

Communications

What is numeracy?

RICHARD BARWELL

A comment on 'Mathematics as social: understanding relationships between home and school numeracy practices', Baker, Street and Tomlin, 23(3): In their recent article, Baker *et al.* (2003) draw on the notion of numeracy. Quoting an earlier article by Baker, they define numeracy events as:

occasions in which a numeracy activity is integral to the nature of the participants' interactions and their interpretative processes. (Baker *et al.*, 2003, p 12)

They also use the term numeracy practices, which:

are not only the events in which numerical activity is involved, but [...] the broader cultural conceptions that give meaning to the event [...] (Baker *et al.*, 2003, p 12)

They give an example of a numeracy event, in which Aayesha, a young informant from a South Asian background, counts on her fingers, three-to-a-finger. The authors see numeracy events as embedded in numeracy practices, such as counting three-to-a-finger. By looking at the different numeracy practices in which numeracy events are embedded, it is possible, they argue, to explore different meanings and social relations involved in numeracy events. In their article, therefore, they speculate on the possible significance of Aayesha counting three-to-a-finger in an interview conducted in her home, in contrast with the practice of counting one-to-a-finger prevalent in her school. They relate these ideas about numeracy with a social view of *mathematics*, in the sense that mathematics can be seen as socially constructed.

Whilst I support the social perspective they argue for, their article raises questions for me. They rely heavily on the notion of numeracy, a term not widely used in a field known as *mathematics* education. I am therefore prompted to ask: what is numeracy? Is it different from mathematics? Should mathematics educators be interested in numeracy? In this article, I consider these questions, through an exploration of the origins of the term numeracy in research on literacy.

Research into literacy includes a broad and influential strand of work that sees literacy not as a set of discrete skills such as spelling and punctuation, but as social practice. Informed by a number of significant ethnographies of literacy (such as Street, 1984; Heath, 1983; Barton and Hamilton, 1998), this work seeks to understand the role of literacy in making meaning as part of people's everyday lives. This perspective is indicated by the following quotation from Barton and Hamilton (1998):

Literacy is primarily something people do; it is an activity, located in the space between thought and text. Literacy does not just reside in people's heads as a set of skills to be learned, and it does not just reside on paper, captured as texts to be analysed. Like all human activity, literacy is essentially social, and it is located in the interaction between people. (p. 3)

It is striking how several recent works on literacy have included some comment on numeracy (see, for example, Barton, 1994, pp. 101-103; Barton and Hamilton, 1998, pp. 176-180; Street, 1995, p. 136). It is as though, in their ethnographic research into literacy practices in everyday life, they have repeatedly tripped over something they have called numeracy. Barton and Hamilton, for example, describe the literacy practices involved in cooking, including reference to and use of a recipe (1998, p. 8). Later in the book, they point out how using the recipe also involves numeracy, such as measurement, relating imperial or metric units to various standardised or informal measuring implements and doubling a recipe to make a bigger pudding. Barton and Hamilton (1998) also give some examples of activities involving numeracy observed in their study:

- gardening, cooking, making clothes, knitting
- following current affairs with charts and diagrams in the newspaper
- health, medicine, contraception, dieting
- doing finances, dealing with bills and bank accounts
- house repairs
- astrology
- arranging travel
- shopping
- map-reading
- using household technology, such as video machines. (p. 177; abbreviated list)

This list of activities suggests that, for Barton and Hamilton, numeracy may involve the use of, or interpretation of, numbers or numerical information, calculations and diagrams. I hesitate to attempt to define mathematics in this article, but if mathematics involves some aspect of abstraction or attention to structure, these activities do not necessarily involve mathematics, since what might be seen as mathematical is embedded in the practice of the activity. That is not to say that such activities cannot be *mathematised*, either as part of the activity, or as an academic exercise. In Baker *et al.*'s numeracy event, the *authors* mathematise the event, by considering the affordances of counting three-to-a-finger in relation to understanding multiples of three.

A difference therefore emerges between numeracy and mathematics. Numeracy somehow involves the use of numbers, calculation or diagrams in social practice, whilst mathematics involves some degree of abstraction or concern with structure. This, still slightly vague, position implies that mathematics is therefore a largely schooled practice, analogous with academic literacy. There remains, however, the

issue of the relationship between numeracy and literacy. Let me return to the literacy literature to consider again the notions of events and practices.

Although the terms numeracy event and numeracy practice are regularly used in literacy research, they are rarely defined. Authors rely instead on an implicit equivalence with literacy event and literacy practice. It is interesting, therefore, to consider Barton and Hamilton's earlier quotation (1998, p 3), replacing 'literacy' with 'numeracy':

Numeracy is primarily something people do; it is an activity, located in the space between thought and text. Numeracy does not just reside in people's heads as a set of skills to be learned, and it does not just reside on paper, captured as texts to be analysed. Like all human activity, numeracy is essentially social, and it is located in the interaction between people.

For me, this reworked quotation makes sense. As Baker *et al.* argue, Aayesha's finger-counting does not exist as an autonomous skill, it is filled with social, situated meaning that emerges through interaction. The reworked quotation raises a question, however: what is the text? Literacy is defined through reference to text (which some have broadened to include visual texts; see, for example, Gee, 1996, p 144). Is text a part of numeracy events? In the case of the above examples of practices involving numeracy, many texts are used such as recipes, DIY instructions, measuring devices, maps and hi-fi displays.

In the case of Aayesha, there is no printed or manufactured text. Her *hands*, however, can be seen as a text (literally *manufactured*), around which meaning is made. This implies, therefore, that numeracy practices are a subset of literacy practices, rather than an essentially different kind of practice. Numeracy practices are literacy practices involving 'numerate' texts, that is, texts that include numerical information, including information in the form of diagrams. This observation sheds further light on the nature of numeracy itself. If literacy is the social process of making meaning with text, then numeracy is the social process of making meaning with numerate text. Numeracy and numeracy practices are not necessarily mathematical, although they are mathematisable, as sometimes occurs in mathematics education.

Let me offer a brief hypothetical example. Road-signs are a form of text. Drivers make meaning as part of a social process of driving their cars on the road. A sign that reads 'school' under a red triangle containing a silhouette of two children has no intrinsic meaning. Drivers learn to interpret the sign through driving lessons, tests and experience. Their interpretation informs their actions as they drive. They may slow down or try to be more alert. They may ignore the sign, arguing, for example, that the school is closed or is not near the road. These behaviours are examples of literacy practices.

A speed limit sign that contains the number 30 in a large red circle is also a text, which in this case involves a number. Drivers learn to interpret this sign in particular ways. They may check their speedometer, making a comparison between their speed and the limit. They may make judgements about their experience of the speed of the traffic and of how close they are to the car in front. They may slow down (or speed

up). These behaviours are examples of numeracy practices. They involve making meaning with text involving numbers (other signs involve maps or directions). These practices are an inherent part of driving. They are not mathematical. They can, however, be mathematised, as school problems about cars and speeds attempt to do. Solving such problems entails moving between numeracy practices and mathematical practices, relating experience of the everyday world to the kind of carefully constructed 'context' of many school mathematics tasks (see Boaler, 1993).

So, if numeracy is a form of literacy, rather than a form of mathematics, should we, as mathematics educators, be interested in numeracy, or should we leave it to the linguists? I believe that we should be interested, but also that we should engage with what ethnographers of literacy have to say. Research that focuses on literacy covers a wide territory, much of it of interest to mathematics education. Two examples come to mind.

One area of research seeks to understand the relationship between home and school in terms of differences in literacy practices and the greater or lesser value these different practices are accorded by society (see for example, Heath, 1983; Street, 1984; Gregory and Williams, 2000). This work has a lot to contribute to mathematics education's perennial concern with the difference between students' mathematical performance at school and at home (e.g. Nunes *et al.*, 1993; Abreu, 2000).

Following on from this focus, a second area of literacy research explores the notion of critical literacy. By exploring the role of text in people's lives, it is possible to explore with students the different literacy practices used in different circumstances and so develop a critical awareness of the nature of literacy and its role in, for example, the maintenance of power relations (see Gee, p. 144). Such research is relevant to, though not identical with, research in mathematics education that seeks to develop a critical aspect to the teaching and learning of mathematics (e.g. Skovsmose, 1994, 2000; Alrø and Skovsmose, 2003).

In this communication, then, I have argued that numeracy is not identical with mathematics, and is better thought of as a form of literacy. Far from rendering numeracy a notion of no interest to mathematics educators, however, this characterisation invites a potentially fruitful dialogue between research into literacy and research in mathematics education. *For the Learning of Mathematics* might be one place in which such a dialogue could take place.

References

- Abreu, G. (2000) 'Relationships between macro and micro socio-cultural contexts: implications for the study of interactions in the mathematics classroom', *Educational Studies in Mathematics* 41, 1-29.
- Alrø, H. and Skovsmose, O. (2002) *Dialogue and learning in mathematics education: intention, reflection, critique*, Dordrecht, Kluwer Academic Publishers.
- Baker, D., Street, B. and Tomlin, A. (2003) 'Mathematics as social: understanding relationships between home and school numeracy practices', *For the Learning of Mathematics* 23(3), 11-15.
- Barton, D. (1994) *Literacy: an introduction to the ecology of written language*, Oxford, Blackwell.
- Barton, D. and Hamilton, M. (1998) *Local literacies: reading and writing in one community*, London, Routledge.
- Boaler, J. (1993) 'The role of context in the mathematics classroom: do they

- make mathematics more 'real'?, *For the Learning of Mathematics* 13(2), 12-17
- Gee, J. (1996, second edition) *Social linguistics and literacies: ideology in discourses*, London, Falmer
- Heath, S B (1983) *Ways with words: language, life and work in communities and classrooms*, Cambridge, Cambridge University Press
- Gregory, E. and Williams, A. (2000) *City literacies: learning to read across generations and cultures*, London, Routledge.
- Nunes, T., Schliemann, A. and Carraher, D. (1993) *Street mathematics and school mathematics*, Cambridge, Cambridge University Press
- Skovsmose, O. (1994) *Towards a philosophy of critical mathematics education*, Dordrecht, Kluwer Academic Publishers
- Skovsmose, O. (2000) 'Aporism and critical mathematics education', *For the Learning of Mathematics* 20(1), 2-8
- Street, B. (1984) *Literacy in theory and practice*, Cambridge, UK, Cambridge University Press
- Street, B. (1995) *Social literacies: critical approaches to literacy in development, ethnography and education*, Harlow, Essex, Longman

Mathematics and mathematical practices: where to draw the line?

BILL BARTON

A comment on 'Solid geometry in the works of an iron artisan', Castro, 23(3): It is always interesting to read about the implicit mathematical knowledge of ironworkers, weavers, tailors and other practitioners as they undertake their various crafts and professions. Quantity, relations, and space are integral parts of many aspects of human life as we both make sense of the world around us and also manipulate it for our own ends. The formalities of conventional mathematics are only one mode of recording and developing these aspects of our lives – mathematicians are by no means the only ones who work with number, logic, and shape. But therein lies a conundrum. At what point do we call these activities mathematics? When is an iron artisan doing mathematics, and when is he or she crafting iron? Can they be doing both at the same time? How do the two activities relate to each other?

Fernando Castro (2003) describes in detail a particular incident in which an ironworker demonstrates, during the construction of part of a toy truck, the knowledge that a right parallelepiped has equal diagonals. Or does he? It certainly seems unlikely that these terms are used in the same way by the ironworker and Castro (in fact they may be, but it is not clear from the article, and it is easily possible to imagine that the craft worker understands the concepts of 'right' and 'parallelepiped' but does not use those terms). I also imagine that this knowledge is, for the ironworker, neither formulated as the statement of a theorem, nor as a logical 'if and only if' relation.

In which case, just how is this knowledge formulated? My reading of the article leads me to believe that there are some fundamental differences about the way Castro and the artisan relate to this knowledge. Castro's development of the activity as a classroom exercise that focuses on the knowledge in isolation is definitely mathematical (and as such may not

always be recognised in all practical situations). The artisan's knowledge is embedded in practical knowledge in a particular context, (and also may not always be recognised in other contexts, including a formal mathematical one).

There have been many studies done on these issues: studies in ethnomathematics, studies in mathematics education, studies in situated cognition, studies in anthropology, studies in the history of mathematics and studies in indigenous knowledge. The writers will be familiar to many. Ascher, D'Ambrosio, Gerdes, and Knijnik are early (and continuing) writers in ethnomathematics – the many later ones can be found in the proceedings of the two International Congresses on Ethnomathematics (ICEMs) (Contreras, Morales and Ramirez, 1999; Monteiro, 2002), or the movement's newsletter. Zaslavsky is the most well-known writer in adapting cultural materials for the mathematics classroom, but members of NCTM and others have been active in this area (Jones, 1998; Krause, 1983; Trentacosta, 1997). Lave (1988) is credited with the theory of situated cognition, also cited are the street-vendor studies of Carraher, Carraher and Schliemann (1985), and the carpentry investigations of Millroy (1992). The anthropologist most noted in the mathematical arena is Pinxten, and there are myriads of studies of the number systems of different cultural groups. Joseph has, in recent years, highlighted non-Western perspectives on the history of mathematics, but other writers have also contributed (e.g. Berggren, 1990). The area of indigenous knowledge is relatively new compared with the others: a starting point for those interested is Semali and Kincheloe (1999).

The question raised by Castro's article, however, is the relationship between these areas of study. This is an urgent question because there is the potential for serious misunderstandings within this body of work. For example, writing in one area has been criticised as if it was from another. Rowlands and Carson's (2002) critique of ethnomathematics as if it is an educational movement is a case in point, the rebuttal (Adam, Alangui and Barton, 2003) differentiating between the open educational questions, and the ethnomathematical issue of relativity in mathematical thought. Similarly, motivational materials using culturally specific material have been critiqued as if they were part of the mathematics curriculum rather than as attempts to address equity-related educational issues. Another example is the welcoming of Joseph's historical works (e.g. 1992), by ethnomathematicians, although Joseph himself has some ambivalence about the basic philosophies behind ethnomathematics (personal communication).

First, it should be noted that the boundaries between these areas of study overlap – the differences are often ones of emphasis and focus rather than distinct features. Furthermore, many writers deliberately address more than one of these areas in the same article, for example Knijnik (1999) addresses ethnomathematics, indigenous knowledge and education simultaneously.

Castro, despite the later, education-oriented section of the article, is addressing ethnomathematical issues. As this is my orientation also, what follows makes a first attempt to distinguish that field from the others.

We would do well, as Castro does, to refer back to Ubiratan D'Ambrosio's original writing about ethnomathematics. The