PARENTS' EXPERIENCES AS MEDIATORS OF THEIR CHILDREN'S LEARNING: THE IMPACT OF BEING A PARENT-TEACHER

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This article discusses the way parents' past experiences influence the construction of their mathematical identities, their representations and their valorizations of current school mathematics, and how these factors mediate involvement with their children's mathematical learning. Two different groups of parents, with and without teaching experience, were interviewed. Participants within the groups showed similarities in the ways they constructed their own mathematical identities, and differences in how they constructed representations and valorizations of current school mathematics. Whilst those with teaching experience generally held more positive representations of current practices, the way they valued these practices changed according to their perceptions of their child's needs, and the various roles they adopted.

Key words*: parents; home-school; identities; representations; valorizations*

INTRODUCTION

The William's Report argues that parental involvement in schooling is a powerful force, and that 'parents are a child's first and most enduring educator, and their influence cannot be overestimated' (Department for Children, Schools and Families, 2008, p.67). However, research indicates that parental involvement in their children's education is complex. In a study reported by the Department for Children, Schools and Families (2007), it was found that whilst 73% of parents feel it is extremely important to help with homework, confidence amongst parents to become involved has decreased in recent years. Barriers to successful interaction may be particularly evident when parents and children work together over mathematics homework (Abreu & Cline, 2005; O'Toole & Abreu, 2005). Societal and cultural changes (e.g. National Numeracy Strategy, UK, 1999; immigration) are among the factors which have resulted in very different experiences of mathematics learning by both parents and children (O'Toole & Abreu, 2005). Abreu and Cline (2005) found that many parents were confronted with differences between their own ways of tackling mathematics and methods their children learned at school. Parents developed sophisticated representations of these differences, the most common concerning teaching methods and tools (e.g. calculators) available in the classroom. They also found that even when parents share knowledge of different methods to approach calculation, they may have a different understanding of how these methods are valued, and it is the position they adopt towards these shared representations that may affect how they organize mathematical practices for their children (Abreu & Cline, 2003). Abreu (2002, 2008) proposes that it is *participation* in particular practices

which enables individuals to master cultural tools, and to understand how these are socially valued. For parents whose experience of learning mathematics was algorithmic rather than conceptually based, new methods of learning may remain inaccessible and they may be expected to support their children's learning in ways that don't make sense to them (Remillard & Jackson, 2006).

THE RESEARCH QUESTIONS

Many studies have examined the response to perceived differences in numeracy practices in minority cultural groups (Abreu, 2008; Abreu & Cline, 2005; O'Toole & Abreu, 2005; Quintos, Bratton & Civil, 2005; Civil & Andrade, 2002). In Abreu's previous studies, it was apparent that both parents' own experience of mathematical learning in a different cultural setting, and their lack of direct exposure to current school mathematics, impact on their understanding of their children's mathematical learning. This study seeks to understand further parental participation in their children's learning within the majority (White-British) cultural group, in terms of how this group experiences their children's mathematical learning in the context of historical changes between their school education and the education of their children. In addition, the study seeks to explore further the impact of parents' personal histories on their involvement with their children's learning, in terms of their experience of direct participation in current methods of learning. In this way, the study can shed light on issues that are specific to curriculum changes over time within a society, and issues that are more related to minority cultural groups. The study explores the experiences of two different groups of parents, those with teaching experience (direct participation in current teaching practices) and those without, with a view to determining similarities and differences in the way the participants in each group interpret their past experiences, construct current representations, and use these representations to mediate interaction with their child. The research questions investigated were: (1) What are the similarities and differences between the parents of these two groups in the way they construct their mathematical identities, and how does different adult experience affects these identities? (2) How do the parents from the two groups construct representations of current school mathematics, and how do they value perceived differences between current school mathematics and their own? (3) How do the parents from the two groups use their representations and valorizations of school mathematics to mediate interaction with their children's learning?

METHODOLOGY

Two groups of six White-British parents were interviewed. All participants had attended schools in the UK during the late 1960's - early 1970's, were university-educated, and all had children currently attending Primary schools. One group ('parent group') had no teaching experience, and were recruited through a Primary

school in Oxford. The other group ('parent-teacher' group) had varying teaching experience. Four of this group had teaching experience prior to the National Numeracy Strategy, had taken a career break, and were selected from a Return to Teaching course organised by the Teacher Development Agency. These parents had undertaken recent placements in Primary schools which involved teaching numeracy, and could therefore compare their experiences of teaching numeracy both before and after the educational reform. The remaining two parent-teachers had recently trained as Primary teachers, and were able to draw on their experience of helping their children with their homework prior to their training.

Procedure and tools for data collection: An episodic interview (Flick, 2000) format was used as this method of questioning encourages participants to give their opinions about the subject matter, and to give concrete examples of situations in their past. The interview covered basic information, and explored the interviewee's biography in relation to their mathematics learning, current uses of mathematics, and their experiences of helping their children with school homework. For parent-teachers, their teaching experience was also explored. All participants were interviewed in their own homes for approximately 45 minutes, and interviews were audio-recorded.

Data analysis: The interviews were fully transcribed and analysed using thematic analysis (Braun & Clarke, 2006), taking into account the research questions, key concepts from the literature, and new information emerging from the data. The coding was supported by NVivo qualitative analysis software. Initial thematic maps grouped sub-themes together into super ordinate themes as described in Table 1. The data was then examined for similarities and variability between the two groups of participants.

Table 1. Superordinate themes and sub-themes.

Superordinate themes	**Sub-themes**
1. Parent's mathematical identities	1. Memories of mathematics learning - emotions 2. Perceptions of own ability 3. Social value of mathematics in family/peer group 4. Effect of parent's identity on child's identity
2. The effect of adult experience on identity	1. Effect of work experience on identity 2. Effect of teaching experience on identity
3. Parents' representations of school mathematics	1. Knowledge/understanding of current methods 2. Perception of own school mathematics as same/different 3. Effect of teaching experience on representations
4. Parents' valorizations of	1. Equivalence of/confidence in different methods

different practices	
5. How different representations and valorizations influence interaction	1. Effect of representations and valorizations on interaction 2. Valorization of methods by parent and child 3. Effect of teaching experience on interaction 4. Emotional aspect: frustration/fear of confusing child

FINDINGS AND DISCUSSION

Parents' mathematical identities

Three main themes were revealed in participants' perceptions of themselves as mathematics learners: their perception of their ability, memories of the emotive nature of their mathematics learning experiences, and their status as a learner amongst family and peer group. Participants in both groups were similar in that their assessment of their cognitive competence in the cultural tools of mathematics formed a significant part of the way in which they constructed their mathematics identity. The data also indicates that participants' view of their mathematics ability did not solely rely on their perception of their competence, but was strongly influenced by their feelings about their experiences. For example, Table 2 shows that there were parents from both groups for whom learning mathematics was remembered as a struggle and was associated with fear and panic. Tilda talks about 'feeling lost for ever, for ever after'.

Table 2. How emotions mediate mathematics identity.

Parent group	**Parent-teacher group**
P: I can remember saying, "I don't understand," and him trying to explain it, and I was none the wiser. I can actually remember saying, "Help!" I mean he tried but it was no good, and then I can just remember being lost for ever, for ever after … I think I was always quite good at just basic maths, but with algebra or anything like that, I'd always be frightened. [I felt] a sort of terror, fear. *Tilda, parent*	*P:* I think it got to that point where sometimes you'd go, "Oh, I can't do that!", and your brain freezes, and your brain would stop working and decide that it can't do this. *Rebecca, parent-teacher*

For both parents and parent-teachers, their mathematical identity relied strongly on how they were identified by significant others, for example, parents and teachers, and their perceptions of their ability in comparison to siblings and peers. Parents in both groups hoped that their child would construct a positive mathematics identity, and for many, it was more important that their child have a confident relation with

mathematics, than be expert in the subject. The consequences of parents identifying themselves, or their children, as less competent, resulted in participants from both groups positioning themselves, or their child, as an 'arts' person rather than a mathematician. In positioning themselves in this way, they devalued mathematics as something not necessary to succeed. Consequently, this may have limited their capabilities in mathematics, or their expectations for their child. Many showed awareness of how their own parents' mathematics identity had influenced the way they perceived themselves as mathematicians, and how this could, in turn, influence their children's identity. As illustrated in Table 3, Tilda felt it was extremely important not to let her daughter know that she wasn't a confident mathematician, whilst Clare understood that her own identity was interlinked with her father's.

Table 3. How parents' mathematical identity can affect their children's.

Parent group	**Parent-teacher group**
P: I've got a friend that says, "I was crap at maths, so my kids are crap at maths", that's what she says. And she has a daughter who isn't doing so well in maths, but she's taking it as an absolute given that that is how it will be and I suppose I don't … I've never said to [Lily] I wasn't any good at maths because that would be a dirty little secret I would keep to myself! *Tilda, parent*	*P*: My dad was a maths teacher for a while, and he used to get really frustrated with me, helping me with maths, because he's sort of mathematically-gifted, he sort of finds it easy. So there was this conflict in my relationship with my dad … and I didn't see myself as a natural mathematician. *Clare, parent-teacher*

The effect of adult experience on identity

The research revealed that parents in both groups felt that they had developed a more positive relation with mathematics due to experience during adulthood (see Table 4).

Table 4. The effect of adult experience on mathematical identities.

Parent group	**Parent-teacher group**
P: I think it's practical maths … because once you actually leave school and you start working, you have to use maths on a day to day basis, and suddenly it all starts to make sense, and depending on the kind of work you do … I've always learnt by rote, managed to get through, and then latterly actually as	*P*: It's interesting actually as I think my own feelings about mathematics really changed when I did my teacher training … Suddenly I saw the beauty of numbers, it all fell into place and I could see how all the different parts of mathematics relate to each other … revisiting it I had this sudden enthusiasm for maths that I'd never had before … I'm not suddenly a better mathematician because I'm doing more

you get older, you realize why that goes with that, and it's a late discovery. Suddenly it's like, "Oh! Oh yes!" *Lisa, parent*	advanced level maths, I'm a better mathematician because I understand the basics in a different way. *Clare, parent-teacher*

Often, those parents who described a change in their mathematical identity, experienced a transformation of their understanding of activities through participation in different contexts for mathematics practice. A number of parent-teachers experienced transition from being an anxious mathematics learner, to a confident teacher of mathematics, through participation in different contexts for mathematics *learning*. Clare reveals that the experience of 'revisiting' mathematics during teacher training allowed her to acquire an understanding of the concepts of mathematics she felt she lacked as a child. Many parent-teachers attributed this greater understanding to current conceptually-based methods, in comparison to the algorithmic approach they had experienced themselves.

Whilst participants in both groups had experienced changes in their relation with mathematics during adulthood, there was variability between the groups in how the participants constructed their relation to mathematics due to the differing nature of these experiences. Those in the parent group tended to associate the change in their mathematics identity with maturity, or to using mathematics in daily life. Those in the parent-teacher group, however, were more likely to associate change with the opportunity to revisit mathematics, and participate in practices which differed from those they were familiar with.

Parents' representations of their children's school mathematics

Whilst having clear memories of certain aspects of their own learning, many participants, particularly in the parent group, had unclear ideas of how their children were currently learning mathematics. As Table 5 shows, this lack of knowledge sometimes produced a strong emotional response. Lisa, for example, talked of feeling 'closed' to the new methods because they didn't make sense to her, whilst Karen experienced frustration and could not view the school's methods in a positive light.

Table 5. The effect of parents' lack of knowledge of current methods.

Parent group
P: I know I'm not open, I feel that I'm quite closed to these new methods because I look at them and they don't make sense to me. I get the impression that they're trying to make maths meaningful and I just think it isn't meaningful, it only becomes meaningful if you start to use it in life. And if you're one of those people that it's not obvious to, the way they're doing it, it's not making it more obvious, it's actually making it more obscure. *Lisa, parent*
I: Can you show me any ways that you think they're doing it?

P: Oh, God, I can't. I mean, no, I can't. I must be really honest here, I don't actually understand how the mathematics is taught or why the mathematics is taught in the way it is … And the point is, I don't actually know whether there are advantages to the way they do it, I just don't know, because I don't understand it, and I don't know how they're teaching it. *Karen, parent*

Although many felt unclear about the new methods, all participants remembered their learning as very different to the ways their children learn now, and these differences were explained as historical changes within Primary education. The representations of these differences were similar in the two groups of parents in terms of teaching methods used, and different mathematical strategies for calculation. Current methods were viewed by participants in both groups as having a greater emphasis on underlying meanings and relationships, whereas a significant feature of their learning had been the repeated practice of 'rules' or 'formulae' for calculation. The groups differed, however, in their conception of whether current or old methods placed a greater focus on mental strategies. Indeed, it became clear that what was meant by 'mental strategies' was quite different to the groups. Those in the parent group tended to equate mental strategies with basic mental arithmetic, and felt strongly that there was less emphasis on this in current teaching. The participants in the parent group valued the repeated practice which had allowed their mental skills to become 'second nature'. The participants in the parent-teacher group, however, viewed current methods as having a *greater* emphasis on mental strategies, but saw this in terms of children having more opportunities to discuss concepts, and have a greater range of mental strategies to tackle calculation. Although parents from both groups talked about valuing mental mathematics, how they constructed their representations and valorizations of mental mathematics was quite different.

Parents' valorizations of different mathematical practices

Whilst participants in both groups shared the view that current school mathematics was different to their own school mathematics, the way the groups valued different practices was quite diverse. The parent-teacher group participants had a clearer idea of the purpose of the new methods, saw the changes as predominantly enhancing children's global abilities in mathematics, and as providing them with a more solid platform for later mathematical study. They spoke positively of children talking about mathematics, developing a greater ability to reason, and a greater understanding of the concepts of mathematics. They were more likely to value conceptually-based learning, and less likely to value an algorithmic approach. Their view of current mathematics was often in comparison with how they remembered their own experiences of learning which whilst enabling them to perform calculation procedures well, had also meant they adopted an 'automatic approach' without understanding how numbers worked together. Their accounts of the way in which

they learned may have been mediated by their greater knowledge of the aims of current methods and their current perceptual frameworks.

Most of the parent group participants, on the other hand, saw the changes predominantly in terms of confusion and complexity. They described the new methods as too numerous and more complicated, and were anxious that the focus on understanding the concepts of mathematics was at the expense of rigorous training in the acquisition of basic mental skills. They viewed that this would result in a gap in their children's cognitive skills, particularly if they perceived their children to have a less confident relation to mathematics. Amongst the participants in this group, differences in methods were not described in neutral terms, and were not treated as equal alternatives. Parents used language such as 'simple', 'straightforward' and 'logical' to describe their own form of mathematics, and 'long-winded', 'complicated', and 'obscure' when describing new ways. Parents in this group were more likely to value an algorithmic approach, and less likely to value an emphasis on conceptual understanding. As they possessed less knowledge of the new methods, they were more likely to feel new methods inadequate or confusing, and to feel closed towards them.

How different representations and valorizations influence interaction

The data revealed that many of the parent group participants experienced difficulties in understanding practices in which they did not have direct participation, and were often dependant on children's explanations about how they use particular procedures. That children themselves were often unable to explain clearly often resulted in a breakdown in communication between parent and child. Table 6 shows that Karen felt frustration that her incomplete knowledge prevented her from helping in anything more than a checking role, whilst Susie described how lack of information made her feel there was nothing she could do, and compromised the amount of effort she was prepared to invest. Not only did those parents who lacked knowledge of current methods feel excluded from helping their children, they couldn't judge their child's competence in comparison with their own ability at a similar stage, and felt they did not know what could be expected of their child.

Table 6. The effects of parents' lack of information on interaction.

Parent group
I: …Do they think they're good at maths?
P: Yes, I think so. The problem is it's difficult for me to know whether they're good … obviously they seem to get their maths homework right …but I don't know what that means, are they good beyond that? Are they capable of more than that? … I sort of feel like, and this is my lack really, I feel I should be more sort of involved with their mathematics ... I feel I'm not involved enough, because I basically just sit and look at it and any that are wrong I'll check them, but only from a distance really … So I do find it difficult to support them as much as I could. I don't feel I can get as

involved as I would if he was learning in the same way as I did. *Karen, parent*
P: Well, a lot of the time if I don't understand what method is to be used, I just throw up my hands. There's nothing I can do. I don't feel ... I don't feel anything really, it's a waste of energy really. There's nothing I can do, but I sometimes feel sorry for Molly, because she gets really upset and there's nothing I can do. *Susie, parent*

As parents talked about the way in which they interacted with their children, it became clear that many children valued school's methods more highly than methods their parents showed them. This was not necessarily because the school's methods were better or clearer, but that children perceived them to be the 'right way of doing it'. Parents in both groups talked of how their children 'revered' school more than their parents, and of their child's resistance to being shown other ways. This often resulted in discordance between parents and child, and led to homework as a source of conflict. The data also revealed that responses to mathematical practices differed according to which practices parents valued more highly. Whilst not wanting to undermine school methods, many in the parent group displayed frustration that their own tried and tested methods were being devalued, whilst they perceived other methods as resulting in confusion for their children. Those in the parent-teacher group, on the other hand, generally had more favourable representations of current school mathematics, and were more willing to support methods which they viewed as enabling their children to achieve a positive relation with mathematics. They reported that their teaching experience had enabled them to develop a greater understanding of current school mathematics, and this allowed them to be more confident in assessing their child's ability, and in participating in mathematics homework. However, the data also revealed that although most of the parent-teachers understood and appreciated the use of multiple methods, they adopted different positions towards these approaches if they perceived their own child was confused and this, in turn, affected how they organized mathematical practices for their children (see Table 7).

Table 7. Parent-teacher's valorizations of their own methods.

Parent-teacher group
P: Milly, I know, knows one method, and if something else is being taught, then I'm afraid I'm saying to her, ignore it, because I'm worried that she will mix it as well. I'm saying forget what Mrs Woods tells you, I keep telling her, which is very naughty, but stick to what you know, because you can do it that way. *Jane, parent-teacher*
P: I think we took the right decisions for Luke at the time, but I think potentially it could have been even more confusing to him, because I could explain to Luke, yes, you can do it these different ways at school, but you know if Dad's shown you this way and you're happiest with that way, then you do it that way. *Cathy, parent-*

teacher

Although some parent-teachers were unwilling to devalue the school's methods, others felt they were right to encourage their children to use only one method, if their child continued to be confused. Jane talks about actively encouraging her own daughter to ignore the school's insistence on multiple methods because of her fear that she will become confused. The effect of teaching experience, then, was generally positive in terms of parents' representations and valorizations of current school mathematics. However, although, many parent-teachers recognized that multiple methods may enhance understanding by providing 'the bigger picture', they constructed different representations of new methods as too numerous and too complex if they perceived their own child to be confused by them. Even with a good knowledge and understanding of new methods, and sympathy towards the aims of the National Numeracy Strategy, their position in relation to the numeracy practices changed according to the particular role, as professional or parent, they had to adopt at any given time. It was the position parents adopted towards these representations which affected how they interacted with their children's mathematical learning.

CONCLUSIONS

The research set out to explore how parents' past experiences influence the way in which they construct their mathematical identities and their representations of different mathematical practices, and how these factors influence the ways they interact with their children's learning. The findings illustrated that both those with, and those without teaching experience, construct their mathematical identity in similar ways and this identity was shown to evolve through participation in different contexts of mathematical practice and learning. Participants in both groups were similarly aware that their own mathematical identity could affect the way in which their children approached mathematics.

The study revealed that both those with and without teaching experiences perceived current school numeracy practices to be very different to those they had experienced when learning. Varying levels of knowledge, and different levels of participation in current methods resulted in the participants from both groups valuing different mathematical practices in different ways; those with teaching experience tending to attribute a higher value to current methods than those without teaching experience. However, the study indicated that although in many areas, those with teaching experience were able to bridge the gap between differing mathematical practices more easily, when confronted with their child's continuing confusion about mathematics, parents may revert to the methods they formerly depended on, despite holding positive representations of current methods. Parents' perception of their child's ability in relation to certain mathematical practices was, therefore, a more significant resource for parents, and contributed more significantly to the way in

which they interact with their children, than their overall representations of current methods.

This research indicated that it is the opportunity for participation in different mathematical approaches which allows parents to construct more positive representations of varying practices, and in turn, to understand how they are socially valued. This has implications for how schools communicate the way they approach mathematics, and the opportunities they offer to parents for understanding these practices and for raising confidence amongst parents to become involved. The study also explored the transitions parents experience between their roles as parent and teacher, and how the subjective knowledge they developed during these transitions is adapted for each role. Further study of teachers' representations and practice in the classroom, in the light of the interaction they experience with their own children, would contribute to research on the ways in which valorization of numeracy practices affect support both within the home and at school.

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