

Uppingham Seminar

Numeracy in Development

20-22nd October 2005



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Uppingham Seminars wish to thank NRDC for their joint sponsorship of this Seminar; the presence of two overseas participants and one UK participant was facilitated by this assistance.

We also wish to thank DFID for their support; and several participants obtained financial and other assistance to attend the Seminar. We are grateful for all the support we received.

We are also very grateful to Kate Newman for drafting this report.

1. Introduction

1.1 Context setting

Uppingham Seminars have been running for the last seven years. They are an informal space for a group of practitioners and academics to engage with each other around a central theme. This time the seminar took place in Reepham, Norfolk, and the theme was *Numeracy in Development*.

The seminar was attended by 27 people from around the world. The range of people included practitioners, policy makers, and academics from 10 countries – representing the northern and southern hemispheres. The seminar took place over three days, from mid-afternoon on the 20th October until lunch-time on the 22nd. Following a brief introduction to the event, and summaries of the background papers, participants were able to decide the agenda and timetable and how to draw on the diverse experiences and perspectives available in the room. Over the three days, a range of lively discussions took place, sometimes in plenary and at other times in break out groups.

Rather than follow the discussion flow in a sequential order, this report outlines the key areas of debate and attempts to give a flavour of the discussion, raise contentious issues and indicate where consensus was reached. The seminar itself does not aim to give recommendations and conclusions; rather it is a space for reflection. This is evident in the nature of the report, where there are no conclusions drawn, just an outline of the different views which emerged during the seminar. Also evident from the report is that the dominant view held in the workshop was a belief in numeracy practices and knowledges. While there were divergent views, because of the nature of the seminar – with agenda setting decided through majority decision - there was less room for other voices to be heard. This report is based on what was discussed in plenary and does not attempt to give an analytical discussion on different interpretations of numeracy. Many examples from practice were shared during plenary session and in small groups. These are included in boxes throughout the report to give life to some of the points that were made. The report is divided into 5 sections: an introduction; exploration of the nature of mathematical knowledge; the bigger picture (ideologies, contexts and priorities); numeracy teaching and learning; and next steps. Significant and contentious issues that arose in the seminar included: meanings and uses of numeracy and maths; social justice: the nature of development; teaching and learning numeracy; power, class, gender, and culture: language; context, values and ideologies; critical maths. These are discussed in different sections of the report.

One key observation which provided a background to much of the discussion was that while Uppingham Seminars always focus on education in development, it is important to reflect on what we mean by this statement. This issue is particularly pertinent when we consider the recent flooding in New Orleans (August/Sept. 2005). Do we mean developing countries or developing societies? Does it refer to places that receive aid and have interventions from outside? Education is an intervention...but it is not always an invited one.

As the author of this report I have attempted to remain as neutral as possible in summarising the discussion and to avoid putting my own perspective on the debate. Other participants will be able to judge how successful I was in this!

Kate Newman

1.2 Background Papers

Prior to the meeting, four background papers were distributed along with a discussion paper on the overview of themes which might be considered in the seminar. This section briefly summarises these as a way of framing the topics for discussion which developed through the seminar. The summaries included here are based on how the papers were presented, using the words of the presenter rather than abstracts of the papers themselves.

Paper 1: Access and equal opportunities: Is it sufficient for maths and social justice? Dave Baker

Dave introduced his paper through starting with a story to highlight that maths or numeracy is not just about number but also geometry. The story concerned a community group who were building a sandpit in a park in Brighton; they had dug a hole and then asked a builder to come and build the walls. When he arrived, he looked at the hole and said it was not square. From his formal training, Dave could give lots of ideas of how to use maths to make the hole square but none of these matched what the builder did. He measured the diagonals to see if they were equal. This is not something that is usually taught in school. And the story raises issues about what is taught in formal maths in school and why certain kinds of mathematical knowledge are privileged.

This led to a reflection on the issue of power and how this impacts on curriculum selection. If maths is understood as a social practice, then the power of what is now seen as formal maths can be challenged through the curriculum. It is important that we, as those interested in mathematics teaching and learning, ask who chooses what people learn within the formal maths setting, why, how, what gives them the right to choose? And from this basis we realise that we need to go beyond the access and equal opportunities model, to transform epistemology and pedagogy. And from this we can begin to understand the social, political, economic and ideological aspects of maths education.

In reconstructing mathematics, there are options. As a minimum we can accept that people have to know the rules and procedures which enable them to do maths by building on their own practice, understanding what they are currently doing and looking at how they could use this knowledge in other places. A more radical option is to reframe pedagogical practices, to build on participants' funds of knowledge/practice and through this reveal social and power relations. In this way we can begin to challenge the 'occupation of mind'.

Paper 2: Occupation of our minds: A dominant feature in mathematics education in South Africa, Herbert Khuzwayo (spoken to by Dave Baker)

Khuzwayo builds on Fasheh's (see below) concept of the occupation of our minds, which Fasheh developed based on his experience as a Palestinian living through British and Israeli occupation. While the occupation of land is visible, the occupation of minds is invisible; how can you see it? Khuzwayo examines the history of mathematics education in South Africa, and argues that maths is used fiercely to occupy the mind – it is a political, social, ideological occupation of mind. This occupation is reinforced because maths is seen as Western (even though it doesn't have origins in Western thought) and, by following a technician approach to maths, notions of compliant acceptance of Western authority are implied. This occupation is not just colonial but can also take place within societies (cf New Orleans).

Paper 3: Mathematics, Culture and Authority, Munir Fasheh

"In 1952/3 I was studying maths, in Palestine, from a British book, There was a topic on shares. I never knew what shares were, but always got 100% in the test, this made me very happy. Much later I realised I still didn't know what shares are, what do they mean in a practical and real way?"

Basing his reflections on this story, Munir shared his view on questions of what mathematics and education are. Highlighting concerns with concepts of education for all/literacy for all which makes education and literacy sound like absolute goods, he comments that we should not just think about technical issues, for example ‘*how can I teach maths better?*’ but first need to think about ‘*what is my perception of maths?*’

For Munir, educating, empowering, developing or conscientising all have the same underlying logic. They all take the view that someone is further along the path, and that person can be given the job to take other people along the path. Because of this, development is the same as colonisation, and this needs to be challenged – by stories of development which show respect for people and do not undermine them.

Maths is about seeing relationships, patterns, similarities. It is about looking below the surface. Through understanding people and their maths, you can begin to understand the plurality and diversity which exist. This also forces you to question assumptions about knowledge – there is not just one knowledge but many. And there is not an absolute logic; a child might not share your logic, but that does not mean that they are not logical. Logic is how we understand what we witness in the world. “*Knowledge is making sense of my experience. I only want to know about knowledge which is part of your experience – if it doesn’t mean anything to you, then it doesn’t mean anything to me!*”

Paper 4: Whose economic wellbeing? A challenge to dominant discourses on the relationship between literacy and numeracy skills and (un)employment. Stephen Black (spoken to by Brian Street)

Black examines human capital theory which he sees as based on the assumption that increasing literacy and numeracy levels will lead to increased ability to gain employment. He challenges this by exploring a social cultural model that might imply it is the other way round and suggests that the industrial revolution generated the need for literacy and numeracy, not vice versa. Based on their belief in human capital theory, Western agencies have been going round the world saying the opposite, that literacy and numeracy will lead to economic development. In this model, numeracy and literacy are seen as goods, and the assumption is: “give them to the poor people, then things will improve. If things don’t improve, blame the poor people”. However, this discourse disguises the real explanations for problems in the economy. By focusing on numeracy/literacy ‘failings’ in a population, attention is diverted from economic and social models, from neo-liberalism.

1.3 Key Questions – framing the debates

In the context of the importance of numeracy and social justice; the need for clarity of interpretation of terms (numeracy, literacy, development, teaching etc.); and the implications of numeracy as social practice, the following background questions were suggested by the organisers of the seminar:

- a. **what do we know** and what do we not know about the existing numeracy practices of the people we work with?
- b. what methodologies do we need to develop **to discover** the existing numeracy practices of those we work with?
- c. what strategies can we develop to help the people we work with to **enhance** their own numeracy practices in a variety of contexts, especially where some of these are associated with positions of power?
- d. what modes of evaluation do we need to develop **to assess** the enhancement of those practices?
- e. what could be the **impact** on individual or community lives of the learning of a variety of numeracy practices?

These questions were expanded to include the following issues:

- How can we differentiate between tools and principles – and what value(s) do the different tools serve?

- What is the role of numeracy in accessing and securing rights and how can this be achieved?
- Where is the place for critical numeracy and ideas concerned with reading the world and dealing with power?
- Is there a place for formal mathematics and where does it fit? It is too simplistic to just dismiss it, so what sort of trade offs should we be considering?
- How can we use PRA tools – for example mapping, to develop numeracy skills and knowledge?
- Can numeracy transform people's identity, does it do something special to the way you see the world?
- Should we be discussing numeracy knowledges or is there just one numeracy knowledge?



2. What is the nature of mathematical knowledge?

The group decided that questions around mathematics knowledge or knowledges were crucial and would provide a basis for future discussions. Therefore it was agreed to start the second day with participants sharing their understanding of mathematical knowledge – based on their personal experience(s). By sharing key insights and drawing on practical examples, a picture developed around the idea of mathematical knowledges which provided the basis for later discussions on curriculum, value, development and social justice.

This section is divided into two parts. The first shares personal opinions and stories relating to mathematical knowledge. Because the stories were personal, they have been attributed and kept more or less in the words of those sharing the experience. This is done to emphasise the importance of individuals as ‘real people’ and to acknowledge that different people might have reached different conclusions having had the same experience. The second part focuses more directly on the debate about mathematical knowledge or knowledges.

2.1 Personal Experiences

- *Munir: we all have knowledge, it is without words in our bones, without concepts and theories. Transforming this knowledge into seeing connectedness and understanding patterns is important, and we can't do this unless we have basic knowledge. e.g. watching my grandson (15 months) eat cereal – while he ate, if he dropped a piece of cereal, he would look down, he already knew about gravity. So to say Newton discovered gravity is untrue – he might have added something to the knowledge of gravity – he saw similarity among phenomena which others hadn't seen – between stones falling and the moon revolving, he made the connections, saw patterns. But he did not discover gravity.*
- *Gelsa: We should be talking about knowledges, knowledge is justified for each of us in relation to our own life and our history, different knowledges have different justifications – knowledges is a statement and a justification. e.g. in the the Landless People's Movement (MST) – how do people know? If you ask them, they will say “because my father taught me, and his father taught him”.*
- *Saraswathi: Measurement means different things to different people at different times – it is object specific and situation specific, there is no abstract concept. It is functional, and standard measures are used in some specific contexts – where they are useful. e.g. I went to a village, asked: How do you measure length? Everyone looked puzzled. So I wrote down 40 items which could be measured, returned to the village, asked about the items, I was given lots of different answers depending on what the item was.*
- *Dominique: Even standard knowledge is different, the way that maths is taught in different places is different, so the way we actually perform maths is different – but you still get the same answer. e.g. in Canada, within*

Integrating mathematical knowledges into a curriculum

People count different things in different ways. For example, in one area in India, leaves are counted in bundles rather than individually and this is much more efficient. If people have effective strategies, what is the point of teaching standard units?

Part of measurement is about seeing/understanding connectivity – and this helps in transforming knowledges. If you start with people's experiences and then make links and connections, you can build new knowledge.

Language is another dimension – people count different things with different languages. This needs to be recognised, and other numeracy practices can also be brought into a curriculum; for example the geometric patterns which women design outside their houses in India.

But this is a bottom-up process, and it would be dangerous to do this in a top-down way – imposing a curriculum.

Reflections from group work led by Dominique and Saraswathi

the standard mathematical field, French mathematics is not the same as English mathematics. When I was involved in teacher training in Vancouver, I had problems with the textbooks – there were different ways of doing division, the result was always the same in the end but small steps are all different.

- *Brian: There is a need to balance traditional knowledge and Western knowledge, and look at how to develop training which blends these – taking an ethnographic approach means being culturally sensitive to local knowledge and understanding while teaching new skills, so that people do not feel the need to abandon their traditional knowledge. e.g. experience in Lalitpur, India. We have been training women in this area to teach other women, and the participants in the programme were going into the villages saying, Look, if you want to get hold of literacy (Western development ethos), then you need to abandon pre-scientific knowledge. For some, literacy and training is associated with science and advancement, so teachers were telling people, You have to abandon this pre-scientific knowledge. But our approach would be to build on this local knowledge, not to demean it.*
- *Dave: The maths that is taught in schools and universities privileges one sort of maths – the abstract sort with no pictures and no context. This maths is presented as high knowledge, as something very important to know, and other sorts of maths are disvalued. e.g. in a projective geometry course I took, lots of lovely maths were studied but not one diagram was drawn. If an ethnographic approach had been taken, we might have asked “Why was it taught this way, what does it mean?”*
- *David: Knowledge is not static, it transforms itself as it comes into contact with human beings who use and apply it – we internalise bits of knowledge, transform them, and externalise them/reapply them as new problems and challenges arise. e.g. with pole vaulting, the longer the sport goes on, the more we know about it, and we change the tools (the material of the pole, the distance of our run up etc.) to increase the vaulting capacity.*
- *Alan: Knowledges can be contested - within a socio-cultural context, and/or internally. Knowledges don't always fit comfortably, they have sharp edges – and this is particularly the case when you receive new knowledge. e.g. the knowledge which sits inside you is like a triangle; as it turns the points hurt but the more often they turn, they wear down, become more comfortable.*
- *Munir: The important question is: is the knowledge meaningful to the person? It might be that abstract knowledge is meaningful, that is fine, we shouldn't judge what is considered knowledge and what is not – it might be concrete, local, indigenous or abstract. What is important is that it makes sense, and it helps someone understand his or her life.*

What is numeracy? – Valerie Seabright

Early on in their course, Valerie asked her students (who are training to become adult numeracy teachers) to share what they understood by numeracy. Here are some of the comments they came up with:

Numeracy provides the tools to incorporate the mathematical skills needed to cope with everyday life; the role of numeracy enhances the transmission of information in order to facilitate an individual's understanding of the world. Without this skill people cannot become active citizens in society and therefore unable to participate effectively in activities that they value.

Making use of numbers to explain and provide information from the everyday to as far as your mind can see or you allow yourself to imagine

It is the ability to understand the concept of number and know how to apply it successfully in everyday situations

Numeracy is literacy with numbers – the everyday use of estimations, interpretations, measurements and quantities. However numeracy falls into 2 categories – essential numeracy and lifelong numeracy.

Being able to make the connection between the abstract thinking of numbers (counting, calculating etc.) to the application of using these numbers to our real world situations (shopping, timetables, measuring etc.)

2.2 Knowledge or knowledges?

The sharing of individual perspectives and stories gave rise to a challenge – what do we really understand by the word knowledge? do these experiences constitute knowledge or are they better described as opinions or views?

For some **knowledge has to be public and accepted/validated**, therefore some of the 'knowledges' shared above would be better described as views or experiences. Those that supported this view highlighted the fact that maths has been and continues to be constructed so that it is internally consistent, it is axiomatic with an agreed set of principles. The view is that if you do not have this, then it is hard to get common understanding and there is a practical need for a common consensus and unified bodies of knowledge. In addition, there is some knowledge that is just wrong, and this incorrect knowledge needs to be challenged. Furthermore, many learners come to class because they want to access the formal system; wanting to discuss the anthropology of mathematics is a very different reason for attending the classes and would imply a very different focus on learning/curriculum.

For others, the concept of knowledges is crucially important because discussing **knowledge gives rise to questions about power – who is it that is validating the knowledge?** A pluralistic attitude requires humility rather than privileging Western science and knowledge. It also requires challenging learners to reconsider (and value) the knowledge they have already, since many learners feel that they do not have knowledge because they do not know formal mathematics. Some people who held the view of knowledges felt that we need also to look at what happens if we don't question received knowledge – it can be much more dangerous, as people may follow blindly a received view (cf. terrorism). Another argument for knowledges comes from the observation that many learners struggle to learn mathematics. We can make the teaching of maths as exciting and stimulating as possible, and people still struggle. If we believe that there is more than one knowledge, this gives us the opportunity of looking for new and different solutions to mathematics education.

A third interest area was to make links between the different knowledge systems, to validate the axiomatic system and complement it with diverse knowledges. Here the observation was that problems come when people try to polarise the systems. While $1+1=2$ in the axiomatic system and does not necessarily in real life (e.g. if you have two jugs of water with a temperature of 1 degree centigrade and you mix them together, you do not get 2 degrees centigrade, or, in some cultures when you give something away, you get more which could be expressed as $3-1=4$, while in the West it would be more likely to be expressed as $3-1=2$) there is value in both – and this means you need to specify conditions for meaning. Here you might agree certain conventions, but also recognise that people will develop different images/reference points. You can agree a half exists, but know that people will see this differently. It is up to the individual to make sense/give meaning and construct their ideas. Here the process of knowledge construction is the focus. But it also raises challenges when looking at curriculum and assessment – how can we develop assessment systems that give space for different knowledges/knowledge construction?

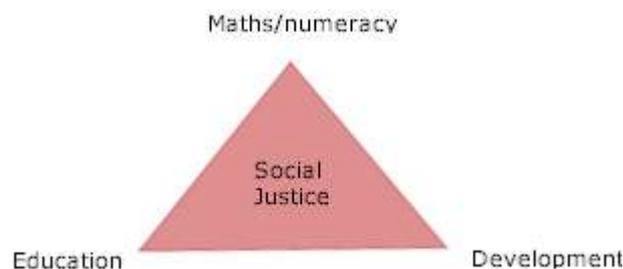
The discussion ended with the wider question of: why is all this important, why do we want to teach maths, why does any of this matter?

3. Ideologies, context and priorities

3.1 Numeracy, education, development and social justice

Although the seminar tried to avoid big debates about understandings of education, development and social justice, inevitably these issues came up frequently during discussions. These issues contribute to answering the question, why numeracy? They also provide a framework for thinking through what specific numeracy/curriculum is important. It is therefore important to touch on these issues briefly.

What is the relationship between these aspects?



The triangle above was developed to show that there is a clear link between the different areas. However the points on this triangle are not fixed, you can change the triangle by putting the aspect you prioritise in the middle. For some in the meeting, social justice was their primary aim and focus – and numeracy was just a tool to help us get there. For others, their primary interest was in numeracy and numeracy learning. For these participants, the specific aim of the learning (beyond enhancing the learners' numeracy skills) was for others to interpret and determine.

Other people were interested in education more generally and numeracy was part of this, and there were those who felt development was the key concern. It was agreed that which perspective you took would impact on how you approached issues of numeracy learning and teaching.

It was also observed that under each point of the triangle there exist different models – for example, mathematics can be understood as autonomous or ethnographic, development processes could be empowering or top-down models etc. It was also agreed that by focusing on concrete issues (see box), we can see how the four areas interrelate; the model taken impacts on what numeracy you teach, and how.

Gelsa and the Landless People's Movement (MST)

MST has 1400 primary classrooms (as well as secondary schools, rural business, law, adult education). The education is run by MST but paid for by the government. Education builds from the MST motto: *occupy, resist and produce*

Here the politics of knowledge and politics of identity are important, as is the concept of difference (rather than diversity, which can suggest that there is something specific and definite).

Gelsa offered the following example of how she has worked with members of the MST around land:

People have different ways of calculating the same piece of land. If you consider a parallelogram, there are many different ways people use to work out the area; people do different things, some work, others don't.

You can add up the perimeter and make a square, this gives a completely different area from the one given if you make an oblong. And this has big impact when registering land.

A different issue is that topography doesn't count in the land registry (so if, for example, the land has a big hill this does not make any difference). These issues are of critical importance when speaking about land rights, so we can begin to see how numeracy can contribute to a social justice agenda.

Here social justice and land is the issue. The development focus is perhaps a rights based approach, and education is that which empowers people to access their land rights (among other rights). In this example, numeracy is both practical/utilitarian (i.e. it helps people access their rights) and it also recognises and builds on social practices – reinforcing those which work and challenging those which do not. Additionally numeracy takes on a transformation agenda – challenging received ways of measuring land which do not recognise topography.

How do different understandings of education, development and social justice impact numeracy teaching and learning?

Although participants at the seminar represented a wide range of views, both in relation to their priority focus area and in their approach to some of these issues, it is fair to say that social justice was the dominant interest, along with an ethnographic approach to numeracy. Outlined below are some of the key points made in relation to education, development and social justice. This is not an exhaustive, or balanced, view of the different perspectives surrounding these issues, and the comments included here merely highlight the issues as raised during the seminar.

Education: Three syndromes in education for development were suggested:

1. The deficit approach (this approach sees people as lacking; the belief is that they are in need of something and that they themselves need to change)

2. The Freirean approach (here the focus is on disadvantage, not deficit. The view is that systems are keeping people poor and it is the systems that need to change, only then can people change)

(both these perspectives argue for universal solutions to problems)

3. The diversity approach (here there are no universal solutions, rather there are different solutions for different people, and people need to be encouraged to find own different solutions).

Based on this typology, it can be seen that depending what view someone subscribes to in relation to education for development will affect how they would understand and deliver numeracy education.

A different way of considering education for development theory is to contrast access and transformation. The **access** argument is based on the feeling that the West has good things, and the people in the South do not have as many. So, if we give people in the South access to Western opportunities and education, this will make things better and more equal. But, there is a difference between **access** and **transformation**; if we just give access then we can end up reproducing inequality. We cannot just say we have it and we need to give it to others – we need to question the **it** and look at transformation. The transformation view reinforces an understanding of numeracy as social practices, or diversity of practices, suggesting that there are many numeracy knowledges.

There is also the issue of what education is for, why do we think education is important? For example, *how does education contribute to social mobility? Are we just interested in education because it is a universal right? How does what we've been discussing about numeracy fit in with our understandings of the purposes of education?*

Kate Newman and Reflect

Reflect is a participatory approach to adult learning and social change, which links a Freirean ideology to participatory rural appraisal methodologies. Focusing on the interplay between communication and power, *Reflect* enables people to discuss and analyse their local reality and devise strategies to address things they want to change. Participants are supported to develop confidence in their communication skills, complementing what they have already with accessing new skills as appropriate. The focus is on understanding the power issues which frame how we use those skills as well as gaining technical expertise.

In terms of numeracy, *Reflect* links ethnographic approaches to understanding and valuing the prior knowledge participants have to critical mathematics approaches. This means using the skills people have already to 'read the world'. Through demystifying the mathematics and developing consciousness of what they are doing already, participants are able to use their knowledge in new areas – to analyse budgets or statistics which are important and relevant to them, and to develop alternatives, to challenge power holders and transform power. Thus *Reflect* links numeracy directly to a social transformation agenda – through valuing what people know already and extending this further.

Development: Development theory falls broadly into two categories – a top-down versus a bottom-up approach. Many of the big donors (eg World Bank, IMF) favour the top-down model, and even those who say they support a bottom-up view may still approach development by setting targets – focusing on outcomes, thus falling into a deficit or disadvantage model. The targets might be primary school completion, gender parity, adult literacy, and all of these are seen as correlated with poverty. But if we take the diversity approach, we need to question how we engage with an IMF framework, targets and PRSPs etc.?

In terms of targets, mathematics is seen as a measurable outcome. But if you believe that there is a whole range of numeracies and literacies, then there is a tension – as how can outcomes be measured meaningfully? At present, these targets are used to measure countries for international comparisons. Through this usage, the development indices are numeracy practices themselves. This means that we should be looking at them also!

But what model of development should we take? If we take a **human capital model**, we need to ask: “Who decides what we teach to add to the sum of human capital?” At present decisions tend to be made by people in the West, and this reinforces their power. If we take a **social transformation** model, this implies a different agenda and this leads to different values, but what would this mean for our work, what could we do?

There is a tendency within the world to marginalise local knowledges and practices, and development agendas often reinforce this. For example, in Palestine there were no external interventions for a particular period, and this was good – it made people (or at least Munir) see what was good about what was there already and build on abundances, not deficits – development programmes often focus on the deficiencies and overlook the positives. *Therefore another key question is, how could we avoid this with some of the numeracy approaches we’ve been talking about? How can numeracy contribute to bottom-up development?*

Social justice: Social justice means different things to different people and this provides different models for maths. Looking at learners, some people want to play the game and get the certificate, but others want something different. What people want is partly a power issue – whether they feel able to challenge the system or just want to be part of it. It is also about our own power, how we interpret our role as intellectuals; for example, are we trying to change the system, or improve it, or just deliver it?

For some, social justice should be understood from an identity (e.g. race, gender, social class) perspective. If we problematise the politics of dominant knowledge, we put the politics of identity into discussion. This involves us asking what types of cultural identity do I want to reinforce, what do I want to ignore? Working from this perspective, it is important to look at peoples’ mathematics, as it is part of what/who they are, together with the other dimensions. i.e. you cannot understand the mathematics without understanding the person.

If we conceive of education as something that only goes on in schools, and development as the World Bank/IMF (professional?) meaning of development, we can end up leaving out the majority of people – people who are outside the school or development systems, or who come through them without learning anything; we run the danger of calling them useless and blaming them. So one view in relation to social justice is that we need to remember these people, and start by looking at what they have already. Our tools are what we have in terms of stories and experiences, friendships, working together. We should not be asking: “What is the alternative to what exists already?” as there are 1000s of alternatives, not just one. Moreover, if

we choose one particular alternative, we are just using our power and this undermines the view of diversity and equal value. So rather than identifying an alternative, we should be encouraging people to learn and share, through horizontal communication, to recognise and value diversity.

Because social justice means so many different things to different people, it is hard to see exactly how social justice affects numeracy curriculum or teaching and learning. However, it is clear that it does, and whatever specific aims you have will affect how you conceive the syllabus and teaching practice. The question goes both ways: *How can numeracy teaching and learning contribute to a specific social justice agenda? And how does a specific social justice agenda influence approaches and understandings of the nature of numeracy knowledge (s)?*

3.2 Key issues/ factors

This section clusters some of the key areas of discussion which came up during the seminar. These are wider issues which influence who decides and prioritises numeracy learning. They also have a direct impact on what is considered valuable in mathematical knowledge, and guide how the knowledge is shared and exchanged. They are mentioned here as a way of illustrating the variety of issues which impact on numeracy teaching and learning.

Power: Power emerged as a key issue in many guises, most importantly perhaps in relation to knowledge, who decides what knowledge is valid and mathematical. One issue which has already been discussed above, relates to school curricula, Western knowledge and axiomatic truth. Is, for example, maths being used as a tool for imperialism with Western knowledge privileged over indigenous practice? There is also the issue of power implicit in what is seen as mathematical knowledge. How do we, as mathematicians, decide what is mathematical and what is not? Is it only when it fits in with our schooled understanding of mathematics that we judge social practices as mathematical? For example, is betting/odds mathematical just because we can see the link to the fractions and probability in school mathematics?

In a study of nurses, the status of knowledge was seen as very important. The nurses had relied on estimating the amount of medication/ratios when mixing medication. However, when challenged with data received through measurement, the nurses believed in the measured information, even when it was very different from their estimation and although the measured result was sometimes inaccurate. This suggests that the nurses gave formal/measured knowledge a higher status than their estimates.

Gender: Across many countries, there is a gender dimension to mathematics learning – with girls performing better at mathematics at an early age, but fewer girls than boys taking mathematics at a higher level. In the UK, girls often drop mathematics when it stops being compulsory and in Sri Lanka few girls took mathematics post 16. This could be partly job related also – with fewer girls going into areas which require formal mathematics qualifications such as engineering. There is also the issue of perception, common across many countries: boys are believed to be better at maths. Language itself reinforces this, maths being associated with objectivity, formalism, logic which are seen as male attributes, while women are seen as the opposite. This discourse suggests maths is not for women and we say that they find maths difficult.

However, this may also depend on which mathematics you are referring to. While men may dominate mechanical or abstract maths, it could be that women are better at life maths. An example of daily life maths and formal maths came from India – where often in the village men will read the time from clocks while women will read it from shadows. The more formalised the mathematics practice, the more the men dominate.

However, by accepting that women might dominate in the real life settings and men in the formal sphere, issues of power and empowerment also become relevant. The

formal sphere brings with it more power, more opportunity for employment and access to decision-makers. If we keep reinforcing the social practices of women, are we resigning them to a life outside the powerful sphere? are we excluding women from many of the opportunities more formal education brings? Can the idea of “knowledges” rather than “knowledge” actually reinforce gender discrimination rather than empowering women. And how can we make sure that this does not happen?

Culture: Because certain types of knowledge are privileged while others are not, cultural perspectives are not always valued. Moreover, numeracy teaching can contribute to undermining culture (due to participants denying their own knowledge in an attempt to access scientific knowledge).

However, the converse of this is that culture is sometimes romanticised and valued too much! This can mean that people are not enabled to access powerful formal mathematics, or that they continue to use incorrect mathematics and suffer from its consequences. This suggests that there is a danger of polarising modernised societies and traditional villages or focusing on indigenous knowledge versus formal mathematical knowledge, saying, for example, that a person in a village can do perfectly well without formal mathematical knowledge.

There is, however, a different danger, which arises through bringing cultural numeracy practices into the classroom. Here the problem can be described using three questions.

1. Does the very act of bringing numeracy practices into the class remove the context and understanding people have of them, making them abstract and hard to grab hold of again?
2. Do we only value those cultural numeracy practices which fit in with our mindset of what we see as mathematics – thus reinforcing the power relations without meaning to?
3. By bringing social practices into the classroom, do we begin to undermine the culture that comes with the mathematics? For example, different languages have a different world behind them, and when a language disappears a world may vanish also. By bringing social practices into the classroom, you could destroy a culture.

Context: Much of the ‘real life’ maths is developed in context; it is useful and understood because it relates to a particular situation. People develop numeracy skills so that they can cope with the context, which could be Reephah, Afghanistan, India, within a classroom or in a village. Thus what skills are developed will depend on what is needed at a particular moment, in a specific context.

However, there was disagreement as to the extent that context is a key issue in understanding numeracy. Some participants thought that context was the key – for example, one participant commented that in Portuguese the word ‘contexto’ means ‘with the text’. This implies a focus on what is going on with the text, with the discourse. This connects to who we are, how we have become who we are, the experiences we’ve had, what we have read etc. Context thus becomes a key notion – as researchers, as teachers, and for the people we teach.

Another participants shared how context gives us reasons for doing the mathematics. For example, when playing with a problem in recreational mathematics, it can be fun

Zakira, Afghanistan

Zakira’s programme involves delivering numeracy classes to trainers who deliver the class to women in the villages. She reflects: “How does, or might, numeracy contribute to village life? Given that we are in a post war phase, and the impact this war has had on family life, what contribution can numeracy and literacy make – are they small potatoes in a big field?!”

But if we connect numeracy, maths, education and development, then maybe we can answer this question. Value is given by the women learning about trading. Before participation in the programme, they were underselling their embroidery because they were not giving any value to their labour. So numeracy is useful. Also, often when we talk about the condition of the village we tend to look at what is absent; why can’t we talk about what is good? Could numeracy contribute to this?”

to do it for hours. But if you face the same problem in a test, then it can be oppressive; or if you are in a classroom and you do not understand the problem, you get anxious. From this we can derive that the context guides the feelings you have towards the specific mathematics.

However, others challenged the concept of context, saying that while it is important, it is not everything. The mediational means/tools are more important still. For example, when faced with a piece of arithmetic, what do you do? Do you use paper, calculator, computer, or do it mentally? These are all different mediational tools, and they affect how you see the question. This implies that the relationship is more complex than person and context; the tool is also important.

The notion that formal maths is in some sense decontextualised knowledge was raised at the seminar. This was challenged by some who point out that formal mathematics, like all numeracies, is indeed sited in a context, but that this context has become normalised and is therefore often dismissed as a context. This is important, as contexts bring with them values, purposes and social relations. In addition, it is only through understanding the detail and nature of contexts and their associated rules and procedures that learners can switch between them and learn to use their numeracy skills to their full extent.

North-South relations: How we learn and exchange across national borders was raised as a challenge in the seminar, and while there are some very positive examples of North-South exchange and learning, for example the Sri Lankan irrigation system, these are few and far between.

This is partly because of the power relations which exist, which suggests that we need to problematise the exchange, to think about who is involved, and what parameters guide their involvement.

It was suggested that someone from a developing country is only allowed to come to the North, to speak at events, if they do not challenge too much. Or perhaps they are only invited to exchanges if they speak about benefits the exchange has had in South?

Another issue is whether knowledge from the South is valued on its own terms. An example was given from experience of looking through documents which were highlighting developing country knowledge. It was interesting to note that the only thing that was seen as knowledge was maths/science; everything else was seen as values, traditions and beliefs which the West could make into knowledge. And this can give rise to another problem: when 'experiences' from the South are turned into 'knowledge' in the West, it is easy for the West to claim that it is their knowledge.

The triple helix: industry, government and mathematics: The influence of industry was not discussed in great detail during the seminar, but it was noted that decision making on curriculum is not just the business of governments and education experts. As industry demands shift, there is often an impact on curriculum and learning.

Critical mathematics: One body of mathematics education, only touched on briefly at the seminar, was that of Critical mathematics. Quoting from Marilyn Frankenstein, there are *four goals in critical mathematics literacy: understanding the maths; understanding the maths of political knowledge; understanding the politics of mathematical knowledge; and understanding the politics of knowledge*. Together these imply politics of identity and social justice and are therefore important. By using a critical mathematics perspective, it is possible to see how mathematics can play a role in empowerment or in exclusion and mystification. The issues were discussed in relation to work with MST in Brazil, and within Reflect, where maths is

put into immediate practical use with clear aims to access rights and challenge power¹.

Class: Another area which was only touched on briefly was that of class. While participants in the seminar acknowledged that social class is an issue, and perhaps the best predictor of attainment in formal mathematics, this was not explored in detail. However, it is clear that if we are interested in social justice, we need to understand how and why social class is implicated in the teaching and learning of maths.



¹ Reference was also made to: Gutstein E and Petersen B 2005 *Rethinking Mathematics: Teaching Social Justice by Numbers* Milwaukee USA

4. Numeracy processes and content

4.1 Why Numeracy?

Who decides: Depending on your focus and priority, the answer to the question ‘why numeracy’ might be very different. It will depend on whom you ask, and what model of development or social justice they subscribe to. In addition, it will depend on who they are, and what their relationship with numeracy is. Those interested in social justice are likely to give a different answer from those interested in numeracy per se. Also, learners might give a very different response from teachers or academics. The box to the right gives some of the reasons learners themselves gave for coming to classes in the UK.

Value: The concept of value is of crucial importance when thinking about ‘why numeracy’? For example, how is learning valued? Is it individuals or a higher authority that drive value? What implications does this have for performance – do people value their own learning or does value only come through external valuation? Where does individual worthiness come from?

Another question is whether ‘use value’, i.e. how useful things are, is our only value system? Some people would say maths is fascinating, interesting and enjoyable – that there is beauty in/of mathematics. Also mathematics can help us understand the world better, it can help, for example, in designing bridges. In addition, maths can help us to see similarities, to see underlying logic, patterns. Two phenomena that initially appear completely different might be the same. Maths can help our perceptions of ourselves and the reality of the world in which we live. How do these different ways of valuing interplay with the concept use value?

In the UK, adult numeracy is valued using the concept of ‘use value’, and this involves a very reduced notion of what everyday life is for adults and therefore what mathematics they might need. While there is nothing wrong with use value, we do need to go further, and we cannot decide what other people may or may not think is useful. Exchange value is also important, and certain aspects of maths have very strong exchange value. For example, there is a market for qualifications, and maths has strong currency here. You may take an ideological stance of dismissing the market as unimportant, but this does not reflect learners’ realities. If this is accepted, then we need to recognise that only certain aspects of maths have an exchange value, and there might be high exchange value in just accessing formal mathematics – as it is the language of power.

Jon Swain (UK study – Making Numeracy Teaching Meaningful to Adult Learners?)

The research focused on three different colleges, using three teachers as researchers, teaching different levels – entry one and level one. The research focused on students in three daytime and one evening class. Adults in the daytime class were not in paid work while the evening class included those in paid work. Swain characterised the evening class as “*more organised, the adults had more instrumental reasons for attending the class.*”

Why did people come, and come back?

- *People who came back wanted to prove to themselves that they could do school maths (not everyday maths)*
- *Because they wanted to help their children, wanted to understand maths – not just the tricks*

The study also found that:

- *People change in classes – this might be because of maths, or because their status changed.*

In a different study in Canada, while apprentices initially attended maths classes to help them in their work and to get a certificate, they began to get interested in understanding maths as well. They became generally curious and liked doing maths. They had failed in school, and this was a second chance to ‘sort it out’, to achieve something that they didn’t think they could.

A different reason for learners participating in the UK is because they have to – they are not able to access their benefits unless they attend, this will lead to very different aims and perceptions of maths learning.

4.2 Curriculum

Issues of curriculum were raised in various guises throughout the seminar. The Focus was on two distinct areas: first, who or what drives the curriculum and how are decisions made about what to include in curricula? Secondly, how does our understanding of the aims of numeracy learning and the nature of mathematical knowledge (s) influence curricula? An issue related to both these questions concerns whether we are designing a system focusing on supply or demand issues. There are of course many different demands and supplies, but certain institutions have more powerful voices in this respect.

Social practices and numeracy: There was a recognition among many participants that diverse numeracy practices exist, and that there is a need to integrate these into the curriculum, not least because many people are failing maths in the current system. Focusing on technical skills does not work for everyone. In addition, sometimes the mathematics taught is just not appropriate and there are practical reasons why this might be.

One example given drew on experience in Mexico, where in some villages people do not hear Spanish except in the classroom. In one particular village, people use a numerical system with a base of 20. However, in the class, in Spanish, they learn the decimal system. Thus, they not only have to learn a new language, but a new system too. This makes the mathematics practically difficult to understand, and relatively useless in their everyday lives; a social practices model would give space to different systems and languages.

A curriculum built on prior knowledge? Should the curriculum be designed so that teachers focus on discovering people's prior mathematical knowledge and look at how this can be used in practice? This could be along the lines of the third 'knowledge option' (p.7) – blending social practices with axiomatic short cuts. But what does this really mean in practice?

A flexible curriculum? Here the idea of English as an International Language (EIL) was offered as an analogy. EIL is a form of English that is not controlled by native speakers; rather, it is that which is spoken all over the world by people for whom English is a second or other language. However, the institutions which test English still base their tests on native English, not EIL, so there are many power issues at play here.

Despite this caveat, EIL may provide insights into possibilities for numeracy and numeracy curricula. Perhaps there is a model of maths that can be hybrid, international, not controlled by a nation state/colonised. The implication would be that the West would lose control of the thing called maths in the same way as EIL implies they are losing control of English. Some people felt that there is currently space for this to happen, but raise the issue as to how would such a system could be measured?

Numeracy and children

There are examples of using social practices within the classroom with children, and experimentation with the curriculum. Two experiences were shared – from St Vincent and Sri Lanka.

St. Vincent The experience here focused on educating children about contributing to social security (national insurance). The project targeted the curriculum used by 11 year olds, and looked at numeracy in everyday skills and saw this as codified knowledge. A textbook was developed which could be used as a reference point to support the project.

Sri Lanka In 9,900 schools around country mental (or talking) mathematics is being reintroduced. This involves moving away from paper and pencil towards other types of activities and focusing on 5 areas of learning: knowledge and skills; communication; connections; reasoning; and problem solving.

However there are challenges; both in terms of *parental perceptions* – (where there are misunderstandings as to the goals of this pedagogy) and in terms of the *exam* which is still paper based.

4.3 Measurement of teaching and learning numeracy

Measurement is relevant on two levels. First, there are issues of how to measure a particular mathematics syllabus or curriculum, especially if the curriculum is to embrace the diversity of numeracy practices. A second issue concerns how measurements are used at international level – to compare across national borders.

Examinations: There are issues about who chooses the questions children will answer? But perhaps a more fundamental question is about whether exams are an effective way to test numeracy skills. For example, in a study of exams in the USA the findings highlighted that the ability to pass the exam had little to do with mathematics – it was all about training in multiple choice questions, and people can learn how to do this, regardless of their mathematical ability. This suggests we should be looking at different ways to examine mathematical learning.

International Comparisons: Again, the issues of who decides what, and why something is measured is important here. In terms of international development targets, measurements are a key way of analysing how different countries are performing in relation to these targets. The PISA evaluation for example enables international comparison. But this is not a politically neutral activity, and many different conclusions can be drawn from any comparison.

At present countries are ranked according to their performance, and this can affect various things. For example: their ability to get aid; or the respect that they are given by other nations etc. This way of measuring is powerful and political. And it is problematic – how do you respond to a country that has good maths scores, but high inequality also?

Measurement and social practices: Although the nature of international measurement and comparisons was challenged, there was also interest shown in how these systems could be made more inclusive, by measuring achievement in ways which recognise social practices. One extreme is to go into more and more detail in the evaluation process. But this can lead to even more value judgements on individual achievements. Measurability brings lots of value judgements which inevitably give rise to tensions between rhetoric, practice and the impact of that practice.

A final suggestion was that numeracy itself could be used to challenge the idea of measurement and comparability, and from this different spaces could be created, to encourage different ways of exchanging between countries.

4.4 Teachers and teacher training

A final subject which was touched upon briefly was the role of teachers and teacher training. Many of the suggestions relating to the introduction of social practices into maths curriculum will depend on the ability of numeracy teachers to change their approach to teaching. The numeracy that is taught and learnt depends on the training and confidence of those delivering numeracy education, and it is therefore necessary to explore how we can change teacher education? Some felt that teacher education was the priority for transforming mathematics learning internationally.

Part of this is to get teachers themselves talk about what they need, professional development courses – giving teachers the opportunity to work together and support their/each others' practice. A large focus of this work is on 'unlearning' maths, on challenging our own assumptions and looking at how to integrate learners' prior knowledge with maths learning. There are some materials in *Reflect* and from Australia on this. But teacher training is not particularly measurable, and this means

it is difficult to raise funds for; we need to find ways of making teacher training appear more attractive.

5. Where do we go from here?

The report will be posted on the Uppingham website; and there is the potential to contribute to the ALM journal and newsletter (<http://www.alm-online.org>) and RaPAL journal (<http://www.literacy.lancaster.ac.uk/rapal/>).

Where should we take this now? Participants came up with the following suggestions – the names in the brackets indicate who took responsibility for follow up

- Maths advocacy – putting our view of maths out there.
- Everyone to write something in defence of teaching mathematics – why might it be important? (David Johnson)
- How could we present these positions to DfID/WB/UNESCO anticipating the counter arguments (e.g. you are romanticising and ghettoising the local is one common rebuttal) – produce a position paper? 'Understanding of indigenous systems allow us to improve the dominant system' – is this a good rebuttal? (Brian and David Johnson)
- Gather together a range of resources – interesting articles etc. – annotated bibliography? (Dave Baker) – everyone send references to Dave
- Research that hasn't been published yet – case studies like Saraswathi's. NRDC and Uppingham Press collaboration? Practitioner research/case studies putting activities into the public domain in an accessible form. Practical not academic. Talking about learning – wherever, whatever (Anna to produce/edit) short booklets like the ASPBAE booklets – funding for a short series (say 6)
- Create spaces for learning to take place outside institutions – collect stories of such spaces (magazine from refugee camp in Lebanon produced by children). Working in local projects helping participants document their experiences - to put on the website? (Munir and Kate to consult)
- Looking into issues around the connections between language and maths (Richard and Dominique who are doing this anyway)





**Uppingham Seminars Numeracy in Development Seminar
20th – 22nd October 2005**

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