

Home and school numeracy practices: Where are the borders and overlaps?

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The paper explores theoretical and methodological issues arising from the application of concepts drawn from social literacies research to research into the home and school numeracy practices of children aged 5 to 7. The issues are illustrated with data drawn from the research.

Introduction

This paper explores questions arising from attempts to research the 'home numeracy practices' of children (from ages 5 to 7) and their families. To the researcher, these questions feel methodological, but they have implications for theory. Our research team attempts to conduct 'ethnographic-style' research (Bloome and Green, 1996) in the area of children's home and school numeracy, and to conceptualise numeracy with reference to literacy theory (Street, 1984; 1995). We² are working with four children in each of three schools, selected according to social features that might affect performance, including variables such as location, ethnicity and relative affluence.

Work in 'social literacies' (e.g. Barton & Hamilton, 1999) has addressed many issues which may have parallels with numeracy; one dimension of our research is to consider how far this social literacies work can be applied to the field of mathematics education. We have adapted the term *literacy events*, derived from the sociolinguistic idea of speech events, to investigate *numeracy events*. Shirley Brice Heath characterised a 'literacy event' as 'any occasion in which a piece of writing is integral to the nature of the participants' interactions and their interpretative processes' (Heath, 1982, p. 93). Brian Street has employed the phrase 'literacy practices' (Street, 1984; 2000) as a means of focusing on 'social practices and conceptions of reading and writing' and the models of literacy that participants bring to bear upon those events and that give meaning to them. Consideration of the relation between *literacy events* and

¹ The home and community numeracies team is part of the wider Leverhulme Numeracy Research Programme, which seeks explanations for underachievement in numeracy in primary school. More detail of the team's theoretical model is given in Street and others, 2001, on which the *Introduction* of the present paper draws. The Leverhulme Trust is also funding a parallel home and community literacies project, with which we have close connections.

² In this paper, the plural 'we' refers to the research team of all three authors; the singular 'I' refers to Alison Tomlin, the lead author.

literacy practices is a useful basis from which to engage in field research on literacy as a social issue.

The Leverhulme team defines numeracy as

more than knowing about numbers and number operations. It includes an ability and inclination to solve numerical problems, including those involving money or measures. It also demands familiarity with the ways in which numerical information is gathered by counting and measuring, and is presented in graphs, charts and tables. (Brown and others, 2001)

We have provisionally adopted the concepts of *numeracy events and practices* on analogy with *literacy events and practices* (Baker and Street, 1996). By focusing on *numeracy events* as units of inquiry in both home and school, we hope to observe those ‘occasions in which a numeracy activity is integral to the nature of the participants’ interactions and their interpretative processes’. We see *numeracy practices* as wider than the events in which numerical activity is involved, and so explore the conceptualisations, discourse, values and beliefs and the social relations that surround numeracy events as well as the context in which they are sited.

As the research has progressed the team remains confident that the concepts of numeracy events and practices are useful analytical tools in an attempt to develop our views of numeracy as social. My concern here, however, is to explore what may be some important differences between numeracy and literacy practices, and to lead from that into wider questions about how we construct and use borders between numeracy practices and other social practices.

Visibility

Numeracy practices may be invisible to an ‘observer’, leading to a question which I think may be less difficult in literacies research: *what counts as numeracy practices?* From much-challenged views of literacy as entirely distinct from orality, to others which problematise the speech/writing or orality/literacy distinction (reviewed by Gee, 1994, and Barton, 1994), there is a constant thread: *something* of literacy, at some time, is *visible*.

Street argues that only reading/writing are usefully termed ‘literacy’:

The metaphorical use of literacy in phrases such as ‘oral literacy’ or ‘visual literacy’ only works if literacy is being taken as a ‘skill’ or ‘competence’. In the broader sense of literacy as social practice, we can only see the relationship between reading/writing and other semiotic practices if we maintain the specificity of literacy as reading/writing. (Street, 2001)

Texts may be words, graphics, TV or computer screens – but they are visible, and outside the reader/writer/producer. Numeracy includes literacy, visual, gestural, and oral communicative practices, and additionally mental imaging and calculation. People ‘solve numerical problems’ without necessarily leaving any clearly identifiable trace that they have done so. For example, some of the most

significant ‘decisions’ for adults in which numeracy is involved are around jobs and household budgeting. I suspect the maths is hidden, for most people, in past experiences, constraints and choices. Such decisions or positionings may be more visible for the self-employed, or for people seeking state benefits - but for most people they probably do not feel like ‘numerical problems’. But even where an issue is consciously identified as one involving problem-solving and numbers, there are two further ways in which the numeracy may be invisible. Firstly, much numeracy goes on in the head, leaving no visible evidence. Secondly, people may count as maths only what they find difficult – if they can do it, it’s common sense rather than maths (Coben, 1997), so they don’t tell us about it.

Sometimes we do ‘observe’ numeracy practices at home, and Aaysha’s counting, described below, is an example. But because numeracy practices are often invisible to the researcher, many of the research team’s exchanges with children and their families are centrally focused not only on ‘observation’ of their practices, but also on interviews and on inference from both. In turn that has led in many cases both to a different quality of data from that we expected, and to some of our exchanges with children at home being disturbingly similar to school discourse. I will present an example of such an exchange, with Kim and his grandmother Carmen, below. It can with justice be criticised for poor researcher technique; my concern however is that the problems I shall raise are inherent in our conceptualisations of numeracy practices.

In the next section I will present some contrasting data extracts to illustrate these concerns, and in the final section I outline some possible directions for analysis and interpretation, and the questions to which these lead. The three children are in ‘Year One’ (i.e. the second year, around 6 years old) of the same inner city primary school.

Examples from the data

Aaysha

When Aaysha (at home) was mentally totting up the number of children in her class, she muttered children’s names to herself while counting on her fingers, counting three to a finger, as in a system commonly used in Pakistan. Her father pointed out that in the count-one-per-finger system used in London you can only count to ten, whereas in this system you have 30. Aaysha says she knows that, for example, four fingers are 12; that is, she already has a good basis for (in school terms) the three times table. I haven’t seen Aaysha use this system at school, and I doubt if her teacher knows about it.

Kim

Next I give an example of one of Kim’s numeracy lessons at school, followed by an example of his homework. Kim’s maths teacher, Dylan, introduced the topic of ‘halving’, with the whole class sitting in front of him.

Dylan draws two people on board ... Counts up to 12, putting one dot in each body, alternately, for each number on the count up. Asks children to count the dots in one body, they say 6 ... [and more examples] ...Dylan splits groups of cubes into halves, similar technique, putting alternate cubes in different piles. Kim is paying attention. Puts hand up to answer question *How many am I sharing them between?* - but he is not called on so don't know what he would have said. .. The children are split in groups of 4-6 children, to work on a worksheet with questions of the form *Half of 6 is ____*. Kim stands by himself, fiddling with his big construction that's been on a shelf most of this term, doing none of worksheet till Dylan went over to him. Then managed *half of 2, half of 4, half of 6* somehow, with Dylan standing over him. I joined them when Kim was doing the fourth question, *Half of 8 is ____*. Kim looked 'vacant' ... Dylan asked him to get out 8 cubes, and he did. Dylan said *Now share them between 2* and Kim did nothing. Dylan started doing it; told Kim to carry on. I'm not sure if Kim had understood the 'sharing' notion - his two groups were muddled up. Dylan asked him to do it again. He did it, with Dylan moving cubes again to make the two groups more clearly separated. Dylan asked Kim how many in half; Kim counted one group, didn't get to end, said 3. Dylan looked slightly tense and said try again; Kim got 4. Dylan said *let's do it again* and I suggested Kim could share the cubes with me. Dylan said *Good idea*, and Kim did it again, though again not moving the cubes much so it only worked because for each of 'mine', after he'd moved it I moved it again more clearly into my pile. Dylan asked *How many in half*; Kim counted his pile, said 4 ... End of maths lesson so that's all Kim had 'done' ... (From Alison's fieldnotes)

I have never 'observed' informal numeracy practices in Kim's household. Carmen, Kim's grandmother (who is often responsible for Kim while his mother is at work), has a formal view of numeracy and describes to me the formal calculations she and her daughter do, and Kim's place in that. The next example illustrates the extension of data collection from 'observation of home numeracy practices' into something harder to categorise.

Carmen showed me Kim's homework. The single hand-written A4 sheet had some anagrams of animal names for the child to write out correctly. The instructions said the answers were 'hidden' (around the border), but Carmen had not noticed that until I looked at the sheet with her; almost all the anagram answers were completed in her handwriting, not Kim's. The numeracy work was questions that took the form *One more than three* or *Four more than three*. Carmen had helped Kim rewrite them in the form $1 + 3 =$ in his exercise book, and there Kim had written the answers. Carmen was critical of the homework:

Carmen It a bit hard for Kim.

Alison Yeah, have you talked to [the teacher] about it being hard?

Carmen No, I won't tell him. Because he's a teacher, I don't have to tell him. I used to teach small kids back home, you know, used to teach before I come here. [...] This is too much for Kim.

Carmen ran a 'home school' in Jamaica, taking children up to the age of 11. I take 'I don't have to tell him' to mean 'I shouldn't have to tell him'. She continued:

Carmen Too much homework. He don't understand what he - he don't understand it you know. It's too much, he's only six.

Alison Right. And is that with the English and the maths?

Carmen Everything he get, everything he don't understand, no, no.

Alison So do you think it's too difficult for him?

Carmen [*Showing Alison the literacy work:*] This is what I did here. He can't do it. I write it here and then he writes it out on the paper, and then the spelling and I tell him that dog is dog but they mix it up and I say spell dog now, and he went d-o-g. And so that's how I teach him ... [*Showing Alison the numeracy work:*] I show him how to do it. I sit him down and show him how to do it, because if you don't explain it to them he can't know. Suppose we couldn't read them, how would he know how to do them? ... Because not every black family can read and write, I'm telling you the truth.

Whatever wider political and cultural questions this comment raises about the relationship between Kim's family and his school, I think it is also a response to Carmen's own discomfort with arithmetic questions written out in words (e.g. *three* for 3, and *more than* for +): in order to 'make them fit' with her own education and maths discourse, she had represented them as traditional arithmetic. The worksheet's use of words for numbers reflects a change in British schools, and is probably unfamiliar in Carmen's own experience as a teacher. I asked Kim about his homework:

Alison So Kim, can you tell me, these sums you've done here [*in the exercise book*], are these the same ones as these on here [*the worksheet*]?

Kim Um yes.

Alison Yes. So what it says on here [*the homework sheet*] is - one more than three. What have you written here?

Carmen Look. Stop that and look. [*Kim was playing with a toy.*]

Alison How would you say that? [*1+3*]

Kim One more plus three.

Alison One more plus three. You say plus. So how would you say this one? [*4+1*]

Kim Um, um, four plus three.

Alison Have a look at that, that's not a three. Four plus?

Kim Eleven

Alison No, have a look closely. Can you see it in the light?

Kim Four plus one.

Alison Yeah, that's it ...

Kim's wording is a mix of the worksheet's, which I had quoted ('more'), and Carmen's, using 'plus' (the school uses 'add'): that is, competing numeracy practices became conflated. There is no feeling that Kim has any ownership of the text.

Alison (to Kim) And when you were at school the last time I was there you were doing halving weren't you?

Kim Yes.

Alison (to Carmen) A number like, say a number like six, and he had them in counters and he had to find what half of six was.

Kim Half of six.

Carmen Is?

Kim Two.

Carmen Three

Kim Three

Carmen Half of six is three, half of ten is five.

Kim Five

Carmen Half of two is one.

Kim Half of two is one.

Carmen Yes. I sit and do my best with him.

Alison Does it help him to have pennies or counters like these?

Carmen He have loads of pennies, he can do them.

Alison Yeah, and does he use his fingers at all? [*I have not seen Kim use counters or fingers unless asked to do so by a teacher.*]

Carmen Yes

Alison So if you are doing four plus three, that's quite hard for a lot of children.

Carmen Yes, that's what I'm saying, I have to be drilling him and he just get fed up and walk away. He don't seem to understand.

Alison Yeah. And when you say drilling him, is that like getting him to remember them?

Carmen Yes, keep bothering him, keep bothering him.

(Two minutes later Kim keeled over, apparently asleep, and was sent to lie down.)

Next I contrast Kim's homework with brief extracts from my notes of a visit to Darris and her mother Ruby.

Darris

Darris took the microphone and said *Welcome to our classes everybody. Sit down - sit back and enjoy it ...* I had arrived while Darris was working on her homework ... She noticed that the numbers she had just ordered (changing the worksheet's 39, 19, 29, 9, 49 to 9, 19, 29, 39, 49) had a pattern, and said *I've got a song for it - and she sang from 49 to 199 (and went on, not singing, to 499) ...* Ruby (Darris' mother), helping her with a computer numeracy game, asked me whether the children have done tens and units, or columns, at school [that is, the traditional vertical layout algorithm]. I said they hadn't. She started teaching Darris: *The column that we start off with here is what we're going to call the units, yeah? So there's 8 units in that column [...] yes? and there's 2 and 1 in that column. So what you do, you add that 2 and 1 up, and what does it give you?* [Darris cheerfully tried out this method for several minutes.]

Again, the parent's assumptions about schooled numeracy practices differed from those of the school itself.

Numeracy practices or wider social practices?

Next I suggest different research directions to which these episodes may lead. My suggestions are not an exhaustive list, but indicative of openness to a range of possibilities.

Aaysha is a 'high achiever' in her class, and seems set fair to do very well in school numeracy. We can consider the fact that she seems to count using three to a finger only when at home, and her knowledge of what is 'appropriate' in different discursive settings, with all that implies about how those discourses

are established and maintained, and how they could be disrupted to incorporate home practices into school. We can consider the issues around the teacher's apparent lack of knowledge of Aaysha's skills ... and so on. Without different methods of data collection, one question remains unanswerable: does Aaysha use her knowledge of counting three to a finger in school? It may be that although we have not *seen* her use three-to-a-finger counting in school, her mental imaging of numbers has changed.

But perhaps counting-related issues are a side-track. Aaysha's parents, living now in shockingly poor hostel accommodation in London, are well educated. Her father has an MA in statistics; both parents were managers in a multi-national insurance company in Pakistan. The school knows the hostel where Aaysha lives; the teachers rarely meet her parents, who don't attend school meetings because of language difficulties. New lines of speculation open up: perhaps the school sees the parents as poor, probably poorly educated, and Aaysha as successful only because she conforms to school regimes. Perhaps her well educated family leads her to start school with a confident assumption that she will get on well. Aaysha is bilingual; how do her language strengths impact on her numeracy? Does her background give her the skills to switch between home and school numeracy practices and discourses with no difficulty? Such wider questions lead me to a concern that perhaps what is at issue in terms of Aaysha's development of schooled numeracy may not be just the particular counting technique as such, but cultural resources at a more general level, including her own and her parents' confidence in their maths skills, and her parents' very successful education.

Darris and Kim have many apparent similarities. Both were born in London, and are members of extended, supportive families. Their grandparents are Jamaican; their parents were either born in London, or came as young children. Both children live in households which appear to be 'comfortable' in financial terms. I can claim further similarities from the particular Darris and Kim episodes given here: for example, both adults use methods they are familiar with from their own schooling. But the tone of the two is very different. I think Ruby believes you have to *understand* numeracy – even if her understanding is not, in detail, the same as the school's. For Carmen, you have to *learn* it. Ruby, like the school, believes you have to *work things out actively*; Carmen believes you have to get to *know facts*.

Kim's homework and school work show clear differences between school and home epistemologies and pedagogies of numeracy - differences which almost certainly cause him confusion and difficulty. There are difficulties/ambiguities in the relationship between Kim's family and the school staff; perhaps we should inquire further into Carmen's evident concerns about the relations between the school and black families. Darris' mother's move into the vertical algorithm layout could be used as an incident showing the differences between her own experience of schooled maths and the school's

curriculum, and perhaps also a gap in the school's communication with parents about its numeracy strategy. Though Darris is cheerful and confident, perhaps her development in numeracy could be even further improved with better communication between school and home. Darris' confidence and ease in both home and school numeracy discourses could be explored in connection with her home and wider cultural life, since her making of a 'song' connects to her church and family singing.

But is numeracy the most important concern here? It may only be a marker for wider issues. Darris' confidence seems to come from some wider confidence in her world and her position as an active 'doer' in her family; and Kim is in such difficulties with education in both environments that he seems to be on strike or in shock. He is 'behind' in all areas of the curriculum, not just numeracy.

All three home episodes show numeracy practices which are distinctly different from those of the school. That already is a generalisation and leads us towards reflexive questions about our own discursive positionings and what we therefore 'see' (what we notice when 'observing'). In what ways are the children's 'differences' derived from our discursive lenses? How can we reach the less visible practices, which may change our picture? Do we 'see' numeracy practices more easily when they are distinctly different not only from the school's practices, but also from our own?

Some of the above wider potential directions for data analysis and interpretation are some distance from the funded purpose of the research. But if 'each practice is located within a network of practices which determine 'from the outside' its 'internal' properties' (Chouliaraki & Fairclough, 1999, p. 23), then to describe particular numeracy practices we need to see them in wider contexts. To detach Aaysha's counting from wider discursive practices, for example, may be to trivialise both the practices and the practitioner. We see the fingers, not the person, and the calculation, not its place in wider discourses.

Yet I have seen these three children perhaps twenty times at school, and up to six times at home, a poor basis for any attempt to describe their families' socio-cultural and linguistic backgrounds, the complications of the relationships of school, family and researcher, and the interplay of all these with numeracy practices. No-one can ever describe 'the whole picture', but that is not an excuse for stereotyping. To contribute to theory, we are tempted to a high degree of abstraction in order to be able to generalise. In abstracting and generalising, we may lose the sense of individuality and agency of particular children and their families and teachers.

The invisibility of many numeracy practices leads to both gains and losses for our research. We may over-emphasise what we learn from those practices which are visible. For example, to a researcher familiar with a quite different system, Aaysha's finger counting is visible in two senses: we can see it happening, and it 'stands out' for us because it is not the same as our own. But

we cannot tell (using our present research methods) in what ways her knowledge of two different systems affects her own mental imaging of numbers, and therefore we cannot tell how deeply or in what ways it has influenced her development of numeracy.

The invisibility of home numeracy practices has also led to both informal conversations with parents and school-like interchanges with children. When we cannot ‘observe’ home numeracy practices, we tend to ask questions instead and families often respond with discussion about schooled numeracy practices, both their own and their children’s. This generates data which leads outwards from numeracy practices to wider discursive and social issues - as our view of numeracy practices, outlined above, is intended to do. Complex questions are raised here: how are the borders between numeracy practices and other social practices constructed by researchers, schools and families? If we analyse only more strictly numeracy-related data, how damaging are our omissions? Yet how can we deal with data which crosses those borders, when our original methodology was designed for much narrower purposes? This paper has offered no answers to the questions, but we hope it will contribute to a productive discussion.

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