

Using sand to count their number: developing teachers' cultural and social sensitivities.

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Abstract

In this paper I consider issues that derive from the viewing of mathematics as social practice for the teaching of adult mathematics and numeracy. The theoretical model is analysed and possible implications for adult education practices developed. I argue that the model allows more nuanced understandings of relationships, contrasts and tensions between adults' everyday mathematics practices and formal educational mathematics practices. The paper draws on my current research in the UK and in the LETTER (Learning for Empowerment Through Training in Ethnographic Research) Project in teacher training programmes and workshops in South Asia and Ethiopia. This project uses ethnographic style research to enable teachers to understand their learners' own mathematics practices. The interrelated models of mathematics as social practices and the training of teachers in ethnographic style research provide the basis for training adult mathematics teachers to become more socially culturally and economically sensitive to their learners. I outline some of the background to and concerns about the teaching of mathematics to adults and illustrate this by drawing on LETTER workshop participants' accounts of their research into local mathematics events and practices. The accounts together with the theoretical positions are further built on to suggest guidelines for policy and practice in adult mathematics education that, I argue, will be of relevance to those working on these issues in the Latin American context. More cross cultural research is now needed to refine the theory outlined in this paper and to consider further potential implications for policy and practice in the teaching of mathematics to adult learners across international contexts.

Introduction

In a LETTER¹ workshop² in Ethiopia in January 2008, an event occurred which seemed to encapsulate many of the ideas I wish to raise in this paper. To prepare participants to go out into the local town of Bahir Dah to learn about local numeracy and literacy practices I presented the workshop with some photographs of events and incidents at Brighton station in the UK. The participants were asked to identify numeracy events or practices (these terms will be defined later in the paper). One photo showed a coffee-vending stall with prices of drinks on display. One of the participants at the workshop suggested that the giving and receiving of change when purchasing refreshments would be a numeracy event. This event would no doubt be recognised in many parts of the world. It is often seen as an “everyday” numeracy event to distinguish it from the formal mathematics of the classroom³. As this was an education workshop, the temptation when observing these practices was to seek ways that adults’ experiences of giving and receiving change could be drawn on in formal mathematics classrooms; that is, to seek links between the experiences learners have with everyday mathematics and the mathematics of the formal classroom and then to build their learning of formal mathematics on their everyday practices. The ways this has been done in many classrooms (I am not claiming this is true for all classrooms) has been to abstract from the purchasing event what is seen as the relevant mathematical skills and understandings that people need in order to operate effectively in this financial situation. One of those mathematical skills perhaps most likely to be abstracted from the change event is subtraction because the change can be calculated using subtraction. There are others that could be focussed on such as complementary addition. So, for example, when buying a coffee in the UK for £1.45, the change that I would get from £2.00 would be 55p. An approach using complementary addition which is very common in shopping numeracy would seek to find how much needs to be added to £1.45 to get to £2.00: that is 55p - perhaps seeing the calculation as an addition - $£1.45 + £0.55 = £2.00$. Whereas in an abstract classroom based representation this subtraction may be shown as $2.00 - 1.45 = 0.55$.

In my view there are many things that are problematic about doing this. I would like to focus here on three. The first is that by moving from the practices of change giving to formal classroom mathematics procedures such as subtraction the focus of attention becomes the procedures of subtraction rather than individuals’ meanings and uses when change is involved. In that sense we are privileging the procedures of the formal mathematical classroom and not being sensitive to learners’ experiences and skills. Further, there is a hidden assumption that the classroom in some sense is dealing with decontextualised mathematics rather than acknowledging that the classroom is a particular context with particular practices, values and social relations.

¹ LETTER (Learning for Empowerment Through Training in Ethnographic Research) is a project of Uppingham Seminars in Development (UK), a training organisation working in adult and non-formal education in a number of countries. It has been developed by Professor Alan Rogers, Professor Brian Street (Kings College, London) and Dave Baker London, (London Institute of Education).

² In this work I have been working alongside Professor Brian Street, Kings College, London and Professor Alan Rogers University of East Anglia and Uppingham Seminars. This article is based on work we have been doing together and without their inputs, help and support neither the work nor this article would have been possible.

³ There are contests about the use of the term “everyday” which I will not engage in here (cf. Tomlin, 2002).

Second, by seeking a generic procedure we are ignoring the variety of possible approaches that people may take including those of mixed methods that are fleeting, personal, idiosyncratic yet effective and useful. Then thirdly we should remember by seeking to move away from their everyday practices to the formal we are suggesting that the learners are in deficit. In those cases where they can give change but cannot do formal subtraction our focus on subtraction places them in deficit. We are then not making use of their funds of knowledge for numeracy (Baker, 2005). The practice in mathematics classrooms is often to identify what formal procedures learners cannot do and then teach that to them directly.

This account of the ways that everyday shopping practices can be drawn on in formal educational contexts needs close analysis to reveal the potential contrasting and problematic tensions between the everyday and formal practices for some learners. It suggests that if teachers of adult mathematics want to become culturally, socially and economically sensitive to their learners then they need a greater understanding of ways of analysing contrasts between the practices of the everyday and the practices of formal education. They will also then have much richer ways of seeking links between what the learners can do and what the teachers may want them to do in the classroom. It is those links, rather than privileging either domain, that the present approach is concerned with.

In this article I want to look first at the need to modify approaches to teaching mathematics to adults. Next, I will look at some of the conceptual and theoretical positions underlying my positions on these issues. I will then draw on some of the work I have been doing in relation to this field and finally draw conclusions about the field in terms of research, theory, policy and practice. The account together with the theoretical positions are further built on to suggest guidelines for policy and practice in adult mathematics education that, I argue, will be of relevance to those working on these issues in the Latin American context, as the chapters in this volume by Irma Fuenlabrada, Mercedes de Agüero and Alicia Ávila indicate. More cross cultural research is now needed to refine the theory outlined in this paper and to consider further potential implications for policy and practice in the teaching of mathematics to adult learners across international contexts.

I have tended to use the word mathematics throughout this article but have sometimes used the word numeracy to reflect links with literacy. In common with many others in the field I see numeracy and mathematics as synonymous and choose whatever term fits most easily at that point.

Background

Before proceeding it may be helpful to first explain the background to LETTER. LETTER (Learning for Empowerment Through Training in Ethnographic Research) is a project of Uppingham Seminars in Development (UK), a small training organisation working in adult and non-formal education in a number of countries. It brings together adult education, particularly the learning of numeracy and literacy, and ethnography. It aims to help adult trainers and course organisers gain firsthand experience of ethnographic style approaches to local literacy and numeracy practices in order to support learning and teaching. The project starts by working with the trainers of those who teach in adult and non-formal education programmes – the facilitators and teachers - so that the trainers can train the teachers to adapt these

approaches to their own local situations. LETTER sees this approach as a way of facing the substantial issues of equity and social justice within adult education, which I discuss next.

It is clear from research on attainment in mathematics and adult numeracy that there are considerable problems with a range of issues in mathematics education. For example the Moser report (DfES, 1999) estimated that up to 40% of the adult population in the UK have very low numeracy skills, and many lack the basic skills to cope with today's world of work. This is supported by a UK survey (DfES, 2003), which suggested that "15 million adults (47%) in England" had low levels of numeracy and this is despite the existence of universal primary education in the UK since 1870. Further, other UK surveys have shown that both men and women with low numeracy skills are more likely in their early careers to be unemployed, or involved in low-grade work in unskilled manual jobs without training (Bynner and Parsons, 2006).

There are also considerable ongoing and parallel problems concerning the learning of mathematics for children in schools (OECD 2004,). The issue in schools has occurred despite the considerable efforts and investment of time and money in schooling; for example in the UK National Numeracy Strategy (DfES, 1999). Other concerns have also been raised about the teaching and learning of mathematics. One of the most central to this paper is the long tail of under-achievement and ways that mathematics may be seen to contribute to issues of social and economic ex/inclusion (OECD, 2004; Feinstein, 2003; Burton, 2003; Black 2005). Further the Smith Report (2004), said that many students in the UK find the teaching of mathematics 'boring and irrelevant'. The concern that I have is that the difficulties learners' have may continue unless significant changes are made to the ways we teach mathematics. Could drawing more broadly on what students know and on their numeracy practices both inside and outside their classroom enable us to contribute to facing the concerns raised above?

The dominant response to the concerns within adult education in the UK has been to seek ways of broadening the approaches to classroom teaching to include substantial discussion and activity based learning. For example, the current view about effective teaching of mathematics to adults in the UK is shown in a mathematics project on "active learning" as described in Swan (2005). There it suggests that:

"Teaching is more effective when it:

Builds on the knowledge the learners already have. This means developing formative assessment techniques and adapting our teaching to accommodate individual learning needs

Uses cooperative small group work. Activities are more effective when they encourage critical constructive discussion rather than argumentation or uncritical acceptance. Shared goals and group accountability are important.

Creates connections between topics. Learners often find it difficult to generalise and transfer their learning to other topics and contexts. Related topics (such as division, fractions, and ratio) remain unconnected. Effective teachers build bridges between ideas". (Swan, 2005, p 2)

Many of these ideas have received the full support of UK official policy units and are seen by them as exemplary approaches to the teaching of adults. The role of discussion, talk through questioning and collaboration are prominent. It is interesting for us here to note that the concept of mathematics underlying these approaches is that of an academic classroom based subject. The document talks of the importance of the interconnections between particular content such as fractions and ratio. Nowhere

does the document challenge the nature of the mathematics they are intending the learners to learn. In fact “build on the knowledge the learners have already” is taken to refer to the learners’ knowledge of the formal abstract content of the classroom mathematics curriculum. This can be found using classroom “assessment techniques”. This model of teaching particular mathematical concepts requires building upon conceptually earlier ones; that is a linear developmental model. In that narrow sense what the learners know refers to particular skills and concepts within the formal mathematics curriculum. It seems to be based on what Freire (1972) called a banking model of education; that is adding more ‘formal mathematical’ skills to those they already have. What I am suggesting is that this is far too narrow a way of viewing “what the students know” and instead I will be arguing that to assist learning of concepts teachers need to build upon what learners know in a broad sense; that teachers need to be conscientized and to develop an “awakening of critical awareness” (Freire, 1976:19). I will discuss what this broad sense means in the next section.

Further evidence of the link between current approaches to teaching and an autonomous view of mathematics (see Street, Baker and Tomlin, 2005) is shown in the following extract from website based advice for teachers of adult mathematics (Website for Skills 4 Life Improvement Programme UK 2007). In section 3.2.2 there is an activity called “Comparing Methods of Calculation”. It says:

“Alternative Methods of Calculation

- 1 Answer the question below. Use any method you like but show your working out 45×127
- 2 Find someone in the room who has answered the same question but used a different method. Write this method below 45×127
- 3 Answer the next question using the new method 95×83
- 4 Reflect on the experience of using a different methods from the one you normally use. How did it feel? What are the implications for teaching? Which method is more appropriate to use with learners” <http://www.cfbt.com/sflip/PDF/D1-7%20Numeracy%20Materials%20AM%20Day%203.pdf>

This activity again is based on a model of maths as autonomous; that is it has placed the activity firmly within formal educational mathematics practices. It is seen as decontextualised and abstract. The learners are intended to learn the skills in this abstract formal context and the expectation is that they will be able transfer or apply the skills and concepts in another context. The authors of the document have extracted the skills from any everyday practices that the learners may have experienced in a similar manner to the removal of subtraction from the giving of change discussed above. It is interesting that the activity no longer sees mathematics as unitary by accepting and even encouraging a variety of different procedures to do formal calculations. As such this may indeed be a more effective approach to the teaching of formal mathematics. However, the mathematics being addressed here is implicitly seen as “decontextualised” skills and procedures, those removed from the practices beyond the classroom. No attempt has been made to justify this. That there is no need to do so reflects the dominant position of formal educational mathematics for adults.

What I am arguing here is that the dominant response to concerns about low attainment in mathematics in adult education has been to suggest some modifications to teaching approaches, but to retain both a narrow model of teaching and an autonomous ‘de-contextualised’ vision of mathematics in the curriculum. This

response seems inadequate given the substantial and intractable nature of these problems. In this article I outline challenges to these positions. Instead I suggest extensions to current practices in adult numeracy to make them more effective and more inclusive. In the next section I will outline the two theoretical and interrelated positions that have emerged in this work and that underpin the LETTER project. These two positions are mathematics as social practice and teachers as ethnographers. These two positions extend and broaden both models of teaching and visions of mathematics in the curriculum.

Conceptual and Theoretical Positions

The two key positions that I now outline are:

1. emerging understandings from viewing mathematics as a social practice.
2. teachers uses of ethnographic style research to enable them to be culturally 'socially' and economically sensitive to their learners.

1 What I mean by suggesting that mathematics is a social practice

I have written about this extensively (c.f. Baker 1998, Street et al 2005, Baker et al 2006). Briefly, in adopting this view I take mathematics to be a powerful set of symbolic tools, concepts, representations, and ways of thinking, which can be used to serve a number of purposes. I also work with the assumption that mathematical ideas are as much subject to interpretative approaches concerning ideology, institutions, social relations and values, as are other systems of meaning and communication that have been the subject of interpretative social science more generally. It is no more given that the tools and concepts of mathematics are 'universal' and 'value free', than it is for the study of literacy. The claim that mathematics is value free, culturally neutral and universal is what, following Brian Street's work in *New Literacy Studies* (Street, 1984; Street 2003), has been called an autonomous model of mathematics. The autonomous model underlies the extracts above where the ideas were seen in a de-contextualised and value free manner. This model does not provide sufficient understandings of concerns about some groups of learners underachieving in mathematics. In contrast the social practice model, which instead views mathematics ideologically, acknowledges the centrality of context, values and social relations in any mathematics events. I suggest that the latter model will enable us to extend our understandings and analyses of these issues of equity in mathematics education.

From this perspective, social relations refer to positions, roles and identities of individuals in relation to others in terms of mathematics. Social institutions and procedures are here seen as constitutive of control, legitimacy, status and the privileging of some practices over others in mathematics, as evidenced through accepted and dominant paradigms and procedures in the ways that mathematics is carried out and conceptualised. Taken together, these concepts provide an alternative way of viewing mathematical practices; that is an alternative model. In adapting NLS to the field of mathematics, I want to identify and make use of such a model because it may reveal complexities that are at present hidden, especially regarding context and power relations. This further enables us to acknowledge and make explicit the plurality of mathematics practices. This is what I mean by seeing mathematics as social practices: it is always being aware that mathematics takes place in contexts with values, beliefs and social relations.

To operationalise this and make it more explicit, following Street in relation to literacies (Street, 2000, 2003, 2005), I have used the term "numeracy (mathematics)

events" (Baker, 1998). These are instances where mathematics takes place and can be seen by an observer, indicated by the fact that they could be photographed. Returning to the event described at the start of this paper, getting change in a shop would be an example of a domestic numeracy event. Being asked by a teacher how much change you might get from a plastic 10 pence coin when buying an object for 4 pence in a classroom would be an example of a classroom mathematics event. The meanings of these mathematics events, however, cannot be fully understood simply by observing - or photographing - them; they are, the theory argues, embedded in sets of practices that form patterns and conceptualisations that I call "numeracy / mathematics practices" (Baker, 1998; Street et al, 2005). Mathematics practices refer to the patterned uses and meanings of mathematics in different contexts and settings. Classroom mathematics practices tend to have educational purposes, with the teacher, with her knowledge and expertise, in control. For example, the teacher selects and sets tasks to encourage the learning and consolidation of a particular skill such as working out the change from 10 pence to be received for differently priced hypothetical objects. Domestic mathematics practices tend to be domestic in purpose, where a learner has a level of involvement or control. An event involving purchasing objects when shopping could, be seen as an instance of a domestic mathematics practice in which, again, control is located in a different agent, in this case perhaps the shop keeper. What is seen as important differs between the classroom, the home and the market. In the classroom, knowing and recalling the change from 10 pence is an important skill in itself. The teacher knows the answer and sets the questions, which are not inherently part of managing money. The processes of teaching money or number in classrooms have certain values, contexts, social, and institutional relations, which I see as classroom mathematics practices. However, if a learner went shopping to purchase an object, the exchange of money might involve change, which would be part of the managements of the home and not an educationally determined and set skill. This would also be part of domestic or shopping mathematics practices with its own values, contexts, and social relations.

The second strand of what I mean by mathematics as social practices is associated with the constructivist teaching concept of building on what learners know. The social practice model takes a broad vision of learners' funds of knowledge for mathematics and in consequence requires an open yet structured engagement to finding out what learners know. This means we have to start from the premise that learners have substantial and valid funds of knowledge for mathematics. I will discuss this next and discuss effective ways of identifying their funds of knowledge using ethnographic style investigation.

Funds of knowledge and practices for mathematics

"Funds of knowledge represents a positive and realistic view of households as containing ample cultural and cognitive resources with great potential for utility for classrooms." Moll et al (134:1992)

and

"For numeracy we could take this to refer to our learners'

- Knowledge, experiences, histories, identities and their images of themselves
- Attitudes, dispositions, desires, values and beliefs, and social and cultural relations
- Relationships to learning, to teachers and to mathematics itself
- Numeracy practices beyond the class" (Baker, 2005, Street et al 2005)

The focus on students' "funds of knowledge" (Gonzalez, 2004; Moll 1992; Baker, 2005) shifts our attention as teachers towards what learners bring to our classes when,

together with them, we attempt to reconstruct their knowledge, attitudes and understandings as well as what they can do as a whole person rather than pasting a new skill onto an old one. It alerts us as teachers to issues of concern to our students, so that they become more central to our thinking rather than the content we are teaching. “Funds of knowledge” in Moll’s sense are therefore more than knowledge of mathematics facts and skills’; they are about processes of engaging with mathematics; relationships between people and relationships between people and their mathematics practices.

2 Using ethnographic style approaches to find out what they know.

Over the years people working in the areas of numeracy and literacy and development have put great amounts of energy and resources into trying to improve numeracy and literacy and work towards the empowerment of underrepresented people. This has generally taken the form of programmes that are designed by formally educated people who have very little sense of the real lives of the people they are trying to serve. Such programmes have tended to be top-down and skills oriented and are very often not as viable or relevant in the learners’ lives as they could be (cf Skills 4 Life Improvement Programme UK 07 Website as discussed on page 8 above). The tools and approaches of ethnography offer a more socially grounded and humanistic approach.

Taking an ethnographic perspective (Green and Bloome, 1997; Heath and Street, 2008) towards the development of literacy and numeracy means finding out what people already know, determining what their existing literacy and numeracy practices are and building on that, rather than assuming that learners bring nothing to a class and must be ‘given’ everything. It means moving away from literacy and numeracy as isolated and autonomous sets of skills, and instead moving towards literacy and numeracy as social practices that permeate the environment and the lives of those people for whom literacy and numeracy learning programs are designed. Those ‘autonomous’ programmes themselves also involve mathematical practices – social and ideological relations amongst participants – and not just ‘skills’ and are equally subject to ethnographic enquiry, as some of the chapters in this volume illustrate (Ávila; de Agüero). An ethnographic perspective means observing people’s uses and understandings of their practices and being sensitive to the variety of different approaches and uses with which they engage. Giving people a test or a formal interview would not be a sufficient ethnographic approach, in part because they themselves may not be conscious of what they do and what they know. It is unlikely to reveal the meanings and uses that people give to their practices.

Working these ideas

In the next section I will look at data drawn from examples where the approaches described here have been used. There are three examples. The first is a LETTER workshop in South Asia (Delhi). The second is a LETTER workshop in Ethiopia and the third draws on work done in adult education in the UK. I will look at ways that the approaches described in this paper can both shed light on adult numeracy education and provide positive ways forward for making use of learners’ funds of knowledge for mathematics that clearly have implications also for work in this field in Latin America. All the names used here are pseudonyms.

South Asia workshop

A full account of the workshops given in Delhi is provided in Nirantar (2007) and Baker et al (2007). The following is based on an extract from Baker et al (2007). As part of the workshop, members of the group were required to design a research project to study numeracy or literacy practices in environment near where they worked. An example of such a research design was provided by the participants from Nirantar, an NGO on women's empowerment based in Dehli. They set out to investigate the numeracy practices of *dalit* women in a rural village near Lalitpur in Uttar Pradesh in India, participants in an adult education class. Together with some members of Nirantar I observed mathematics events in the village. One such was the weighing of small and large amounts of metal (fig 1). The instrument was so well balanced and designed that it even registered the placement of a 5 Rupee note on one of the pans. It had apparently been designed and made in the village and was used by traders who saw themselves as largely innumerate and illiterate yet their mathematics practices for measuring were substantial, effective and reliable. The villagers were highly skilled in these practices although not skilled at formal classroom mathematics practices.



Fig 1: A balance for measuring the weight of metal objects in Mehrone, Uttar Pradesh.

A second numeracy event I observed was women measuring the produce they take to sell to shopkeepers in the villages. The shopkeepers only dealt with standard weights such as kilos. But the women use their own local container called a “*barajja*” (which holds about a kilogram of water) and a *paili* (which holds about 9 to 11 kg) to measure a range of produce including ghee, wheat and sesame seeds (fig 2). Everyone had their own *barajjas* and *pailis*. Conceptually these containers are measures of capacity but are used in the villages to weigh the produce. The weights of sesame and ghee that these containers hold are different because their densities are different. The women's farming numeracy practices seem to involve them in switching between their own measures and standard measures, between the concepts

of capacity and weight, and between the weights of different produce as they negotiate to sell it (cf. Saraswathi unpublished). Not surprisingly, given the differences in social and cultural backgrounds, the Nirantar trainers were not always aware of these practices, which were local, well-established and sophisticated. The practices were part of the women's 'funds of knowledge' for mathematics (Gonzalez, 2004; Moll 1992; Baker, 2005). Yet these mathematics practices had potential to contribute positively to the classes that the women were attending. It was also clear that these mathematics practices did not include written recording. As such, they were different to many usual classroom mathematics practices where different standard measures, different tools, different modes (written) and different social relations were privileged. The women's practices did not have currency in the classroom. However, an important part of the workshop was the extent to which their teachers had been aware of their practices or now were more sensitive to these practices and could now build constructively on the *dalit* women's mathematics practices and funds of knowledge in their teaching of adult mathematics.



Fig 2: A woman in Uttar Pradesh, India showing her barajja, a container for measuring her crops

Ethiopia workshop in Bahir Dah

A second LETTER project occurred in Ethiopia in 2007/8 with one workshop in September 2007 and others in 2008. One of the participants on the LETTER workshop in Bahir Dah, Ethiopia in January 2008 was Kebede Jobir from Arbaminch College of Teacher Education. As part of the programme he and his colleagues in the College investigated the use of an ethnographic style approach to alert them to the mathematics practices of women working in small-scale microfinance projects in Arbaminch town. They observed the women working and then talked to a small group of nine women from the areas of *Limat*, *Konso* and *Menoriasefer* about the

ways they worked. When asked how the microfinance programme would help them the women said:

“We have dreams of improving our families' economic well-being, developing our own income-generating projects, setting our children, especially our daughters, on a path to a better life through school which we never had ourselves”

Kebede and his colleagues looked closely at the practices of several of the women. In this paper I have selected just one to discuss. This was Matale Masalo from Konsosefer. She had borrowed 1600 Birr (about £90) from a microfinance initiative. She used this to make cheka a local drink in Konso. From this and the sheep she fed on cheka by-products she and her daughter made significant amounts of money. They kept some of this money secret from Matale 's husband to avoid it being taken from them. She said:

“We get money by selling cheka, and retailing of sheep, so it is good”. When asked how she calculated her profit. She responded that *“a cup of cheka sold at 0.40 cents and out of the 50 kilo grain that I bought, I got about 70 to 80 cups profit which nearly is 28 birr.”*

When Kebede asked when and how she returned her loan to the project, Matale answered as follows:

“I used to pay monthly 40 birr for a period of 40 months; for this I counted 40 grains (of maize) and kept it in safe place, in which a single grain is 40 birr, so when I pay 40 birr, I reduced one grain and so on”. (fig 3)

When asked where did you get such experience, she said,

“I heard when my father Masalo talked about his father i.e. my grandfather who was dead before my birth. I asked, ‘what did he tell you?’ “No, it is not for me”, she said, “My father talked to our family about my grandfather. I heard my father say that his father was having so many sheep, **he used sand to count their number**; when there is a new birth, he added one sand grain; if he slaughtered, he reduced one sand grain and so on. I was astonished by the knowledge of my grandfather at that time when I heard his duty, so I think it is my grandfather's experience that was transferred to me and helps me to calculate my loan of return,”

Kebede reported during his observation:

‘there were 26 grains. When we asked how many had been paid and how many remain, she automatically responded, “I have paid 560 birr, and 1040 remain”, which is correct.’

He also reported the following conversation with her

Kebede asked:, ‘Do your family members know where you keep this grain?’ “No”, she said, “Because my husband always asks me for money to buy drink. I refuse to give and he gets angry and we quarrel always. He thinks I have more money and he is unemployed, he used to say, so I am afraid that if he knows this, he may steal and throw away my grains to make me angry”, she said. I asked her, ‘what if something happens to you when you are away from home? Or if something like fire burns your house?’ She smiled and “Don't worry”, she said, “I am not a mother who leaves problems to my family. Every information about this is known by my mother. I told her and she knows; I also keep some money in her home, because I am afraid of my husband that he may steal it when I am not at home.”

These data, collected through ethnographic methods, reveal many things. They show some of the funds of knowledge and methods used by so called innumerate adults to successfully manage their finances within the context of their financial mathematics practices. These methods will not be the same as some of the book keeping techniques of the classroom. Yet they are powerful and effective. Further, there are also social relations particularly to do with gender and historical and cultural practices in which these techniques are sited which are not the same as those of the classroom. Indeed one of the surprising aspects to arise in Ethiopia was the value, claimed by some of

the women, in not having written records of their transactions. Written records they felt might leave their money more vulnerable to their husbands. Similar evidence to this issue relating to written forms of keeping accounts has been found in Bangladesh (Alan Rogers e mail 29 February 2008). I am not suggesting that these mathematics practices would be seen as sophisticated in relation to formal western mathematics. I am saying that even people who are labelled illiterate and innumerate have mathematics practices that are effective, powerful problem solving tools that could be built on if the women wanted to develop their formal educational mathematics practices, just as NLS researchers have discovered the literacy practices of many people designated 'illiterate' (cf Nabi, forthcoming). These practices, both numeracy and literacy, are embedded within contexts, values and social relations. Removing the techniques of handling finances from the practices in which they occur and are used by the adults in order to develop a curriculum and pedagogy for an adult mathematics classroom may however not be an effective or useful way of building on what they know in order to teach them. Further, without culturally sensitive approaches such as ethnographic style research to uncover the complexities and details of these practices teachers, who come from quite different backgrounds and experiences with their own funds of knowledge and practices, will be unaware of the rich resources, backgrounds, skills, understandings and uses their adult learners may bring with them to classes.



Fig.3 Matale a woman from Konsosefer shows how she uses grain to keep records: "A single grain is 40 birr".

Working with adults in the UK

In 2006 / 7 a research project looking at the extent to which teachers of adult mathematics make use of their learners funds of knowledge for mathematics was conducted in the UK. The project found (Baker and Rhodes, 2008) that teachers do seek to build on what learners know in a narrow sense about the topic being taught in their classrooms. But they were not sensitive to and did not take positive account of the learners' broader funds of knowledge for mathematics. The project looked at

tensions between what the learners knew about mathematics and what their teachers were able to make use of in their classroom.

An example of this from the project came from one of the teachers Katrina at Burstead College of FE. She said that learners have trouble coping with the metric system. They have no feel for metric units, as they don't use them in their everyday lives. They do not know even their own height and weight in metric units. But this topic is part of the formal examination and curriculum and they need to know the metric system to pass their adult numeracy examination. It is not however, part of their background and current practices in informal mathematics. This was especially true for older adults who were brought up with imperial units. Katrina accepts its place in the formal adult mathematics curriculum but it is clear to her that many of her older adult learners seem to struggle unsuccessfully with it. It is not part of their previous experiences of measuring and not sited in authentic settings for them. This, therefore, has the potential to conflict with what learners know outside the classroom and especially their informal everyday mathematics practices. Indeed what becomes quickly apparent is that some of the learners struggle with metric units because their out of class experiences and backgrounds were almost solely connected to imperial units.

Katrina: And if a person has been talking in feet and inches their entire life, and has never even looked at a thirty centimetre ruler, you are not going to transform their understanding of metric in that time. And it does almost become like – this is a topic, this is something you have to learn, here is a list of facts, go and learn it. It becomes very hard to make it more relevant to their lives. Because they will be going out of the class and they won't be using centimetres. Or suddenly change to thinking about their journey to college in kilometres instead of miles. It is a hard topic in that sense. Well it is a way that I think the curriculum is out of step with society, really. It is like everything in shops now, is sold in metric units, isn't it? But including myself, maybe yourself, perhaps everyone you know, who goes in and asks for half a kilogram of olives or something? It is not in our social consciousness to use metric. Yes, so in other words the curriculum is in conflict with it, which is interesting. I can't see us getting to the stage where that isn't the case. Which is quite bizarre when you think of how long metric has been around, because obviously it must be taught in schools, but from my experience youngsters still learn an awful lot of that terminology from talking to their parents. Because I have taught sixteen year olds, who I know will have been brought up totally with measuring in metric. And I go – how tall are you? Oh, five foot eight. (Interview Dec 2006) (Baker Rhodes, 2008)

The latter point shows how deep seated funds of knowledge can be and how significant experiences beyond the classroom are. We have to accept that funds of knowledge are not derived solely from educational contexts as is sometimes assumed in classrooms. Home backgrounds may be more significant than formal education experiences and may have a more substantial role to play in learning than has been assumed in the past. It also shows that informal “home” mathematics practices can be very different from formal mathematics practices and that learners need to be helped explicitly to switch between them, (Street et al, 2005). I am not saying that learners should not learn about metric units but that teachers need to be sensitive to their learners' experiences. In particular older learners who in their past had extensive experience of imperial units of measurement means that they lack the experiences on which to build knowledge of metric units. This seems to interfere with and inhibit their learning of metric units. The conflict raised here between the metric units of the formal curriculum and the imperial units of learners' funds of knowledge emphasise the importance of this issue particularly for older learners who then struggle to pass their formal adult examinations. There is evidence here of bias in adult education against older learners and therefore a lack of equity.

Conclusions

The intentions of the work described in this article were to understand issues underlying ways of encouraging teachers of adult mathematics to be more socially, culturally and economically sensitive to their learners. Experience and data from the field suggested that concerns about teaching and learning mathematics were complex and intractable and that teachers too often were unaware of the funds of knowledge and practices that adult learners bring to their sessions. To tackle these issues I based my work on two theoretical pillars; that is mathematics as a social practice and teachers as ethnographers. I have outlined in some detail understandings of these two key concepts. After the work I have done in the UK, Ethiopia and South Asia it is clear to me that practices based on these concepts have much to offer those involved in adult education both theoretically and practically in other international contexts, including the Latin American situation described by authors in this volume. In terms of theory, maths as social practices provides a lens through which to view and understand some of the rich experiences, practices and ideas that adult learners engage in. It alerts us to their funds of knowledge and shifts our attention away from aspects that they cannot do towards aspects that they can do. In parallel to this, ethnographic style research of adult practices provides a way of accessing as closely as possible adults' uses and understandings of these practices and the funds of knowledge and practices adults can bring to sessions. The situation remains complex and there is no suggestion in this work that this approach will on its own have solved the many problems in the teaching and learning of adult mathematics. There remains much research to do to refine and extend these processes, approaches and understandings but I would suggest that the work described here has begun the process of training teachers to be culturally, socially and economically sensitive to their learners in ways that it will be fruitful to see followed through in other contexts around the world.

At the same time some of the ideas that have arisen suggest that for teachers to be culturally and socially sensitive to learners there needs to be a substantive extension of current educational practices and policies towards the teaching of mathematics so that they:

- go beyond teaching autonomous skills and mathematical content towards practices; that is to teaching through events and practices, and to using students' funds of knowledge, including their funds of numeracy practices and encourages explicit switching between formal and informal practices.
- go beyond a limited focus on number and also include concepts from shape, space, data, patterns, ways of thinking etc
- go beyond teaching through embedding mathematical skills in educational contexts; that is moving from decontextualised and educationally embedded contexts towards "real" and purposeful contexts for learners such as giving change in a shopping context.
- go beyond a restricted focus on cognitive aspects of teaching and learning mathematics such as linearly developed abstracted skills and towards the development of social, cultural and emotional embedded mathematics practices.
- go beyond the performance of mathematical routines such as formal subtraction and towards a critical position; that is being aware of, confronting and extending the epistemological positions of formal mathematics practices.

- go beyond teaching numeracy as skills and towards the complexities and potential of teaching numeracy as social practices.
- go beyond deficit models and a narrow view of the funds of knowledge students bring to classes and towards building positively on learners' broad funds of knowledge and practices in mathematics; that is through using ethnographic approaches to ensure that teachers are culturally, economically and socially sensitive to students' beliefs, values, diversity, and funds of knowledge and aware of the complex issues of social relations and power within education.

I welcomed the opportunity to share the ideas and accounts outlined in this article at the exciting LALS conference in Patzcuaro, Mexico. The next step will be to identify, extend and research ways of implementing and refining the ideas and approaches derived from both mathematics as social practice and teachers as ethnographers to classrooms and teacher training in other countries, including those of Latin America, where colleagues from Mexico and Peru have already expressed an interest in putting on Letter workshops. I would welcome interacting with those who would be willing to take these ideas further.

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