Mathematics and Numeracy in the Practice of Critical Citizenship

Jeff Evans,
School of Mathematics and Statistics, Middlesex University, Enfield, Middx. EN3 4SF

Ingrid Thorstad,
Community Education Division, Matthew Bolton College, Birmingham B5 7DB.

This work arose from separate projects which we have discussed together but are presenting in two separate sections. Section 1 is basically the work of Jeff Evans and Section 2 of Ingrid Thorstad.

Section 1
Initial Considerations

In recent discussions across various branches of education, it is striking to note the growing acceptance that mathematical and numerate thinking are "situated"; that is, they have to be observed and understood **in context**. This agreement is evident both in mathematics education (Lave, 1988; Nunes et al., 1993) and in adult education (Riley et al., 1984; Thorstad, 1991).

Indeed, the idea of **numeracy** has been used to emphasise the need for "the maths" to be learned (and often used) **in context**. What distinguishes the context of everday numerate thinking and problem solving from that of academic mathematics is the different activities and practices which form the different contexts. Thus the numeracies used in the work of builders, pharmacists and shop-managers are all different - because they are based in different practices and hence are specific to them. Therefore there is in principle a *discontinuity* between, say, school maths, and the numerate ideas and skills that are used in shopping - or between numerate aspects of two different practical activities, such as shopping and playing bridge. These ideas have been explored and developed in a wide range of recent research projects: those of Nunes, Schliemann and Carraher (e.g. 1993) in Brazil; those of Jean Lave (1988) in the USA (for a summary, see Evans and Harris, 1991); those of Valerie Walkerdine and others in the UK (e.g. Walkerdine and Girls and Maths Unit, 1989;); and those of Nick Taylor and others working within the democratic movements in South Africa (e.g. Taylor, 1989).

Now if numeracy is specific to each meaningful context in which it may be "found", it follows that we need to learn and develop it within specific practices, using the languages specific to that activity. (NOTE 1)

Let us consider what numeracy conceived within this new framework might be like. There is a rich variety of non-school practices which involve "numerate" aspects, and in which almost every adult in industrial (and other) societies participates:
- many work practices, such as engineering, accounting, making machine tools; plus
- a range of "everyday" non-work practices.

Some of the latter include:
- purchase (and/or production) and consumption of food and other necessities;
- involvement with, and raising of, children;
- paying for (and/or building) and maintenance of housing and its surroudings; plus
- engagement with discussions and debates about individual, family and public well-being, and about describing, appreciating, evaluating, deciding on future directions of public policy.

This last activity might, for the moment, be called *critical citizenship.*

It is possible to envisage the learning of what might be recognisable as numeracy or mathematics-type "skills" being taught in a way that is grounded much more explicitly in many of these practices, or perhaps in a combination of several. However, for school level learning, it would seem that the wide variety of *work* practices that might be relevant to the pupils makes the task of choosing a single (or a few) appropriate "grounding(s)" exceedingly difficult. And this difficulty will be heightened by the continuing high level of change in workplace practices that is predicted.

We would argue that, in many settings, there is likely to be more shared experience around contexts related to the learners as *citizens*, present and future, than around those related to them as future *workers.* Thus, we would like to explore more fully the characterisation of a practice of *critical citizenship.* In the UK of the 1990s, it is likely to involve engaging with issues such as (NOTE 2);

> *What have been the increases in income for different groups in society since 1979, and have these been fair?*
> *What would it mean for the increase in unemployment to be slowing down, would it matter much, and is it doing so?*
> *What would it mean for inflation? (see next section)*

We make a start here by focussing on the skills and resources likely to be necessary for the practice of "critical citizenship". The specific skills are likely to include :
- knowing about information sources and how to read them (see e.g. Irvine Miles and Evans, 1979; Frankenstein, 1989, esp. Ch. 17; Marsh, 1988);
- the ferreting out of information produced, but not published (see Irvine et al. (1979, Ch. 10) for some hints);
- methods for the production of information / data at a small-scale level in the community (see e.g. Kane, 1984); and
- interpretation of information either from other sources, or from one's own research.

For other possibly relevant skills, see the discussion of community researchers and "barefoot statisticians" in Evans (1989). (NOTE 3)

Thus, an important resource in the struggle for critical citizenship is access to, and a grasp of, *official statistics*, from which we obtain most of our information about government spending, unemployment, inflation, poverty, and many more (e.g. Irvine et al., 1979). In 1990s Britain, access to these sources of information takes place (largely through the media and) in a context constituted by the following tendencies by government and the state:

- mystification of trends through publishing of claims without reference to full details of the assumptions etc. which are necessary to interpret them; e.g. on the oft-repeated claims that there has been "increased government spending" in certain areas, see e.g. Radical Statistics Health Group (1987) and Radical Statistics Education Group (1987);
- frequent changing of crucial definitions; e.g. unemployment, "new hospital schemes" (a measure of the claimed expansion of the NHS);
- ceasing to publish certain statistics e.g. the number "living in poverty".
For fuller discussion of these last two issues, see e.g. the Channel Four *Dispatches* programme "Cooking the Books", Jan. / Mar. 1989.

These and other examples give grounds for optimism that links can be made between distinct practices, that can promote learning, including learning that may be useful for the practice of critical citizenship. In this enterprise, the concept of *numeracy* - especially in the sense above - can help to point the way ahead through developing numerate thinking which is grounded in practices such as *critical citizenship*.

These ideas prompted us to look for activities where critical citizenship could be practised. In the exploratory research described in the next section, we focus on adults training to be school governors, and their understandings of several numerate topics, including percentages and inflation.

Section 2

Understanding Inflation

I aim in this paper both to trace my journey from one piece of research to another in order to describe some of the processes involved in initiating research, and present some thoughts provoked by my results.

My starting point was 'Adult Numeracy and Responsible Citizenship', a project initiated while funded by the UFC. I was aware that considerable attention had been given to the numeracy requirements of adults in relation to their everyday needs and work but very little in relation to the numeracy needed to understand issues of political and social concern. Marilyn Frankenstein's text book 'Relearning Mathematics' (1981) is one of the few exceptions.

I decided to focus my research on 'Numeracy and School Governors' as school governors were being asked to assume greater responsibility for the management of schools, including the financial details of management. I was concerned that the changes either would completely disenfranchise many parents, especially those who were anxious about their maths, or at least would mean that they would not participate in crucial financial debates. Not everyone I spoke to agreed with my preoccupation: some thought that the 'detail' of financial calculations could be left to sub-committees.

I approached the research from different angles. On the one hand I observed Governing Body Meetings and Governors' Training Sessions and talked to paid officials in order to understand what might be expected of a school governor - and in particular their

numeracy needs. On the other hand I gave out a questionnaire at training sessions to a toal of 47 school governors and I interviewed some of them in greater depth.

It was only after some deliberation that I decided to include some mathematical questions in the questionnaire. I based two of the questions on calculations and concepts that had been required at one of the School Governors' training courses. In one question they had to calculate and add on 5% to an item on the school budget. The second question was designed to assess their understanding of the mechanics of inflation. I was interested in the latter question for several reasons. Not only had it arisen on the training course but it was clearly related to the notion of critical citizenship. Furthermore it was based on a question that Bridget Sewell (1981) had asked it as part of her study for the Cockcroft Committee. Sewell had written:

> Percentages play an ever increasing part in the dissemination of information, both through the news and from central government. Those who lack the skill even to calculate 10% are surely handicapped when attempting to understand the affairs of society.(Sewell, 1981).

Her question was phrased as follows:

> On the news recently it was said that the annual rate of inflation had fallen from 17.4% to 17.2% '
> What effect do you think this will have had on prices?
> (If answer 'none') What do you think ought to happen if it had fallen to, say, 12%?

There were other reasons too for my interest in this question: the replies of her interviewees did not fall into the standard pattern. In answering the other questions it would seem that most people either assessed their capabilities fairly accurately or underestimated them, as when they chose to answer a question they usually got correct. *Inflation was the only question which many people elected to answer and yet gave the 'wrong' answer.* Of the 50 people she asked, 16 gave the correct answer, 22 the wrong answer and 12 did not answer.

I updated the question and phrased it slightly differently as it was part of a questionnaire and not given orally.

> The rate of inflation has fallen a lot in recent years.
> What effect do you think the recent fall to 4½% should have had on prices?
>
> The prices should have continued to go up
> No change
> Prices should have gone down.
> I don't know.

Over 80% of them gave correct answers to the '5% question' but only half of them gave a correct answer for the question on inflation. I then went on to interview 16 of them as part of the broader research which gave me an opportunity to ask them how they had 'worked out' the answer. And, because I was now interested in finding out more about how people explained their choice of answer, whether or not their answer was right or wrong, I also asked some students in an adult numeracy class.

There were two particularly interesting answers from those who had answered

incorrectly in the questionnaire: both had said that prices should fall. One governor, when she came to explain her choice said:

> The prices wouldn't actually go down would they? They wouldn't go up so fast.
> (But you said they would go down.)
> But some things go down, like house prices. They've gone down a lot.

That she understood the concept of 'the rate of inflation' is clear from this answer. It would seem that her first answer, the wrong answer, was as a result of her awareness of the importance of house prices in terms of budgeting. The second used all her 'common sense' to help her come to terms with the concept:

> If the rate of inflation comes down, therefore the mortgage comes down. That's what you look for. But prices do not come down - they should but they don't. I do not bring my prices down. You tend to think, I'll pocket that little bit extra and when prices have gone up again I haven't got to put the price back up.

This governor correctly realised the link between the mortgage rate and the rate of inflation, but she wrongly thought that falling inflation meant that shop prices should fall. However, this mistake was cancelled out by her practical decision not to lower her prices. I was particularly interested in these two answers as they seemed to illustrate the benefits and hazards of learning in informal situations.

These aspect of the research recall a series of studies into the learning mathematics in out-of-school situations, in particular those carried out by a team in Brazil into the mathematics of young street vendors, foremen on building sites and bookies. Their research seemed pertinent to the situation many adults entered, be it school governors' needs to 'learn on the job' or all adults' needs to understand as much as possible about inflation. In all these work situations, the people involved seemed to have a better understanding of the topic than the adults that I interviewed had of inflation. The reason for this may be that anyone acquiring new mathematical concepts in work environments, where incorrect answers can lead to immediate and disastrous consequences, is in a position where the calculations are verified. However, this is not true in the case of isolated adults learning about inflation. Most of them had gained their knowledge from the television and newspapers and so their concepts were rarely challenged and they were reduced to making sense of the concept without the benefit of feedback. The stage of interactive learning, through discussion with others, be it at work or in a class, is missing, as is the opportunity to verify their ideas. On top of all this, most people's cynicism leads them to believe that prices would never go down in practice even if that is what they believed should happen in theory. However, the results of Schliemann and Acioly (1988), who investigated the understanding that bookies had of probability, clearly show that the greater the length of time at school the greater the likelihood of their giving logical answers to questions relating to probability which seems to indicate the need for a variety of approaches to learning and in particular formal input as well as meaningful everyday situations.

So, from the initial question: Do school governors understand 'the' meaning of inflation? I moved on to: What do adults understand by inflation? Further questions such as: How do adults acquire their knowledge? Does the quality of their understanding bear any relation to the different ways they acquired their understanding, their mathematical knowledge and ability, or the number of years that they spent at school?

Notes

1. This raises a whole series of questions about traditional ideas of numeracy and how it is taught and learned. In particular, the position on numeracy put forward here is exceedingly sceptical that transfer of learning from school to other settings such as particular jobs is anywhere near as straightforward as the proponents of other views on numeracy would have it. For further discussion of these issues, see Evans (1995).

2. We should like to acknowledge the contribution of members of the audience attending our presentation of this paper at the ALM Founding Conference, July 1994.

3. Radical Statistics Group (RS), including its thrice-yearly newsletter. RS also receives requests from voluntary and pressure groups for help in questionnaire construction, sampling, etc. in connection with surveys of "needs", self-monitoring, etc. Further information from: RS, c/o London Hazards Centre, 3rd Floor Headland House, 308 Gray's Inn Rd., London WC1X 8DS.

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