Teachers' Funds of Knowledge and the Teaching and Learning of Mathematics in Multi-Ethnic Primary Schools: Two Teachers' Views of Linking Home and School

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Abstract: In this paper we explore two teachers' views on the role(s) of parents, the local community and children's home lives in the learning of mathematics in primary school. We use Moll and Greenberg's concept of 'funds of knowledge' and apply it to the case studies of two teachers working in the UK context. Issues of teachers' professional experience, ethnicity, class and gender emerge as significant in examining similarities and differences in the teachers' beliefs, understandings and practices in the area of linking home and school. We end with a discussion of some implications for teacher education and professional development.

1. Introduction and background

The academic achievement of children from minority ethnic families is considered an important issue in the UK. A government document entitled "Aiming High: Raising the Achievement of Minority Ethnic Pupils" (DfES, 2003), for example, was designed to identify and disseminate good practice in schools. A minister of education wrote the following in the introduction:

"… the best schools already show us the way to deliver high standards for their minority ethnic pupils. They employ several complementary strategies. High expectations are matched by strong parental and community support."

This quotation makes clear a belief that raising achievement is closely associated with various strategies, one of which is the involvement of parents and the local community. In this paper, we explore beliefs relating to the importance of parents and communities in the context of inner city, multicultural primary schools in the context of primary school mathematics. To do so, we present two teachers' views on children's home lives and the role(s) of parents in children's learning of mathematics in two inner city UK primary schools.

We use Moll and Greenberg's (1992) concept of 'funds of knowledge' to consider how teachers' own background, professional experience, and beliefs impact on their work with children and parents in the area of mathematics education. The term 'funds of knowledge' was used by Moll and Greenberg to refer to the information, skills and strategies which families and households acquire and use to maintain their survival and well-being. The idea of funds of knowledge was developed originally to highlight and celebrate the skills and knowledge possessed by members of the Hispanic community in Arizona. Moll and Greenberg's goal was to illustrate how these children and their parents were undervalued within the formal educational system. Moll and Greenberg made clear that "we perceive the students' community and its funds of knowledge as the most important resource for reorganising instruction in ways that "far exceed" the limits of current schooling" (p. 345).

Since Moll and Greenberg's original work was published, the term funds of knowledge has been taken up and applied in different educational settings. For example, in multi-ethnic primary schools in the UK where the practice of employing 'bilingual classroom assistants' has developed, Martin-Jones and Saxena (2003) use the concept of funds of knowledge to specify ways in which the bilingual staff engage with minority ethnic pupils through shared language and cultural references. In addition, a recent government document published by the DfES (2004) in England used the term 'funds of knowledge' in the context of making recommendations for good practice in working with parents from minority ethnic groups where the children are attending "mainly white" schools and are therefore in a minority.

Our focus in this paper is on the teacher and his or her funds of knowledge. In the field of mathematics education, Clarkson (1998) drew attention to "the influence of 'the' teacher" and reminded us not to ignore the role played by the teacher in mathematics learning contexts. He built on mathematics education research which investigates children's 'out of school' encounters with mathematics (e.g. Abreu, 1998) by posing the following question: "If teachers are not fully aware that their pupils will be bringing their whole personality to the doing of mathematics, are they aware that they too bring all their personality to bear when they are teaching mathematics, including what they value as worthwhile?" (p.134). More generally, Osborn (1996) focused on how teachers' personal biographies, gender, ethnicity, phase in the life cycle of the teacher interacted to produce a set of values and beliefs about teaching.

In this paper, we focus on the teacher and consider what 'funds of knowledge' they bring to the teaching of mathematics, to working with parents and to acknowledging children's home lives. We begin with a discussion of relevant research in mathematics education. We then introduce our research methodology and present interview data from two teachers who are responding to questions about their beliefs and practices in relation to children's lives, parents and mathematics. We explore these data through the lens of 'funds of knowledge'. We conclude with some implications for both policy in this area and practice in terms of support for teachers (either in training or in-service).

2. Engaging with parents, communities and mathematics learning out of School

Working with parents is an issue which has been and remains of considerable interest to researchers, policy makers and practitioners in different countries around the world (see, for example, Epstein 2001, in the US; Wolfendale; Bastiani 2000, in the UK; and Castelli; Mendel; Ravn 2003, for a range of European countries).

In this section, we briefly describe some examples of research into working with parents and the learning of mathematics in and out of school in order to situate the work we present subsequently in this paper.

Nunes et al. (1993) explored differences between mathematics in different settings and made distinctions between three types of mathematics: one which children construct outside school, one which is embedded in everyday practices and one which is taught by schools. This work is important in raising our awareness of activities with which children engage out-of-school and indicates the kind of knowledge and experience teachers could draw on in their teaching of mathematics in school. Nunes et al. do not, however, explore specifically how parents are involved in out-of-school mathematics.

Baker, Street and Tomlin (2003) undertook ethnographic research in homes to explore mathematics events and practices which were taking place 'spontaneously'. Their study highlighted the kinds of expertise in children's homes (both of the children and their parents) which may not be understood or drawn on in schools. Baker et al. discuss issues such as the nature of culturally diverse mathematical practices and present a case study of a Pakistani pupil who counts three to each finger (more common in Pakistan) as opposed to only one to a finger (more common in western cultures). Baker et al. speculate on the implications of such differences for children learning and using different mathematical methods in the different settings they encounter in everyday life.

Ways in which parents and children can be encouraged to engage in mathematics in out of school settings were explored through the IMPACT project (Merttens & Vass, 1990). The materials designed for the project took into account affective factors, such as anxiety, which can be associated with mathematics and also attempted to bridge the divide between school life and home life which the researchers referred to as different "cultures".

Bonotto (2001) reported on an intervention project in Italy which aimed to incorporate children's out-of-school mathematics into school activities. This work is located within the ethnomathematics field (see e.g. D'Ambrosio 1985, 2001; Begg 2001) and outlines a role for artefacts (receipts, etc.) from children's home lives to enrich and support mathematics learning in school. Similar activities for linking home and school mathematics were also developed as part of the Home-School Knowledge Exchange project, from which this current paper is drawn (see Winter; Salway; Yee; Hughes 2004).

Presmeg (1998) reported on a course in mathematics education focusing on cultural practices for pre- and in-service teachers in the U.S. As Civil (1998) points out, this work foregrounds the funds of knowledge of teachers as well as that of students and as such resonates with our interest in the teacher. Presmeg's work incorporates teacher and students developing their understandings and ownership of "personally meaningful" mathematics activities. Her frame of reference is equity in mathematics education and her goal is to support teachers to "cope with the challenge of cultural diversity in the classroom" (p. 137). This goal is central to our discussion in this paper.

In summary, research and intervention studies have pointed toward a diversity of mathematics practices taking place in different settings in children's lives. These studies all indicate a need for school education to at least be aware of this diversity, and ideally to incorporate it into mathematics learning at school. In this paper, we present case studies of two teachers who work in schools with a high proportion of children from minority ethnic communities. We explore the specific issues of diversity of mathematical practices for these teachers, children and parents in relation to mathematics learning.

3. Methodology

The Home School Knowledge Exchange project (Hughes et al. 2003) was carried out in two multicultural cities in the UK: Bristol, in England, and Cardiff, in Wales. Since 1999, the National Assembly for Wales has been able to take decisions developing education, training and lifelong learning in Wales, independently of decisions made in England.

The data we discuss in this paper consist of two semi-structured interviews (conducted at the beginning and end of one school year) with two teachers in two different primary schools. Data collection also involved visiting the schools for other research purposes such as observing lessons and conducting a range of assessments.

Interview 1 (at the beginning of the school year) covered the following headings:

1. The teacher's background
2. The teacher's knowledge about the children in the study
3. The teacher's views on involving parents
4. The teacher's own background in mathematics
5. The value of mathematics to the teacher
6. The teacher's beliefs about mathematics learning
7. Individual children and mathematics
8. Home and mathematics learning

Interview 2 (at the end of the school year) covered the headings below. We were particularly interested in any changes in views or practices which had occurred since interview 1:

a. About the children (in the study)
b. Practices (in teaching mathematics)
c. Children and school
d. Children and home
e. The teacher's relationship with parents
f. Feedback on school-based activities initiated by the HSKE project

The interviews were tape-recorded, transcribed and checked before two stages of analysis were carried out. The first analysis followed the structure of the interview schedule and focused on the areas signalled by headings 1-8 and a) to f). The second analysis identified the funds of knowledge of these two teachers by a careful reading of the data and sought evidence of different kinds to validate our findings. One type of evidence was a linguistic signalling of sharing or belonging expressed by the teachers such as the use of possessive pronouns in relation to a phenomenon. For example "our area" is the way in which one teacher talks about the community she and the children live in. A second type of evidence is that

which is signalled more by the content of the utterance. An example of this is when one teacher comments about his family situation: “my boy is four now, he’s in reception”, which prefaces an observation about home-school communication from his perspective as a parent.

There was an interaction between the two sets of analyses in that certain data extracts were being drawn upon for each analysis. The structure of this paper reflects these two stages of analysis with sections 5, 6 and 7 reporting themes from the first analysis and section 8 reporting the application of the funds of knowledge concept to the data.

The two teachers we refer to in this paper were involved in the HSKE project because they were teaching the children who were part of the study, that is, Year 5 classes with children aged 9-10. They had not volunteered to be part of the study. We present data from the two teachers here as case studies (Stake, 1995). We do not claim that any generalisations can be made to other teachers in other contexts. We present them with the intention of illustrating some of the issues that they, as teachers working in multi-ethnic, multilingual, inner city schools, encounter as they attempt to engage with children’s parents and home lives. In addition, the case studies allow the beginnings of a picture to emerge of the diversity amongst teachers in terms of their funds of knowledge.

4. The two teachers and their schools

In this section, we introduce the two teachers and describe the schools in which they were working. This is followed by sections in which we describe the two teachers’ beliefs about the nature of mathematics (section 5), their views on teaching mathematics (section 6) and their beliefs about involving parents in their children’s learning of mathematics (section 7). In section 8, we examine what the two case studies tell us about these teachers’ funds of knowledge.

In UK primary schools, teachers are generalists who teach the full curriculum, although each school has a nominated co-ordinator for the different curriculum areas. Neither Farzana nor Dan was a mathematics co-ordinator.

At the time of the first interview, Farzana (a pseudonym) was a newly qualified teacher and had just completed her first year of teaching. She had a degree in history and visual arts, and was responsible for history at her primary school. She shared a Muslim background with some of her pupils and was a Punjabi speaker, but found a contrast with some of the children she was teaching in that she described her parents as having a ‘very liberal attitude’ which focussed on school learning rather than Islamic teaching. As with many teachers working in inner-city schools, she occupied a different socio-economic position from that of her pupils.

Farzana taught Year 5 (ages 9-10) in a new, purpose-built school which served a poor, urban community in Bristol that had a diverse range of ethnic, social and cultural backgrounds. It had become popular amongst its local community due, in part, to the fact that the school has the facilities to provide halal meals for children and staff in its kitchen. Over 50% of the pupils were entitled to free school meals (well above the national average) and around two thirds of the pupils had a mother tongue other than English. A recent inspection report noted that the school had a shifting population where an above average number of children joined or left other than at the usual time. It noted that the children’s standards in mathematics were below average although the pupils were ‘generally, acquiring mathematical skills at an appropriate rate’. The same report classified the school as ‘failing’ and this had entailed additional inspection visits.

When we first talked to Dan (also a pseudonym) he had been teaching for seven years in primary schools. He had previously worked in the housing sector but had sought a more creative outlet for his skills by training to be a primary school teacher. As Dan was originally from a town in northern England he had had to learn Welsh in order to teach Welsh lessons. At the time of the interviews, he taught Year 5 and had responsibility for design technology in his school.

Dan’s school was housed in a 19th century building, centrally located in Cardiff on a commercial road with a diverse population. The school population, and Dan’s class, reflected this socio-economic and cultural diversity. 27% of the pupils in the school were entitled to free school meals. The school’s own annual report referred to its performance as ‘an extremely effective school’ which gave priority to mathematics as a ‘very important curriculum area’. 82% of its pupils were performing at the level expected for their age in mathematics.

5. The teachers’ beliefs about mathematics

Farzana’s view of mathematics was: “it’s like a – almost a second language that we need to understand”. Interestingly, Farzana was bilingual and made an analogy with bilingualism to describe how she saw facility with mathematics. Farzana talked about the consequences of not being able to operate in this ‘second language’: “without it I think we’d be quite confused”. Her example of where confusion might set in was watching TV news reports which made use of statistics.

Farzana talked more generally about a perception in UK society of mathematics: “I think there’s too much negativity around – you know – lack of confidence towards numeracy”. She talked about how this influenced her pupils’ feelings about mathematics as well. She contrasted that with her own position: “I wouldn’t say I am the most confident person at mathematics but I know I wouldn’t say it out loud in front of children”. Dan also talked about children’s feelings towards mathematics: “I know some children are really scared of it [mathematics].” He then mentioned the importance of children becoming confident in mathematics at primary school in preparation for secondary school mathematics classes. He referred to “horror stories” of children’s experiences of mathematics at secondary school where, unlike in primary schools: “there’s no support in the school, or there’s not enough so the children just fall further behind”. At this stage in the interview, Dan appeared to consider the role of the class teacher in primary school in terms of developing children’s confidence in relation to mathematics: “if they can get to

grips with the basics – you know – if their self-esteem improves a great deal…But – you don't want children to go away thinking they're stupid."

6. Teaching mathematics in the two schools

In the education system in England, mathematics teaching has been standardised under the "National Numeracy Strategy" (DfES, 1999), a framework for mathematics teaching within a daily lesson for all primary school pupils. The Strategy argues that one factor which helps to promote "high standards of numeracy is if parents are kept well-informed and encouraged to be involved through discussions at school and sometimes in work with pupils at home"[1].

In her interviews, Farzana talked about her frustrations at 'being expected to be an expert' in all subjects, and feeling constantly 'overwhelmed' by the new developments and materials in mathematics. She talked about her desire for more creativity in the teaching and learning of mathematics but in the context of teaching in a school where many children have 'special educational needs', she expressed a concern about the inadequacy of the support for those needs which led to a reduction in her enjoyment of teaching mathematics.

In setting her teaching objectives, Farzana was torn between "working with what the children wanted, where we felt they were and what they needed" and working with the Year 5 objectives set by the National Numeracy Strategy. Under pressure from the Local Education Authority and her school Numeracy Co-ordinators, Farzana, "changed it to what they wanted and we did it so that we watered, really watered down Year 5 objectives to sort of teach these children". Farzana's response illustrated some of the tensions she felt between working within nationally set objectives and the reality of her own multi-ethnic classroom where she felt that these objectives were unrealistic or inappropriate

In Wales, an initiative in school mathematics teaching in Cardiff (Cardiff Achievement in Numeracy or C.A.N.) has many parallels with the content and methods of the National Numeracy Strategy in England. However, in contrast to Farzana, Dan talked about how he had successfully adapted his teaching practices to fit in with the new methods. During the course of the year, he had developed a greater awareness of differentiation, he set more varied tasks for his pupils and made greater use of whole class plenary (a session at the end of the lesson where children come together to review what they have learned). Whereas the latter practice was usually confined to work with younger children, Dan recognised that a plenary would "get their concentration better to use the carpet[2] more often, and have them interact, you know, doing things that, where they interact". He acknowledged that this practice also disadvantaged some of the quieter members of his class and referred to an Asian girl for whom the plenary interaction, "when it comes to speaking out in front of everybody else she still finds it really hard. Which is strange really because she's got the language in terms of speaking out".

In summary, both Farzana and Dan were teaching mathematics in the context of increasing external specification of teaching methods and curriculum objectives. However, while Farzana struggled to come to terms with this external specification, Dan was adapting his practice to take on board the new methods.

7. The teachers' beliefs about involving parents in mathematics learning

In this section we present the two case study teachers' beliefs about involving parents in their children's mathematics learning. These are considered under the following five themes:

- Using different mathematical methods
- The teachers' impressions of parents and mathematics
- Linguistic diversity and communication with parents about mathematics
- The teachers' ideas about parental roles
- The teachers' beliefs about acknowledging children's home lives

These themes were either the focus of specific questions or emerged from a grounded analysis of the interview responses.

7.1 Using different mathematical methods

Both teachers expressed an awareness of the challenge raised by using different methods in mathematics. The teachers referred to examples of different methods from parents' own experiences of learning mathematics in schools and children's own experiences of learning mathematics in different countries they had lived in. Farzana spoke favourably about the following incident:

"I had a parent come and ask me that, they're from Kosovo, he said 'in Kosovo we used to do it like this and I'm worried that I might be teaching my daughter the wrong way'…"

Farzana explained how encouraging this was as it had given her an insight into a parent's engagement with his daughter's education. She spoke positively about the fact that mathematics learning in and out-of-school could be different:

"I don't see that just because I'm teaching one method in the classroom and they have a different one at home, I think it's quite nice to look at both methods rather than the parents were feeling a bit as if, you know, the way that we've been taught back in Kosovo might affect my daughter's learning in, you know, here at her school"

In contrast, Dan was quite different in the way in which he considered the issue of using different mathematical methods at home and at school. He referred to parents' own educational background as likely to cause problems for them in supporting their children at home in mathematics learning:

"I mean obviously parents have grown up with different approaches in mathematics – whereas we give them you know a spectrum of different ways of doing things so they can you know overcome problems – but often parents have their particular way you know which can be a problem if you're teaching one way and they're being told to do it a different way at home".

7.2 The teachers' impressions of parents and

mathematics

The two teachers talked about their impressions of parents and mathematics in two ways: in terms of their attitudes towards mathematics and the practicalities relating to helping their children with mathematics. Farzana was concerned about parents passing on negative feelings about mathematics to their children. She linked parents' negative feelings with the specific local area where the children and their families lived by saying "that just has a lot to do with our area". She continued:

"I think a lot of parents do feel, especially in our school, that mathematics is a lot to do with just adding and subtracting and just multiplying and division. All these other extra bits we do like data handling are not really um, they don't understand that and things like, you know, for the fractions we do, percentages we do decimal numbers we work with parents don't understand that , word problems as well again …"

Dan mentioned time as an important factor in determining whether parents can get involved in their children's mathematics learning:

"You know, I mean, obviously parents have limited time themselves, to do things with their children".

Dan mentioned time on several separate occasions during the interviews. He noted it as an additional problematic factor for minority ethnic parents who were not confident users of English who were helping their child with their mathematics learning.

7.3 Linguistic diversity and communicating with parents about mathematics

Many of the children and families in both teachers' classes were multilingual. Dan's comments about the relationships between parents who spoke English as an additional language (EAL) and the school were:

"I think they must find it hard in terms of being aware of what's going on, basically, and they must, I assume they find it frustrating trying to help their children to, you know, do some of the basic things we do, if you've got a limited amount of time to spend with your children doing some work, you know, a few minutes or five minutes, then to have the language problem as well is just going to you know make it difficult"

Dan moved from considering parents' relationships with schools (the focus of the question) to speculating about parents helping their children with school mathematics at home. He presented a monolingual worldview, ignoring the possibility that parents and children could discuss schoolwork in a language other than English.

When Farzana considered language issues she spoke positively about school initiatives, such as, for instance a 'Bangla Club' in which parents and children came into school at the end of the school day to engage in information and communications technology (ICT) together. This positive attitude towards parents and linguistic diversity was not consistently followed through within the school, however, and Farzana talked of the frustrations this caused her at parents' evenings:

"I had a few where there was a language barrier so I couldn't really, I found myself saying things and not really sure how to um I could either go on for ages and know that this parent doesn't really understand anything - they want to hear the word 'good' or 'bad' - you know"

Farzana spoke of the consequences:

"I wasn't able to discuss perhaps the ways that the parent could support their child at home in a particular area of their learning"

Dan also raised the issue of communicating at parents' evenings with minority ethnic parents who were using EAL. He mentioned the facilitation provided by a "translator" but acknowledged that the approach of the school was more "ad hoc" than systematic in terms of meeting the linguistic needs of parents:

"Well, what we've done in the past is, if people have come in with them, to translate. You know, or when we have a parents evening, to try and translate information. So we've done that in the past and that works quite well."

Sharing a language did not necessarily ease home-school relations in Farzana's experience, however. When talking about a child with challenging behaviour, she talked of how her sharing a language (Punjabi) with parents had not helped in her task of engaging the boy or enlisting his parents' support. Farzana had invited the boy's mother to come into school for a meeting about her son's poor behaviour and had spoken on the telephone in Punjabi about this. The proposed meeting never took place, as the mother had wanted to meet in lesson time before three of her children came home from school. Farzana expressed indignation that a parent would request a meeting during lesson time and as neither side could or was prepared to compromise, no meeting took place.

At a more general level of communication, Farzana talked about her feelings about how some parents perceived her and how that impacted on her interactions with them at, for example, parents' evenings. She referred to some parents, particularly fathers, as not taking her seriously and she speculated that things may have been different had the headteacher (a white female) been making the comments instead of Farzana, as the class teacher:

"I wonder if it's because it's me and how culturally they see me, as a woman, as an Asian woman …"

When talking about his general relationships and communications with parents, whether they were EAL speakers or not, Dan's philosophy was:

"just the sense that it's not an 'us and them' situation really. I mean some, I know sometimes teachers because of the pressures ... you know, slip into this, 'us and them'"

Dan's desire to present himself on the same 'side' as the parents was illustrated when he described his interactions with a child's mother, who, he reported, was seen as "a difficult character" by other teachers. Dan noted that his relationship with that parent was "fine" and he added that good communication "depends on how you talk to people, I think, sometimes." The implication was that Dan felt he had a technique of developing a rapport with all parents that some other teachers lacked.

7.4 The teachers' ideas about parental roles

Dan considered the issue of sending work home from two different perspectives: as a parent and as a teacher. He made the following comment regarding work his four-

year-old son brought home from school:

"And, you know, he's brought home some words they've been learning. But, I think it's good, because you feel like you're helping your children to be educated, and you have some sense of what's going on. Because sometimes school can be just a mystery. Because you know children never tell you what they do."

As a teacher, Dan talked of the mathematics curriculum being "packed". His solution was linked to the role he envisaged for parents. He saw parents reinforcing mathematics work undertaken in class. Some children needed this reinforcement, he noted, but he felt unable to spend more time on this in class due to pressure to progress through the curriculum. Dan's model of parents' roles in some ways resembles what Edwards & Warin (1999) refer to as the school "colonizing" the home. However, Dan specified what parents might do: "a little activity or two without being a formal structured lesson because they get that at school".

As we saw earlier, Farzana welcomed the fact that parents might be engaging with their children in ways that might have been different from the methods used in school. On the other hand, she, like Dan, saw a need for parents to share in the school's goals regarding learning mathematics, or in her own words: "I think parents need to know what it is that we're expecting from the children…. And what it is that we are teaching …". She also spoke of parents providing a similar role to Dan's vision of parents reinforcing school mathematics learning*:*

"so they have their mathematics homework and um speaking to parents on parents' evening and asking them to support their children on their times tables and make sure they listen, practice with them …".

Farzana had strongly felt ideas about how parents could support their child and the examples she gave involved parents coming into school. One example was to seek support from the teacher on specific mathematics tasks sent home:

"I've had a parent in fact come in once and she asked me about some homework I gave her daughter and er she didn't really understand it and 'how do we, how do you work this out?' So I went through it with her and I, I like that, you know, I thought that was good, you know, that mum had come in and she was a bit confused about something and then she saw it".

Farzana spoke very positively about that experience implying she would welcome more parents coming into school in this way. She also referred to attendance at parents' evenings. At the most recent parents' evening attendance had been less than 50%. Farzana linked this fact to how she viewed parental involvement as closely tied to raising the achievement of pupils in her class: her message to parents was "no, sorry but you can't just sit at home, you need to be in school, we need you, your child needs you". She was frustrated with her perception of the school's approach to parents which she described as making "excuses" for non-attendance at parents' evenings. She said she would have liked to explain her view of education and attainment in general at the school more explicitly to parents in order to specify what their role should be:

"we need to be a lot more tough on parents I think – and if you paint pictures of, you know, they just, this is what your child should be doing, there is what your child should be achieving, this is where your child is, you know, why we need to improve, why they need to improve, and what you can do…"

Farzana also went so far as to make judgments about parents' engagement with their children. One example concerned a child from a Pakistani family whom Farzana considered to have poor behaviour which was contributing to his poor progress in all subjects, mathematics in particular. Farzana speculated:

"I get the impression he's very spoilt at home and I do know being an Asian boy that in families they tend, not all families, because I have a brother and I know my mother's never, you know, she's always said 'no he's not going to be spoilt' and he's been made to do things for himself".

7.5 The teachers' beliefs about acknowledging children's home lives

Both teachers admitted to not knowing much about what the children did at home, either in general or in mathematics in particular. Dan referred to how he managed to find out about what the children are doing at home: "…I don't know a load about their home life – it tends to be things they mention in school". He commented on popular culture and expressed his doubts about what children were learning from it in relation to mathematics. He admitted that children were often dealing with "huge" numbers in, for example, Pokemon games, but he suspected that the children playing did not really know what these numbers meant.

Farzana acknowledged that she knew little about what the children were engaging with at home. When an opportunity arose for her to learn about a child's home life, she was positive:

"I've had parents who will tell me what children have been doing outside of school or what they enjoy doing and that's very useful – I find that it helps build up a good sort of relationship not only with the parents but with the child as well…".

In this section, we have presented data from interviews with the two case study teachers about various aspects of their work with children and parents in relation to mathematics learning. Some views were shared by both teachers, such as their impression that some parents lacked confidence in mathematics and their awareness of parents and children using different mathematical methods. There were also differences between the two teachers, however, such as in their reported experiences of meeting with parents and their perceptions of linguistic diversity. In the next section we link the two teachers' beliefs as expressed in the data discussed here with the concept of funds of knowledge.

8. The teachers' funds of knowledge

When engaging with our questions about parents, communities and children's lives, we argue that the teachers drew on their 'funds of knowledge' (Moll & Greenberg, 1992) derived from both their professional knowledge of pedagogy and mathematics and their personal knowledge and experiences beyond being a

teacher. In this section, we discuss each teacher's funds of knowledge which we have grouped together into four aspects, noting where there are similarities and differences between the two case study teachers.

8.1 Being a parent

One component of Dan's funds of knowledge derives from the fact that he himself is a parent. This may explain his apparently contradictory remarks about the ways in which parents should support children's mathematics learning at home. On the one hand, he expressed a desire for parents to provide practice and reinforcement of mathematics that he, as a teacher, could not do in school. On the other hand, he felt that the work completed at home should not be formal or like a lesson.

Dan's reiteration of the lack of time at home for parents and children to engage in school-related work seems also to derive from his own sense of feeling under pressure of time, perhaps due to being not just a parent but a working parent. He mentions the notional idea of whether or not parents have "five minutes" to spend with their children on some aspect of mathematics learning. Both the concern for how mathematics might usefully be engaged with at home and the awareness that time is limited suggest that Dan considered issues through the 'filter' of being a parent.

Farzana was not a parent, and this might explain what seemed to be a harsher or less empathetic view of how time is spent outside school hours. She expressed her impatience with parents for not attending parents' evenings and referred to the school as being too accepting of what she termed 'excuses' on the part of parents.

8.2 Sharing ethnic and religious background

Dan did not share ethnic or religious characteristics with the minority ethnic children in his class and only referred to aspects of their lives to which the children or parents had themselves drawn his attention. In his interviews, he did not engage in speculation about issues he had no experience of or evidence for. In this way, his interviews and Farzana's differed markedly in that she tended to note characteristics of children and families in her class and then proceeded to provide an opinion on them as well. For example, she noted that children in her class were under-performing and she went on to express her desire to speak plainly to parents about it so that the low attainment trend of particular minority ethnic groups could be reversed. She had a broad framework in which to consider educational achievement and her shared background in terms of language, ethnicity and religion in the case of many of the children and families provided her with an 'insider' perspective on those children and families which she used to move from description to opinion giving and passing judgement in some cases.

It also needs to be noted, however, that what Farzana did not share with the children and parents in her class was a similar socio-economic background. This fact overlapped with her gender and, perhaps, her young age to create barriers between herself and her pupils' parents. She noted a feeling of not being listened to or taken seriously.

8.3 Being a part of the local community

Farzana lived in the same locality as the children she taught, which was near to the school building. In her interviews, she often used the possessive pronoun 'our' to refer to the local area and the school, which pointed towards a sense of closeness to and familiarity with both the locality and the school and the people associated with both. When talking about parents' confidence in mathematics, she referred to parents in "our area". Farzana drew on her local knowledge when considering parents and mathematics education. Dan, on the other hand, did not refer to his relationship with the locality of the school or relate 'local' issues to issues of teaching and learning mathematics, involving parents or engaging with children's home lives more generally.

8.4 Being a teacher

Farzana and Dan shared similarities in the ways in which they talked about their idealized models of parental involvement. Both seemed to consider parental involvement at one level to provide a compensation for the limitations of the packed school curriculum. This seemed to be the 'colonisation' of the home, as described by Edwards & Warin (1999), in action. Both teachers also expressed an awareness of their lack of knowledge about what parents and children were actually engaged in in terms of mathematics out-of-school, although both appeared to welcome the idea of finding out more (in a part of the interviews not reported here).

Where Dan and Farzana differed in their consideration of the mathematics which took place at home was in the ways they talked about the use of different mathematical methods. Dan saw it as a problematic area, particularly for minority ethnic parents who spoke languages other than English at home, but also for parents who experienced a different kind of mathematics education in their own schooling. In contrast, Farzana seemed to take a broader and more inclusive view of diversity and welcomed any practices outside of school which might engage children in learning. It could be that Farzana's engagement with different languages and cultures in her own life had prepared her to feel positively about diversity in the lives of her pupils and their families and by extension about their approaches to mathematics.

Farzana's professional knowledge also gave her access to the current discourse of raising achievement amongst minority ethnic groups and we saw her attempting to address this issue in her own practice. Perhaps we could consider her commitment to the issue as deriving from her shared religious and cultural background with some of the children in her class who she saw to be underachieving. Dan did not refer to the agenda of raising achievement for minority ethnic pupils in either of his interviews, although the issue had been highlighted in Wales in a report by the English as an Additional Language Association of Wales (EALAW, 2003).

To summarise, we suggest that the two case study teachers drew on their funds of knowledge when we asked them to consider the issues of linking home and school in relation to mathematics learning. These funds of knowledge extended beyond professional knowledge associated with being a teacher into areas such as being a

part of the local community, being a parent, being a member of an ethnic group and being a follower of a religion. The funds of knowledge between the two case study teachers were shared in some cases but varied in many others. From our study, we would not want to attempt to generalize to the funds of knowledge of other teachers. The important point is that any other two primary school teachers are likely to have as varied funds of knowledge as the two we have studied. The implications arising from this diversity are challenging for those involved in supporting teachers in their work with children and parents and for those developing education policies in this area. Some of these implications are discussed in the next section.

9. Implications for policy and practice

The data we have presented raise challenging issues for the UK government's strategy of raising the mathematical achievement of minority ethnic groups through parental and community involvement and through valuing home lives. This strategy is to be carried out by teachers. From our data, we have illustrated some of the challenges that two teachers have faced. The following list provides a summary of those challenges:

- to support parents who are not confident in their own ability in mathematics
- to support parents' learning that different methods can be used to do mathematics
- to expand parents' understanding of what doing mathematics can mean – e.g. data handling, fractions, etc.
- to enlist parents' support in addressing pupil behaviour issues which impinge on mathematics learning
- to support parents in how best to use their limited time at home in supporting children's mathematics
- to value multilingualism and encourage parents to support children's mathematics through home language
- to engage with parents in a way that avoids an "us and them" scenario
- to balance the formal and informal distinction between home and school mathematics learning
- to find out more about children's engagement with mathematics out of school
- to win parents' support to the importance of attending parents' evenings
- to share expectations about achievement in mathematics with parents

The two teachers whose case studies form the basis of this paper have similarities and differences in their beliefs and practices relating to the teaching and learning of mathematics, involving parents, communities and children's home lives. We trace these differences back to the two teachers' funds of knowledge which emanate from their personal and their professional knowledge and experiences and the interactions between these factors. If teachers working in similar contexts to these two teachers are to address issues of diversity and raising achievement then, we argue, attention needs to be given and resources need to be channeled into providing initial and ongoing training and support. The area of parental and community involvement and inclusivity of children's out of school lives presents challenges to all teachers and schools and therefore deserves increased attention beyond mere exhortation.

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Notes

1. see http://www.standards.dfes.gov.uk/numeracy/
2. Dan is using shorthand here to indicate his increasing use of having pupils sitting down on the floor together for a whole class teaching and learning session. This contrasts with the usual practice of teaching and learning taking place with pupils sitting at their desks in small groups.

References

Abreu, G. de (1998): Reflecting on mathematics learning in and out of school from a cultural psychology perspective. – In: Olivier, A.; Newstead, K. (Eds.), Proceedings of the 22nd conference of the international group for the psychology of mathematics education, Volume 1. Stellenbosch, South Africa: University of Stellenbosch, p. 115-135.

Baker; D., Street; B.; Tomlin, A. (2003): Mathematics as social: understanding relationships between home and school numeracy practices. – In: For the Learning of Mathematics 23 (3), p. 11-15

Begg, A. (2001): Ethnomathematics: why and what else? – In: Zentralblatt fur Didaktik der Mathematik 33 (No.3), p. 71-74.

Bonotto, C. (2001): How to connect school mathematics with students' out-of-school knowledge. – In: ZDM, Zentralblatt fur Didaktik der Mathematik 33 (No.3) p. 75-84.

Castelli, S.; Mendel, M.; Ravn B. (Eds.) (2003): School, family and community partnership in a world of differences and changes. - Gdansk: Uniwersytet Gdanskip.

Civil, M. (1998): linking students' own cultural mathematics and academic mathematics – a reaction paper to Presmeg – In: Olivier, A.; Newstead, K. (Eds.), Proceedings of the 22nd conference of the international group for the psychology of mathematics education, Volume 1. Stellenbosch, South Africa: University of Stellenbosch, p. 152-159.

Clarkson, P. (1998): Reflections on mathematics learning and teaching: implications of cultural perspectives. – In: Olivier, A.; Newstead, K. (Eds.), Proceedings of the 22nd conference of the international group for the psychology of mathematics education, Volume 1. Stellenbosch, South Africa: University of Stellenbosch, p. 131-135.

DfES (2004): Understanding the needs of minority ethnic pupils in mainly white schools – a guide to good practice. - London: DfES

DfES (2003): Aiming high: raising the achievement of minority ethnic pupils. - London: DfES

DfEE (1999): The national numeracy strategy: framework for teaching mathematics from Reception to Year 6. - Sudbury: DfEE Publications

D'Ambrosio, U. (1985): Ethnomathematics and its place in the history and pedagogy of mathematics. In: For the Learning of

Mathematics Vol. 5 (1) p. 44-48
D'Ambrosio, U. (2001): General remarks on ethnomathematics. – In: Zentralblatt fur Didaktik der Mathematik 33 (No.3) p. 67-69.
Dyson, A.; Robson, E. (1999): School, family, community: mapping school inclusion in the UK. - Leicester: Youth Work Press for the Joseph Rowntree Foundation
EALAW (2003): The achievement of ethnic minority pupils in Wales: An EALAW research report for the Welsh assembly government. - Cardiff, Welsh Assembly Government
Edwards A.; Warin, J. (1999): Parental involvement in raising the achievement of primary school pupils: why bother? – In: Oxford Review of Education; Vol.25, no.3; p.325-341.
Epstein, J. (2001): School, family and community partnerships: preparing educators and improving schools. - Westview Press
Hughes, M.; Andrews, J.; Feiler, A.; Greenhough, P.; Johnson, D.; McNess, E.; Osborn, M.; Pollard, A.; Salway, L.; Scanlan, M.; Stinchcombe, V.; Winter, J.; Yee, W. (2003): Exchanging knowledge between home and school to enhance children's learning in literacy and numeracy. – In: S. Castelli, M. Mendel, and B. Ravn (Eds.), School, family, and community partnership in a world of differences and changes. Gdansk: Uniwersytet Gdanskip, p.175-189.
Martin-Jones, M.; Saxena, M. (2003): Bilingual resources and 'funds of knowledge' for teaching and learning in multi-ethnic classrooms in Britain. – In: International Journal of Bilingual Education and Bilingualism Vol.6, Nos. 3 & 4, p. 267-282.
Moll, L.; Greenberg, J. (1992): Creating zones of possibilities: combining social contexts for instruction. – In: L. Moll (Ed.), Vygotsky and education. Cambridge: Cambridge University Press, p. 319-348.
Nunes, T.; Schliemann; A.D.; Carraher, D.W. (1993): Street mathematics and school mathematics. - Cambridge: Cambridge University Press
Osborn, M. (1996): Identity, career and change: a tale of two teachers. – In: Croll, P. (Ed.), Teachers, pupils and primary schooling – continuity and change. London: Cassell, p. 53-61.
Presmeg, N. (1998): A semiotic analysis of students' own cultural mathematics. – In: Olivier, A.; Newstead, K. (Eds.), Proceedings of the 22nd conference of the international group for the psychology of mathematics education, Volume 1. Stellenbosch, South Africa: University of Stellenbosch. p.136-151
Stake, R. (1995): The art of case study research. - London: Sage
Winter, J.; Salway, L.; Yee, W.; Hughes, M. (2004): Linking home and school mathematics: the home-school knowledge exchange project. – In: Research in Mathematics Education, Volume 6 - London: British Society for Research into Learning Mathematics, p. 59-75.
Wolfendale, S.; Bastiani, J. (Eds.) (2000): The contribution of parents to school effectiveness - London: David Fulton

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