‘Real life’ in everyday and academic maths

Alison Tomlin, King’s College London

Data from a participant action research project with basic education students is used to challenge dominant notions of adult basic maths students’ needs for ‘real’ and ‘everyday life’ contexts for maths.

Introduction

This paper draws on data from a participant action research project with adult basic maths students, in inner-city areas of south London (Tomlin, 2000; Tomlin, 2001). The students were all attending general basic maths courses (two hours a week) for which, in the period when we did the research, there was no set curriculum in the UK and course content was negotiated between students and tutor. Most of the students also attended literacy courses. The data challenges the view that curricula for basic maths should be determined by tutors' or policy-makers' notions of ‘real life’ maths. I don’t want to argue against using maths from students’ ‘everyday lives’. However, I do want to argue against the idea that we can predict, for students, what ‘real life’ means, or that we can always help with the maths that students need in their everyday lives.

First, I look at examples of the claim that adults returning to basic maths should be offered curricula and learning materials from ‘everyday’ or ‘real’ life, drawn from UK national policy and the work of Marilyn Frankenstein, Roseanne Benn and Jeff Evans. I will then present some snapshots of data drawn from the students’ and my research which, I argue, challenge this dominant perspective. In analysing the data I used tools from critical discourse analysis (e.g. Fairclough, 1992; Gee, 1999), which helped me to recognise my own position, both as a dominant voice in the classroom and as someone who believes, as do many in adult basic education, in the importance of a ‘real life’ focus.

The claim that adults should work on maths from ‘real life’

This claim seems common sense – the implied alternatives are ‘unreal’, or ‘abstract’, and sound like the kind of maths many students have suffered in the past. Indeed, it may have contributed to their being failed in school maths. The claim that adults should work on maths from ‘real life’ comes from different perspectives within education; those I cite particularly address adult education.

UK official policy

Here I point to the place of ‘real life’ in the new UK adult basic skills curriculum. The teacher’s job is to relate maths skills, seen as universal, to the students’ personal contexts. *Everyday, familiar*, *straightforward* and *practical* are used as descriptors for levels and content. These definitions are from the glossary:

P. Valero & O. Skovsmose (2002) (Eds.). Proceedings of the 3rd International MES Conference. Copenhagen: Centre for Research in Learning Mathematics, pp. 1-9.

> Everyday: an adjective used to describe numbers, measures, units, instruments, etc. that fall within the daily lived experience of most people in non-specialist contexts. (DfEE and Basic Skills Agency, 2001, p. 89)
>
> Familiar: describes contexts, situations, numbers, measures, instruments, etc. of which the learner has some prior knowledge or experience. (p. 89)
>
> Straightforward: describes information, subjects and materials that learners often meet in their work, studies or other activities. (p. 91)

'Practical' is not defined, but we can work out possible meanings from the contexts in which it is used. Here is one example: at Entry Level 2, learners should 'use and interpret +, -, x and = in practical situations for solving problems' (p. 26). The sample activities for this section are:

Match words to symbols, using a range of vocabulary
Match word problems to written calculations
Translate single-step word problems into symbols and solve. (p. 27)

'Practical' here seems to mean the use of spoken or written word problems, the traditional way to bridge the calculation: real world gap.

A critical perspective

Marilyn Frankenstein, writing from a Freirean perspective (e.g. Freire, 1972), argues for centring the curriculum on students' contexts:

> Teachers can ask students about the issues that concern them at work, about the non-work activities that interest them, about topics they would like to know in more depth, and so forth. These discussions can indicate the starting point for the curriculum. Then the teacher's contribution can be to link up the students' issues with an investigation of the related hegemonic ideologies. (Frankenstein, 1987, pp. 195-6)

and

> Hopefully, the more practice students have in creating questions, the more they will become used to asking questions, in school and in their daily lives. (Frankenstein, 1987, p. 210)

UK government policy sees maths skills as free-standing, best learned in the students' contexts, and then transferable to new contexts. Frankenstein similarly sees maths learning as originating in the students' everyday lives but then seeks to use the learning process as a way towards changing students' lives, as part of a critical agenda. The political stances are radically opposed, and that is reflected in the examples of 'real life' contexts: the UK government's are often domestic or vocational, whereas Frankenstein's are typically drawn from social-economic data. However, the assumptions that maths is best learned in real life contexts and that tutors can come to know students' contexts are common to both.

A citizenship perspective

Roseanne Benn's argues that

> If mathematics is a dynamic, living and cultural product, the contextualisation of problems is essential. (Benn, 1997, p. 38)

Benn seems to imply that it is possible for maths problems to have no context. I shall suggest that the ‘context’ may be the group’s own discourse, rather than something drawn from outside the classroom. Benn’s suggestions for pedagogy and the curriculum (though not prescriptive) are centred on a citizenship agenda:

> Fostering critical awareness and democratic citizenship for adults through mathematics requires questioning and decision-making, discussion, permitted conflict of opinion and views, challenging of authority, and negotiation. Hence the curriculum must include these components, and materials should include socially-relevant projects, authentic social statistics, accommodate social and cultural diversity and use local cultural resources. (Benn, 1997, p. 88)

My difficulty is that ‘fostering critical awareness’ is presented here as something that students need and tutors can give; ‘challenging of authority’ is something timid students need to learn from confident teachers. But the authority may be the teacher’s; the challenge may be rejection of this curriculum and a demand for, say, ‘straight’ fractions.

Discourse analysis and numeracy practices

Jeff Evans’ study of adults’ ‘numerate practices’ is directed in part towards addressing the question, ‘How should we teach mathematics so as to support adults’ functioning satisfactorily in their work and everyday lives’ (Evans, 2000, p. 289). That purpose for the teaching of mathematics seems to be assumed, rather than argued through. In other words, ‘satisfactory functioning’ has become a standard purpose for adult maths education; it has attained the status of ‘common sense’. I don’t seek to challenge that purpose of itself, but to raise questions about whether it should be the sole purpose (and in particular what place students’ purposes have in teachers’, policy and research discourses), and about the relation of tutors’ and policy-makers’ discourses to students’ ‘everyday lives’.

Next I give two examples of students’ work on maths from an ‘unreal’ world.

Students’ work on ‘unreal’ mathematics

A word problem

Word problems are typically used in an attempt to bridge the gap between problems in the real world and abstract maths symbols and calculation. This problem was written by a student, Tanya, as a contribution to her group’s work on the topic of money:

> There are 12 people waiting to use the phone. Each person spends 28p a minute and 3 minutes and 45 seconds on each call. a) how much does each call cost? b) how much do all the calls cost? c) how long does caller number 9 have to wait before it’s his turn to use the phone? d) how long does caller number 11 have to wait?

This is a perfectly-crafted example of the word problem genre (Gerofsky, 1996). Word problems are very often a trigger for panic and anxiety, but Tanya's group worked through this problem together and commented on enjoying it. It required more difficult maths than Tanya expected. No-one knew how to find the cost of a call (most tried 28 x 1.45 rather than 28 x 1.75); caller number 9's wait required the time multiplied by 8, not 9; no-one, including Tanya, found any of the questions easy. The notion of a telephone queue is drawn from real life, but its associated 'problems', in my experience, would be whether it took cards or coins, and whether I had the right change. The students of course knew it was not a realistic question (as someone said, 'Caller number 11 would be long gone') but committed themselves to its solution. What gave the problem meaning was the writer of the problem and her relationship with the group: people tried it at first perhaps because it would be rude to ignore a colleague's problem; no-one knew the answers (unlike a textbook problem); they worked through it together, not in isolation, and shared ideas. Had this problem been in a textbook and set by a tutor, I suggest it would have triggered quite different feelings for the students; the problem's meaning came from its discursive production and context, not from the immediate text.

Fractions

The second example shows a challenges to my authority through demands for 'unreal' maths. The story concerns two different groups of students; the link is my own persistence in thinking the adult basic maths curriculum should be based in demands arising from students' 'real' lives. The first discussion followed on from a students' conference, and the second was an end-of-year meeting.

After the students' conference

The students' conference had included discussion of what students characterised as 'everyday' and 'textbook' maths. I called on 'real life' to justify my arguments against work on fractions. I was immediately challenged:

Alison	The fractions, you just don't use it in real life, at all, ever, I don't think.
Jeremy	You do, you do, you do.
Alison	When?
Tracy	Actually I think you do.
Jeremy	That's where you're wrong, because [in] the topic I was studying [accountancy], right, they had to write all the fractions out in the book for you, so you could work out the 8%, the 10%, the 15%, 25%.
Alison	Oh yeah, percentages, yeah.
Shazia	Percentages, but that comes into fractions as well, doesn't it. 25% is a quarter.
Alison	Yeah.
Jeremy	No, no no, no, but they show you the fractions, like say you've got a 100 pounds, how to work the VAT [tax] at 8% or 25% or 15%. To make sure you got it right, they worked (.) they did the fractions, and they were put beside the percentages.
Alison	Right. But you can, you see, you can do percentages by decimals instead of by fractions, and I think it's easier. If you do it by decimals, I think it's easier.

Shazia Quick, write that [i.e. the method] down! [laughing]
Lorraine Show us how you do that.
Jeremy That's what it was in the book, and it was quite clearly explained.
Antoinette We went to a shop, a store, and they have (.) three third -
Alison A third, a third off, or something.
Antoinette Yeah.
Shazia Yeah, you do -
Alison Yeah, it's true. Ok, I'll back down.

This exchange made me realise that students saw me as being too general in my argument against fractions. I still believed that in everyday life people did not need to use more complicated fractions, but recognised I needed to distinguish between these and Antoinette's 'a third off'.

The following day: an end-of-term discussion

My agenda included discussion of students' options for the following year, and checking aspects of the research project, including how students wanted to be identified in anything I wrote; I did not intend any work on fractions at all. The group discussed topics in maths which they wanted to pursue, and mentioned fractions, at first in the context of the requirements for entry into the next level of maths course. I had the previous day's discussion in my mind, and I commented,

> things like five sevenths multiplied by four fifths ... you never do it in your normal life, do you?

Joyce said,

> You learn it, and then you forget all about it, because it's never necessary.

Meanwhile, Dave had been working on it: *I got 0.5714285 for that*, and then Joyce worked out an answer: *Four seventh. And what the hell is four sevenths?*

My suggestion that complicated fractions were unnecessary (except for higher level courses) had backfired on me. I tried to get off the fractions topic, but Joyce didn't want to stop:

> If somebody ask you that question [5/7 x 4/5] now, you know like you just mention it. It's not a thing you're going to <u>use</u> anyway. Just to know how to do it …

In responding to Joyce, I said,

> Where it comes in useful is when you're doing algebra, to know that when you're multiplying fractions you multiply the top by the top and the bottom by the bottom..[1]Those rules come in useful later on …

I was suggesting a context for which I thought work on the standard algorithms for fractions calculations would be 'useful', even though Joyce had implied that usefulness was not the only criterion for deciding whether a topic was worth

1 'Top' and 'bottom' are often used in English for 'numerator' and 'denominator'.

studying. I had given the multiplication rule as an example only, but Dave interrupted me:

> What did you say, multiply the top by the top and the bottom by the bottom? But that's only if you've got the same numbers on the bottom, isn't it?

This question revealed an error, and then Dave gave me an example to work on (4/5 x 4/7). We did that work, and I tried again to get back to my own view:

> But ... this is not useful, I don't think, you can go through the whole of your life without this, but in maths, in later studies in maths, suppose you had half of some number and you don't know what this number is …

… and we worked on solving equations (e.g. 3x/2 = 6) for about 10 minutes. I then firmly changed the subject and asked the students about further participation in the research; then the conversation drifted onto holidays. Dave interrupted us:

> Can I just show you something ... I just want to know whether this is correct or not or whether I'm missing something, a stage, out.

This turned out to be division of fractions.

I returned again to my own agenda, asking the students what names they wanted me to use for them in writing up research, and checking with each student individually. As soon as each student had replied, Joyce started up the fractions discussion again. She had meanwhile been working with Violet on fractions problems they set themselves:

> Well we still want to learn, what we take this thing for. Right, I'm doing this, trying to, this is something I want to remember, as I go along… this one we just done, the multiply. Four sevens twenty-eight, 28 times 2, something six, fifty-six? (The calculation was 4/5 x 7/10 x 2/7.)

This story shows me, as tutor, several times being pushed back into a fractions lesson. The fractions were ‘meaningless’ in that they had no content beyond the numbers themselves: the four-fifths were not four-fifths of the population, of a pizza, or of a budget. Yet the manipulation of fractions seemed to be, for that hour or so, the only subject that had real interest for the students.

Why were the students so interested in the abstract manipulation of 'meaningless' fractions? I didn't ask that question - perhaps I should have, but I was concerned with my own agenda. I can suggest some possible answers based both on these transcripts and other conversations. Many students associate fractions with being failed in school maths. Some for that reason seek to avoid fractions; others want to overcome that earlier failure. Some of the group wanted to check they were up to the required standard for a higher level course the following year. The abstract maths becomes 'real' through students' engagement with it. In Benn’s terms (quoted above) the students ‘challenged authority’ – but it was the teacher’s authority; they used ‘local cultural resources’, including their solidarity in working together on their own problems.

Although this group pursued traditional fractions algorithms, they didn't do it in a traditional way. The questions were student-generated and expressed orally, and people worked alone or with friends as they chose. Many of the questions were harder than a tutor would set for a course at this level.

Next I turn to an example of a ‘real life’ maths problem.

A real problem: paying for electricity

When I asked a group of students to ‘bring in some problem to do with maths’, Margaret asked the group about her electricity bill. She was moving; she had the choice of a quarterly-read meter (with further choices of payment method, some of which reduced the unit price), pre-paid plastic card (requiring a deposit) or cash meter. She had a low weekly cash income, and wanted to know both which was the cheapest payment method, and which would be easiest to handle. Within the discourse of maths education, working out an answer would require checking the unit rates, standing charges and deposits for all payment methods; if relevant (a question in itself) checking Margaret’s previous average bills; estimating her likely consumption in the new flat; applying answers from the first questions to Margaret’s probable future consumption; and comparing results. This is technically demanding, even with a calculator; for example, unit charges are expressed in pence to two decimal places.

Margaret understood perfectly well that the maths involved was ‘too difficult’ for her - that was exactly why she brought the problem to the class. It was solved, but not by mathematical methods, or at least, not following the steps outlined above. Others in the group advised her that the card would suit her best; their reasons included flexibility (you can charge it up as much as you want) and security. I said I thought a quarterly bill, paid by direct debit, would be cheaper. The students agreed, but all, including Margaret, ruled it out because they could not take the risk of direct debits on small and fluctuating bank accounts.

Real world problems are *real* – Margaret *had* to have a solution, then and there. Margaret knew the other members of her group well enough to tell them she didn’t know what to do about her bills. Her colleagues were able to draw on their own experience to suggest a solution – in Luis Moll's terms, they used the group’s ‘fund of knowledge’:

> *funds of knowledge are manifested through events or activities*. That is, funds of knowledge are not possessions or traits of people in the family but characteristics of people-in-an-activity. (Moll & Greenberg, 1992, p. 326; original emphasis)

Margaret’s problem points to the folly of assuming that tutors, policy-makers or researchers can predict students' mathematical questions, or always answer them. I could have analysed Margaret's question and made elements of it into a manageable mathematical inquiry - but I could never have known enough about the other variables involved to help her towards a decision. It’s manipulative, perhaps, of tutors to seize on ‘real life’, as we judge it, and slow it down by analysing it. Further, such an analysis, or ‘specification of practice’, as Jean Lave puts it, may misrepresent the situation:

> The problem is that any curriculum intended to be a specification *of* practice, rather than an arrangement of opportunities *for* practice (for fashioning and resolving ownable dilemmas) is bound to result in the teaching of a misanalysis of practice […] and the learning of still another […] In the settings for which it is intended (in everyday transactions), it will appear out of order and will not in fact reproduce “good” practice. (Lave, 1997, p. 33; original emphasis)

Margaret's problem was ‘practical, familiar and everyday’, in the terms discussed above, and the group's solution was ‘straightforward’, but it was beyond the competence of the tutor. Margaret's colleague students shared the knowledge of ‘people-in-an-activity’ – that is, ‘good practice’ in this context - in ways I could not.

Conclusion

Analysis of data from the whole research project showed a consistent demand for an extremely wide range of curricular possibilities. Individual students may choose to work on particular topics (and choices may vary over time), but all the students argued that the available curriculum should be very wide.

One of the ways in which tutors and policy-makers constrain the basic education maths curriculum is through our focus on ‘real life’ and ‘everyday’ contexts. My concern is not to argue that a basic maths curriculum for adults should or should not be based on such contexts, but to raise questions about the basis of the distinction and about the ethics of tutors’ being positioned as able to decide what is or is not real life for students.

The data supports an argument that meaning is discursively formed, so that students’ engagement with the material (and the potential for learning) depends not on the material itself, but on the discursive contexts of the work, including group relationships, prior experiences and the practices behind the production of the learning materials. ‘Academic’ maths can become the real world; apparently ‘relevant’ materials can be meaningless; and some apparently mathematical real world problems may not be soluble through tutors' mediation.

Jean Lave argues that we need to:

> move away from the relation that looms so important because of its theoretical and institutional history - that between the ‘everyday’, or ‘concrete’, and the ‘theoretical’, scholastic abstraction of school maths - towards a different distinction: that between things (real and imaginary) that do and do not engage learners’ intentions and attention. (Lave, 1992, p. 88)

In talking as though we (tutors and policy-makers) know or can predict students’ everyday lives and maths problems, we risk being profoundly patronising. What is real, everyday or relevant, or has meaning, depends on things far more complicated than tutors can know. They include students’ personal aims for the course of study – for example recovering from previous experiences of being failed, or moving flat; students’ personal maths histories, in and out of education; the history of relationships in the particular group; the discourse of texts, including the practices behind its production – a student-written problem is not treated the same as a text-book problem; the particular discursive contexts at the moment the maths is being done; and the tutor's role in the group.

If meaning is discursively formed, as I have argued here, then I think a key element in course planning that lies within tutors' influence is the framing of group discourse - what students are able to say, with what authority, in the classroom. We must stop speaking for students, however kindly we do it; unless there is more space for students' voices, we will never be able to explore, in Lave's terms, 'things (real and imaginary) that do and do not engage learners' intentions and attention.'

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