the classroom as a community of practice. Resources recommending such approaches to practitioners do not, to date, discuss how students with additional needs might be integrated into the activities. Further research is urgently needed to identify ways to ensure that all students are given the opportunity to participate fully, including students with disabilities, and students in multilingual communities.

Linguistic practices in the classroom: uncertainty and self-deprecation

Uncertainty is often seen as problematic in adult numeracy learning. 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 (Tobias 1978; DES/WO 1982; Gal 2000; LSC 2009; Coben *et al* 2003; Lee 2006; DfES 2005a).

Expressions of uncertainty and doubt were highly prevalent in the recordings I collected, varying from mild modalising expressions, or hedges (Lakoff 1973) such as "…I think", "…isn't it?", "Is that right?" and "Would that be…?" to stronger expressions of self-deprecation such as "It was just a guess" (on being congratulated on a correct answer). While this prevalence may at first seem to indicate a problematic lack of confidence, a more careful analysis of the way such expressions were used in collaborative groupwork began to reveal a more complex and less negative picture.

Firstly, such expressions did not always seem to indicate genuine doubt, but instead were used to invite other students to contribute to the discussion, and even to project the level of under-confidence required for social acceptance within the class. In the following example, a group of students were trying to spot the multiples of three on a 100 number square, when one student, Ruth, realised that she was dominating the activity. Note the tell-tale pause before Ruth belatedly added the expression "I think".

Ruth	Sixty-nine, seventy-eight
Dawn	You're good at these, aren't you?
Ruth	Eighty-seven.
	So they're the threes … *I think*

Secondly, other students' response to uncertainty (genuine or otherwise) seemed to play an important role in the social cohesion of the group, and to contribute to the learning process. Expressions of uncertainty were acknowledged and accepted, and 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.

It also seemed to help the students to articulate any difficulties and formulate these into questions for the teacher or fellow students to answer. Consider, for example, the following extract in which Judith and Donna were struggling to convert between metric units of measure. The full discussion is too long and fragmented to include here, but they had been making apparently random guesses at method and answer, before gradually identifying the nature of their difficulty.

Donna	[reading question from worksheet] 'Circle the longer distance in each block'
	Which is number three-
Judith	Three hundred and eighty
Donna	Yeah, three hundred and eighty centimetres
	(…) convert them, like that
	Is that right? If you convert them in to the -

Judith Centimetres in to millimetres

Centimetres is one hundred

Donna One hundred

Judith One hundred and nine millimetres. So that's bigger, isn't it?

Donna Um, is that one hundred and fifty – no one point five centimetres

So it's that one

Is that right?

If that was –

That would be – that would be – seventy five millimetres

Judith (…) centimetres is much more

Donna Is that right?

Judith I think it's right – but I'm not

Not overconfident on these

Donna *It's knowing which way to go round with them, isn't it?*

Judith *Yes*

The hesitations, false starts and pauses which occurred throughout this extract are characteristic of exploratory talk, in which 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). Their discussion enabled Judith and Donna 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 was then able to elicit the teacher's help. The teacher suggested a useful strategy, which Judith grasped quickly.

Judith I think we need your help, Elizabeth [the teacher]

[laughs]

I'm confusing myself

Which way round do you do it?

I've just really muddled myself up [laughs]

…

Teacher Yeah, if you think, if you're measuring here

What does it say? Nought point -

If you're measuring in metres, and you want to change to centimetres

Are you going to have more of them or are you going to have less of

them?

Judith It's – sorry? I'm going from metres to centimetres

So I'm going to have more, aren't I?

Teacher Yes, so it's going to get bigger

Such formulation and articulation of difficulties also allow the students to suggest metacognitive strategies to each other. For example, when one student, Jackie, expressed uncertainty about how to express a proportion of a whole as a fraction, her friend Dawn made the suggestion "I draw pies," (in order to visualise fractions) and demonstrated her technique to illustrate the fraction 3/5.

In conclusion, although uncertainty and under-confidence are usually regarded as problematic, the students in the study drew on 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 formulate and articulate questions which could be answered by the teacher or by each other; 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, most of the adult students here seemed to be "ready-equipped" for it. I suggest that the ability to acknowledge, express and accept uncertainty, whether that uncertainty is genuine or is affected in order to participate in groupwork, should be regarded as a resource rather than a problem.

Relevance of classroom mathematics to adult learners' lives

As described above, one of the main aims of my research was to examine the "funds of knowledge" which students might bring to the classroom, and the way in which they related classroom learning to everyday numeracy practices. However, despite my interest, my recordings only rarely included examples of students drawing on numeracy practices from outside the classroom.

Students drew on funds of knowledge *least often* in traditional context-based word problems. When solving such problems students ignored the artificial "context" provided by the word problem, and merely extracted the numerical data to manipulate. They tended not to question whether the context was realistic or relevant, and rarely used the context to check that the answer they had calculated made sense. I have referred to this absence of engagement with the context of traditional word problems as a "willing suspension of disbelief" (Oughton 2009), and feel that it is of particular concern because assessment materials at Level 1 and Level 2 in England consist entirely of context-based word problems, and one has to question the validity of such assessment materials if students ignore the contexts.

By contrast, some alternatives to word problems, such as card activities and group discussions, seemed more successful in encouraging the students to draw on their out of classroom numeracy practices. For example, in an activity which required students to match objects to be measured to suitable units of measurement (Figs. 1 and 2), the text on the cards uses the conditional mood to relate the activity directly to the students' own practices. In their accompanying discussion, students drew on their experiences of food shopping, mixing concrete and filling cars with petrol (Oughton 2009).

Fig. 1 *Thinking Through Mathematics* card matching activity in use (DfES 2007)

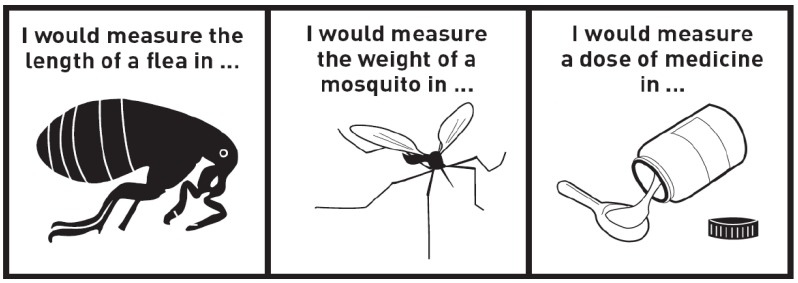


Fig. 2 Extract from *Thinking Through Mathematics* card matching activity (DfES 2007)

Such activities also allowed the students' to critique the relevance of examples to their lives, as in the following extract (note how Sally maintains the conditional mood used on the card):

Judith: [reading from card] I would measure the weight of a mosquito in

Sally: *I wouldn't* [laughter]

In another example, the group examined how the mean salary in a small company might be distorted by outlying values such as the director's salary. This example is often used in adult numeracy classrooms, but here the teacher gave it extra immediacy by randomly distributing a card to each student showing a salary which was to be regarded as theirs. The cards showed salaries alone, ranging from £10,000 to £100,000, and no details of job titles or roles were provided. Although not directed to do so by the teacher, the students spontaneously seized on chance to role play, demonstrating a level of humorous, critical knowingness about salary distribution which belies comparisons with 11-year-olds.

Donna: [receiving her card] Oh yeah. I'm the cleaner.

[laughter]

Teacher: I'm going to calculate what a typical wage (…)

…

	So what have you got there? Donna?
Donna:	Ten thousand [pounds]
Sally:	Twelve thousand
Judith:	Miss Moneybags here
	[laughter]
Abigail:	["posh" voice] I have one hundred thousand
Donna:	The director. You're the director

Their role-play later enabled them to make more sense of their eventual conclusion about how the mean had been distorted.

Topics which were of intense interest to the students were body size and body image; interests which conflict with the assumption by policy-makers that adult numeracy education should primarily be relevant to employment (DfES 2001; DIUS 2007; 2008; 2009). A worksheet which invited students to suggest suitable units of length for a waist measurement resulted in animated discussion:

Sally	Did you put your waist measure in?
Donna	I put twenty-four inches
Abigail	In your dreams [laughs]
Donna	["prim" voice] Actually, I'm thinner than Posh*
	The waist measurement of a boy, an eight-year-old boy
Judith	Probably our leg measurement
Abigail	Wouldn't want to be like her anyway
Judith	[disparagingly] She's going to be ill, she is
	(…)
Abigail	She's just stupid
	I just don't get why people would want to copy her and all that, that people do

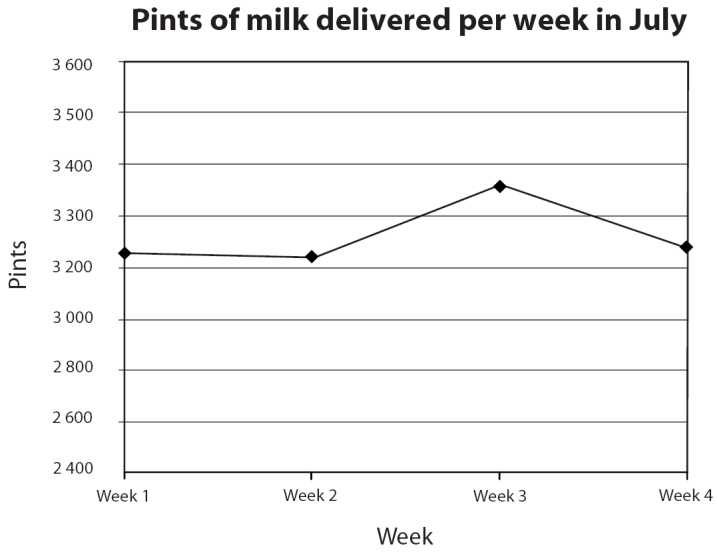
*"Posh" refers to Victoria Beckham, former member of the pop group the Spice Girls, and married to international footballer David Beckham.

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. Judith and Abigail's subsequent remarks demonstrate their critical engagement with the politics of body image and the compulsion felt by some women to be dangerously thin (Grogan 2008). I find social practice theory helpful in illuminating such exchanges, in which we see how certain forms of numerical understanding are intensely meaningful, or even emotive, to the students, without being of direct "functional" use.

Rarity of formal mathematical discourse

According Kieran et al (2001:5), learning mathematics might be seen as a process of "becoming fluent in a discourse that would be recognized as mathematical by expert interlocutors." However, mathematical terminology did not seem to be a major focus of the learning activity in the participating 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".

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 students were working together on a question from a practice examination paper, in which they were asked to identify an error on a graph. They quickly spotted the error, but struggled to identify which of the four multiple choice answers corresponded to the error they spotted:



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. 3 Question from *National Certificate in Adult Numeracy Level 2 Practice Test "L"* (LSIS/Tribal 2008)

Gemma The numbers are – wrong

Charlotte Yeah

Gemma They go up in twos, and then ones

Jackie Why, where you looking?

Gemma Look [pointing]

Jackie Oh, right

Gemma When it goes to there, it goes up

Melissa [reading from multiple choice options] "The vertical scale is incorrect"

Why did the students make so little use of mathematical discourse? To some extent it seemed to reflect the teacher's commitment to making mathematics accessible, 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 (one student claimed that "They just want to confuse you"), and seemed to *choose* to reject it.

Pedagogical Glimpses

The recording of students' mathematical groupwork has the potential to provide illuminating pedagogical insights. Although my research questions generally took a social, rather than a cognitive perspective, it became clear to me how useful such insights might be in teachers' continuing professional development, particularly if they were to record and reflect on discussions generated in their own classes. Here I briefly outline some of the observations made in the participating classes; equally useful observations might be made in other classes taught by other teachers.

Tomlin et al (2002) and Coben (2006) point out difficulties in studying informal calculation strategies because these are most often carried out invisibly in one's head. However, when working collaboratively, students "think aloud", making "invisible" practices audible. Informal calculation strategies, such as counting on for addition, and repeated addition for multiplication, predominated greatly over formal written methods in the participating classrooms. For example, here Roz, Dan and Pete were attempting to calculate areas of rectangles.

Roz Yeah, so it's twenty sixes

So it's (…)

Dan Yeah

Pete That's one-forty isn't it

Roz No, it's a hundred isn't it?

Pete Twenty, forty, sixty, eighty, a hundred – and twenty

Later in the same session, Pete and Roz were struggling to use repeated addition for a more difficult multiplication. The teacher, 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 the teacher moved on to the next group.

Amongst principles currently regarded as effective practice are "multiple representations of mathematical concepts", and activities which involve categorising,

sorting and matching these concepts (Swan and Wall 2005; Swain and Swan 2007). Recordings of students' discussions might be a particularly useful tool for teachers developing their own activities and wishing to evaluate their effectiveness. For example, the "Tarsia" puzzle in Fig. 3, developed by the participating teacher, involves matching the perimeters and areas of regular two-dimensional shapes to a description of their dimensions. When correctly matched, the puzzle will form the complete triangle as shown. The recordings demonstrate how the students use this knowledge, including the knowledge that the outer sides of the triangle are blank, to scaffold their understanding of how to calculate area and perimeter.

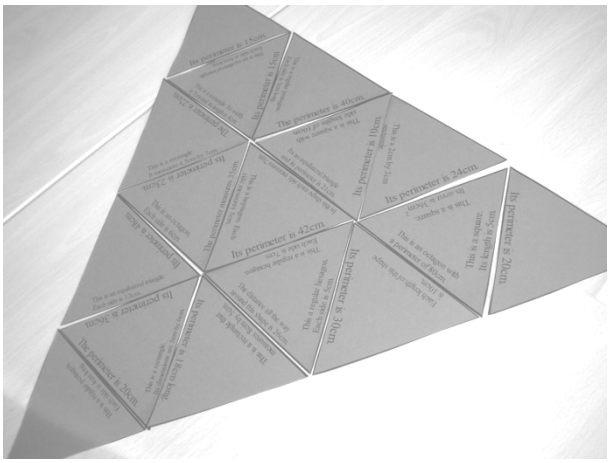


Fig. 4 Area and Perimeter "Tarsia" puzzle developed by the participating teacher

The use of colours also seemed very helpful to students. The activity in Fig. 5 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 chose to use the colour names as signifiers to reference abstract concepts, for which they perhaps lacked formal vocabulary:

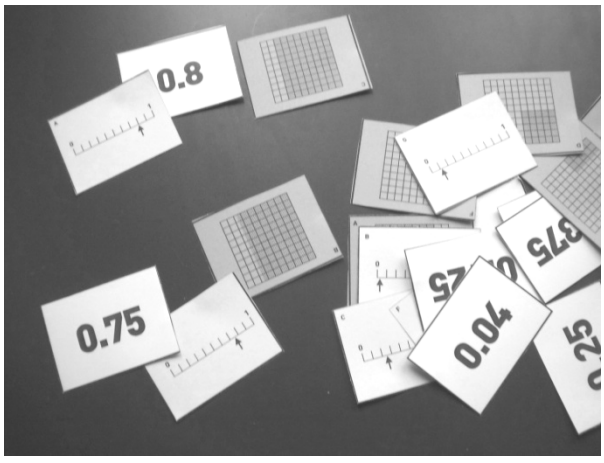


Fig. 5 ***Thinking Through Mathematics*** **Fractions Cards in Use (DfES 2007)**

Ruth All these are mixed up, I think.

Still not got a green

We've not got a green for 0.4

I don't know why, but we haven't

There were a number of further ways in which teachers could use recordings of their students as a reflective tool. For example, "Gestalt" moments were sometimes rendered audible – usually with the expression "Oh!" Analysis of the explanation or activity which led to such a moment of understanding might enable the teacher to identify successful approaches to use in future. Teachers might also identify whether students were over-relying on poorly understood algorithms rather than conceptual understanding. Finally, they could assess how students work together in groups; for example whether a student is dominating the group, or conversely, lacks the confidence to make contributions.

Conclusions: potential of this method for research and teacher development

In this brief overview I have aimed to show the potential of this research method for revealing new insights into students' social and cognitive experiences of learning mathematics, both for researchers and for practitioners. The method of using mobile phones (or other small, low-cost recording devices) was simple and unobtrusive, but yielded large quantities of usable and very rich data, which could be analysed from a number of research perspectives. A limitation is that audio-recording does not capture all aspects of classroom interaction, and the role of gesture, sketches, diagrams and symbols cannot fully be explored, but the affordances provided by video-recording have to be balanced against the more intrusive and sensitive nature of video-recording, which might render the resulting data less naturalistic.

With continuing professional development now mandatory for post-compulsory teachers in England (Institute for Learning 2009), I would suggest that this approach could be adopted as a reflective and evaluative tool for practising teachers, provided that issues of informed consent are addressed.

In my own study, a primary aim was to examine the funds of knowledge brought to the classroom by the participating students and how these were drawn upon in collaborative learning. 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. As illustrated in this paper, this method can be used to explore whether new approaches are more effective in drawing on students' funds of knowledge and developing their understanding in ways which are relevant to their lives outside the classroom. It also provides a powerful means to disrupt deficit discourses by demonstrating the social and linguistic resources, such as a willingness to express uncertainty, which the students bring to their learning.

However, the area I consider to be most urgently in need of further research is the exclusion of certain students from collaborative groupwork. Although this was not one of my original research questions, ways need to be sought to include students with disabilities and learning difficulties in all activities of the classroom.

I conclude by expressing my gratitude to the participating teacher and students, who generously welcomed me into their classrooms, and allowed me to record their discussions and share their enjoyment of their learning.

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