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Why Is Parental Involvement in Children's Mathematics Learning Hard? Parental Perspectives on Their Role Supporting Children's Learning

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Abstract

This article focuses on parents' experiences and practices supporting children's mathematics learning. We employ a conceptual framework that makes a distinction between school-centered and parent-centered approaches to parental involvement in children's learning. We review literature showing that aspects of both school-centered and parent-centered approaches can be problematic, and explore this further in a group interview study. Group interviews were conducted with parents of children in 16 primary schools in a city in the southwest of England. Topics of discussion included parents' level of confidence and perceived ability in mathematics, their experience of doing mathematics with their children out-of-school, and their interactions with school about mathematics. Findings revealed some specific negative effects of school-centered approaches, and suggested that school-centered approaches may in fact restrict parents' understanding of how they can support mathematics learning in the home. However, the analysis also adds useful depth to our understanding of opportunities associated with a parent-centered approach to parental involvement in mathematics learning.

Keywords

parental-engagement, parental-involvement, homework, out-of-school learning, mathematics

Introduction

This article makes a contribution to knowledge in the area of primary school parents' perceptions of their role supporting children's mathematics learning. We report a study in which we carried out a series of group interviews with parents of 7- to 8-year-old children in 16 primary schools in a city in southwest England. The study was motivated by a number of related issues. There is a large and growing body of evidence showing that parental engagement in children's learning is associated with higher levels of attainment among children (Cairney, 2000; Desforges & Abouchaar, 2003; Melhuish et al., 2008). Governments and educational advisory bodies have responded to this evidence with policies encouraging, and in some cases mandating, strategies for schools to raise levels of parental engagement (Department for Children, Schools, & Families, 2008; Department for Education, 2010; U.S. Department of Education, 2014). However, there is a more recent body of evidence that shows that it can be difficult for schools to raise levels of parental engagement—especially in support of mathematics learning (Gorard & Huat See, 2013; Patall, Cooper, & Robinson, 2008). Moreover, some strategies for developing and raising levels of parental engagement can have the opposite effect to that intended, and lead to lower levels of attainment and attitudes to learning—again, this is especially the case with mathematics.

If schools are to be successful in raising levels of parental engagement in children's learning, and in turn raising levels of children's attainment, it is essential that we gain an understanding of how parents construct their role. On one hand, parents are more likely to respond positively to strategies that align with their existing conceptions. On the other hand, if desired strategies do not align with parents' existing conceptions, then further research and development will be needed to develop new ways of working.

The next section will begin with a summary of research showing that parents and the home environment are

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generally recognized as making a substantial contribution to children's mathematics learning. This sets the scene for a review of some key drivers for, and barriers to, different forms of parental involvement in children's mathematics learning. The literature in this area can be divided into two broad categories—school-centered approaches and parent-centered approaches to parental involvement—each with its own set of drivers and barriers. We argue that school-centered approaches can be problematic, as they often depend on parents having resources that they do not believe they have. There is also growing evidence that some school-centered approaches, such as the use of homework, can be problematic for children's learning. We argue further that parent-centered approaches may be difficult to implement because they are often not recognized or valued as useful for children's learning. We highlight a gap in the research literature in terms of parents' own perceptions of their role supporting children's mathematics learning, and of any conflicts or tensions that relate to this role. We suggest that the distinction between school-centered and parent-centered approaches to parental involvement in children's mathematics learning can help make sense of parents' perceptions of this role.

Background

The Influence of Parents and the Home Environment on Children's Mathematics Learning

It is widely recognized that parents and families are the primary educators of children and are responsible for laying down the social and intellectual foundations for their learning and development (West, Noden, Edge, & David, 1998). There is a clear message from the literature that parental support benefits children's learning, including their numeracy development (Cairney, 2000; Melhuish et al., 2008). For example, Fan and Williams (2010) showed that the frequency with which parents engage with extracurricular activities, for example, sports events and holidays, is positively related with children's self-efficacy toward mathematics and their subsequent achievement; and Chiu and Xihua (2008) showed that provision of learning resources and activity at home, for example, books, music, and discussion of everyday facts, is likewise associated with improvement in children's mathematics achievement.

Although these research studies agree that parents have an important influence on children's mathematics learning, they focus on relatively young children. When children start school, parental involvement can become more complex. There is agreement among researchers and policy makers that parental involvement in children's school learning is a positive influence on academic (Desforges & Abouchaar, 2003) and affective (Fan & Williams, 2010) outcomes, but evidence suggests that interventions to *raise* levels of parental involvement are rarely successful in raising attainment (Gorard & Huat See, 2013). Gorard and Huat See's meta-analysis of parental involvement interventions found limited evidence for any positive effect. In fact, in the higher quality studies, findings showed that interventions had negative effects on pupil attainment. Similarly, a recent meta-analysis of the effects of parental involvement in children's mathematics homework (Patall et al., 2008) raises some concerns. Although a positive correlation was found between parental involvement in homework and children's achievement in reading, the effect of parental involvement on children's achievement in mathematics was negative. This may relate to another finding of this meta-analysis concerning differential effects of different forms of parental involvement in homework. When parents were directly involved in the content of homework, then there was a positive effect on children's achievement. However, when involvement consisted of simply monitoring homework completion, there was a negative effect. Research from elsewhere in the literature (e.g., Peters, Seeds, Goldstein, & Coleman, 2008) suggests that parents may find it more difficult to provide support and help with children's mathematics homework than in other subject areas, such as reading and writing, because of their own attitudes toward, and levels of achievement in, mathematics.

We are faced with a kind of paradox then, whereby correlational studies of parental involvement in education show uniformly positive effects on pupil attainment, but efforts by schools to increase levels of parental involvement tend to have either no effect or a negative effect on attainment in mathematics. To address this issue, we suggest that it could be useful to distinguish between two different approaches to parental involvement, broadly defined as school-centered and parent-centered.

School-Centered Approaches to Parental Involvement in Children's Mathematics Learning

We refer in this article to school-centered and parent-centered approaches to parental involvement in children's mathematics learning. These two approaches can be understood as representing two ends of a continuum between parental-involvement and parental-engagement as described by Goodall and Montgomery (2014). Goodall and Montgomery suggest that the greatest benefits for children's learning arise from the "parent-engagement" end of the spectrum—which we describe here as "parent-centered" approaches—where parents define the kinds of learning activities that take place outside of school. On the contrary, at the "parent-involvement" end of the continuum—which we described here as "school-centered" approaches—parents are passive recipients of information, and their position is that of "helping the teacher" by carrying out school-defined learning activities at home. According to Goodall and Montgomery, while this "parent-involvement" activity can provide a useful foundation for further work, it is unlikely in itself to have significant benefits for children's learning. We prefer the

terms "school-centered" and "parent-centered" in place of the terms "parental-involvement" and "parental engagement" as they more clearly connate the ways in which learning activities involving parents and children are coordinated and motivated. We also prefer to focus on these two sets of approaches, rather than Goodall and Montgomery's more finely graduated continuum, because we do not see evidence of the whole continuum in many schools or in much of the literature. Although Goodall and Montgomery's model is helpful in identifying potential models of communication and activity between parents and schools, we believe it presents an idealized model of parental involvement in children's learning. Our "school-centered" and "parent-centered" distinction is less subtle, but more in line with what we have observed in practice.

By "school-centered" then, we mean approaches that focus on parents engaging in activity where the primary aim is to help children learn aspects of the school mathematics curriculum and where activities are set and defined by teachers and schools. Common practices in English primary schools, for example, are asking parents to help their children learn or practice their timestables and/or inviting parents to workshops on arithmetic methods used in the classroom. In contrast, a parent-centered approach focuses on activities arising in everyday family life, as defined by parents and families. This section discusses some of the issues relating to school-centered approaches, and explores reasons why these approaches may fail to lead to higher levels of pupil attainment or engagement with mathematics.

In a survey commissioned by the Department for Education and Skills in the United Kingdom (Peters et al., 2008), two in three parents said they would like to be more involved in their children's school life. This same survey also reported a decrease over time in the confidence of parents to help their children. There are a number of issues that, according to the survey, can undermine parents' confidence with regard to children's mathematics learning, including differences between school instruction and parents' own mathematical knowledge, parents' attitudes and anxiety toward mathematics, and parents' beliefs about their interaction with the school. Peters et al. reported that parents' misunderstanding of what their children do and the differences between the current teaching methods and their own experiences were the main reasons for lacking confidence to help with homework. Discrepancies with school-like forms of mathematics might be a consequence of factors such as cultural differences or historical changes. Parents may conceal their ways of doing mathematics from their children so they can learn schools' methods (de Abreu & Cline, 2005), and some can feel excluded from helping their children because they fail to understand the value of newer approaches to teaching mathematics (McMullen & de Abreu, 2011). The decline in the numeracy skills of adults in England seems to be accompanied by a generalized attitude of "I just can't do maths" (Department for Business, Innovation and Skills [BIS], 2011; National Institute of Adult Continuing Education [NIACE], 2011), which has been highlighted as a major obstacle for parental involvement (Williams, 2008).

Homework is often used by schools to try to increase levels of parental involvement in children's learning. Although data on the frequency of the setting of mathematics homework in primary schools in the United Kingdom are not available, our experience, and anecdotal evidence, suggests that many schools are setting mathematics homework for children from the first year of primary school, when children are 5 years old, and that parents are generally encouraged to directly support children with the completion of tasks. There is evidence to suggest that homework may not be effective in raising attainment, and may have negative effects on pupil attitudes to mathematics. The work of Patall et al. (2008) referred to above showed that higher levels of parental involvement in homework were associated with lower levels of attainment among pupils. In the United Kingdom, Farrow, Tymms, and Henderson (1999) found that homework set more frequently than once per month had a negative effect on pupil attainment. Results from studies such as Solomon, Warin, and Lewis (2002), suggest that homework at secondary level can be a cause of considerable tension between parents and children, as many parents do not feel they have the competence to help, while at the same time having awareness of the pressure to succeed in mathematics. However, there is a gap in the literature concerning reasons why mathematics homework, and parental involvement in mathematics homework, at primary level, may have a negative effect on children's attainment and attitudes.

There is evidence to suggest that many parents experience barriers to school involvement more generally, as well as with regard to children's mathematics learning. The building of communication channels for parents to become informed about their children's activities and performance generally leads to improvements in children's achievement (Sirvani, 2007). However, parents might perceive the school as a closed system, and feel a sense of powerlessness when interacting with the staff (Harris & Goodall, 2008). Parents who see teachers as experts in exclusive possession of the content and pedagogical knowledge to teach mathematics may also believe that their own knowledge is not valuable or worth sharing with their children (Civil & Bernier, 2006). Schools are often good at involving parents in school life and activities, but it can be more difficult for schools to work with parents on how they can support pupil learning at home (Harris & Goodall, 2008). There are no "one size fits all" actions to link home and school, especially in England given the diversity of ethnic, class, and cultural backgrounds of children and their families (Feiler, Greenhough, Winter, Salway, & Scanlan, 2006).

Taken together, the research reviewed in this section tells us that when parental involvement is defined by schools then two major barriers to success may be present, in the form of power imbalances in home–school communication and a

lack of confidence and perceived ability in mathematics among parents. Where parents are confident in their mathematical ability, there may still be barriers to successful involvement in children's mathematics learning due to a lack of familiarity with the methods, algorithms, and pedagogical approaches used in the classroom, or due to the nature of the home–school relationship more generally.

Parent-Centered Approaches to Parental Involvement in Children's Mathematics Learning

Families often encounter problem-solving situations that require the instantiation of considerable mathematical knowledge and practice (Goldman & Booker, 2009). Research on mathematics in the home consistently shows that families often draw on distinctive funds of knowledge that include an array of information, skills, and strategies that can be qualitatively different to, but equally effective as, the mathematical knowledge that children are taught in school (Baker, Street, & Tomlin, 2003; González, Moll, & Amanti, 2005). Some attempts to connect home and school mathematics demonstrate that day-to-day household situations offer a context rich in opportunities for children to learn and apply different forms of mathematics (Winter, Salway, Yee, & Hughes, 2004). Although these studies collectively show that the family and the home environment can be thought of as a promising source of mathematical thinking and activity, it is not clear that parents always recognize the potential of these forms of home activity for children's mathematics learning.

There is evidence that schools find it difficult to incorporate out-of-school experience in classroom learning (Hughes & Pollard, 2006). This is due in part to the diversity of children's experiences outside school, and the dissimilarity between pupils' and teachers' experiences. In addition to the work of Hughes and colleagues in the United Kingdom, there is a growing literature from the United States with related findings. A large volume of research has been conducted that makes use of the "funds of knowledge" conceptual framework (González et al., 2005). What is clear from studies such as those reported in Civil and Andrade (2002) is that a huge amount of work is required to bridge the gap between families' funds of knowledge (pertaining to the mathematics of the home) and that knowledge that pertains to the mathematics of the classroom. This is due to several factors, but one that appears to be shared by the United States and the United Kingdom contexts concerns the valorization of knowledge (de Abreu 1995, 1998), including ideas of "what counts" as mathematics, or what kind of learning is suitable for the classroom. Further research is needed to explore parents' and families' understandings of "what counts" as mathematics thinking and learning and how this affects out-of-school learning in other cultural settings, including in the United Kingdom.

Jay and Xolocotzin (2012; Xolocotzin & Jay, 2012) found that a sizable proportion of parents are motivated to support their children's mathematics learning, but are anxious about their ability to help. These studies also found that children's involvement in the everyday mathematics of family activity can be seen as an important source of mathematics learning. For instance, children reported taking part in the budgeting for parties and holidays, and showed an awareness of household economy management, including the selection of mobile phone networks and utilities providers. Children also showed concern for longer term financial issues, such as saving for university and "the future," even while still at primary school. In line with Goldman and Booker (2009), Jay and Xolocotzin found that family activities can entail a range of mathematical thinking and learning, and that by sharing everyday problems with their children, parents can draw attention to mathematical activity by modeling, prompting, or disclosing a solution.

Home practices involving mathematical thinking and activity vary widely between households (Esmonde et al., 2013; Hughes & Pollard, 2006; Jay & Xolocotzin, 2012). These differences are often broadly associated with socioeconomic status, whereby children in more economically deprived areas are more likely to report activities involving receiving and spending money, but less likely to be involved in, or have knowledge of, home economy management. For example, in Xolocotzin and Jay (2012), children from middle-class homes were more likely to know how much their family usually spent on a supermarket shop or on an electricity bill, than children from more deprived families. However, children from across the socioeconomic spectrum found it very difficult to make connections between family activity and school mathematics, without significant levels of support from teachers, and family activity was not always recognized by children as having mathematical content.

The Present Study: Parents' Perspectives on Supporting Children's Mathematics Learning

We have seen that a school-centered approach to parental involvement in children's mathematics learning can be problematic, due to parents' perceptions of their own mathematical abilities and their attitudes concerning mathematics, and to parents' relationships with schools and teachers. We have also seen that, while parent-centered approaches to parental involvement in mathematics learning come with great promise, it can be difficult for both parents and children to make connections between home mathematics and school mathematics. This raises the question of how parents negotiate this issue; the evidence suggests that parents are very keen to support their children's mathematics learning, but face a number of difficulties in doing so.

The present study had two main aims. First, we wanted to explore parents' experiences around their involvement in

school-centered mathematics learning, including supporting children's completion of homework tasks. With this, we hoped to gain understanding of potential explanations for findings suggesting that parental involvement interventions, including those involving homework, often fail to lead to higher levels of attainment and indeed sometimes have a negative effect. Our second aim was to explore ways in which parents engaged in alternative, parent-centered, forms of engagement in mathematics learning. We were aware that this was a more challenging goal, as parents' understandings of "what counts" as mathematics learning (de Abreu, 1995, 1998) could well not include many of those home activities that we hoped to uncover. Our reason for addressing this aim was to contribute to the argument that more effective strategies for parental engagement in mathematics learning in the United Kingdom ought to recognize parent-centered mathematics thinking and learning as a valuable resource.

Research Questions

We aimed to explore parents' attitudes and beliefs about supporting their children's mathematics learning with a diverse sample of parents. In particular, we addressed the following questions:

> **Research Question 1:** What do parents do to support their children's mathematics learning?
> **Research Question 2:** How do parents experience difficulties when supporting their children's mathematics learning?
> **Research Question 3:** How do parents negotiate or avoid any difficulties they experience?

We were particularly interested in learning about ways in which the third question could lead us toward understanding positive experiences of supporting children's mathematics learning, especially those that were potentially useful for future research or intervention. We took a responsive approach, to allow space for parents to tell us what the important issues were in supporting their children's mathematics learning.

Research Method

Design

Group interviews were used to allow a range of perspectives to emerge and to ensure that parents had mutual support in expressing their opinions to the researchers. Following Frey and Fontana (1991) and Gibbs (2012), we planned the group interviews to allow discussions to be led by the group itself as much as by the research team. This allowed outcomes that were not necessarily anticipated by the researchers in advance. This was important for the study as we wanted to encourage a wide range of responses from parents and were clear from our understanding of the literature presented above (Civil & Bernier, 2006; Hughes & Pollard, 2006) that we should expect a diverse set of forms of engagement with schools, with children's learning, and with mathematics. These previous studies also suggested to us that parents would also not always share understandings of "what counts" as "mathematics," as "learning," or as "engagement," with the research team, and so we allowed the possibility of approaching the topic from different perspectives during the interviews—again partly by allowing the group to take the discussion in unplanned directions. Topics covered in the focus groups included: the ways in which parents interacted with their children about mathematics; parents' experiences of school mathematics and how that differs from their children's experiences; interaction with school about mathematics; parents' confidence and feelings about mathematics, and about helping their children with mathematics; and ways in which parents use mathematics in their everyday lives. Conversations were audio recorded and transcribed verbatim for later analysis.

This study was conducted according to the ethical code of conduct of the researchers' institution, and included measures to ensure anonymity of the participants, secure data storage, and transparency of purpose.

Recruitment Strategy

We chose to include parents of children in primary school in the study, as it is at the primary school level where the biggest gaps in the literature are to be found. As discussed in previous sections, it is at the primary school level where we see the majority of conflicting evidence around the effects of homework, and of parental involvement interventions more generally, on children's attainment and attitudes associated with mathematics.

Sixteen primary schools were recruited for the study during February and March 2013. Local authority data were used to approach a variety of schools, with a wide range of the following:

- Size of School (participating schools ranged from 30 to 90 children in Year 3)
- Percentage of children eligible for free school meals (FSM)
- Percentage of children with English as an additional language (EAL)
- Percentage of children with special educational needs (SEN)
- Percentage of children achieving Level 4 or above at KS2 in mathematics and English
- Location of school (participating schools were situated across the city, from some of the least to some of the most affluent areas)

While we were not aiming for a representative sample, we wanted to ensure that a range of experiences could be drawn on during the group interviews.

Twenty-five schools were sent an initial letter inviting participation, outlining the project, and explaining what participation in the study would involve. These letters were followed up by email and phone calls. The 16 schools that chose to participate included one primary school in another city who had found out about the project and contacted the project team.

Recruitment strategies within schools included putting up posters at school entrances, sending letters home to parents, and school staff (including teachers, teaching assistants, and secretaries) and project researchers talking directly to parents about the study. As part of this process, the project researchers asked parents what time of day would be most convenient for them to attend. In most schools, a session was held at the beginning of the day, after parents had brought their child(ren) in to school. However, in others, sessions were held later in the day to accommodate participants' needs. We acknowledge that, as flexible as we were around interview times, some parents will have been excluded from the study due to working hours and other considerations.

Across the 16 schools, 19 group interview sessions were held (where there were high numbers of parents, two sessions were advertised), with between two and 15 parents attending. Most sessions involved much fewer than 15 participants, however. Across the 19 sessions, there were 87 participants, giving an average of between 4 and 5 parents per session. Parents who attended had a range of jobs and a range of educational levels and experiences, from those who left school with no qualifications, to those with postgraduate qualifications, and those who were educated in other countries and continents. Some of the parents attending the group interviews had English as an additional language: some were happy to discuss ideas in English, others worked with friends or formal interpreters (provided by the research team) to enable ideas to be shared. Each group interview session was facilitated by one or two of the three authors of this article—each author facilitated at least three sessions. The sessions took place in a suitable space within each school site—this was usually a school hall, library, or a classroom that was not in use at the time.

Interview Protocol

A protocol for the semistructured group interviews was devised by the research team. The first part of the interviews focused on parents' experience of mathematics with their child(ren): "Do your children talk about maths?"; "What kind of things do they say?"; "How do you think they feel about maths?"; "Why do you say this?" We then asked parents about their own experience of mathematics when they were at school: "What did you think of maths when you were at school?"; "Can you remember the kinds of things you did?"; "How different do you think this is to what you see your child doing?" The third part of the interview focused on parents' interactions with their child(ren)'s school about learning: "How much do you talk with the school about what your child is doing?"; "How much does the school ask you about what you do with your child?" We then focused on interactions with schools about mathematics learning in particular: "What do you think about the maths your child does at school?" "What do you think about what/how the school teaches in maths?" Next, we asked about parents' experience of mathematics with their child(ren): "What kinds of things do you do to help your child at maths?"; "How do you feel about helping your child at maths?" The final part of the interview explored ways in which parents used mathematics in their everyday lives: "What kinds of ways do you use maths now? (not school maths, just in everyday life)"; "How important is maths to you? And for your child? Why is this?"

The questions listed above are indicative, and the wording sometimes varied, but the topic order was followed in all interviews. Follow-up questions and probes were used to explore parents' responses further, and to encourage participants to discuss similarities and differences in experience. Given the potentially sensitive nature of the discussions, we aimed to make the group interview context a safe and comfortable space for parents to talk. For some parents, the interview session represented a rare visit to a school building. We deliberately avoided collecting systematic demographic data from parents about characteristics such as educational background and social class, as we believed the formal collection in writing of sensitive data could have had negative effects on the way in which group discussions proceeded. Some data relating to such factors emerged naturally during the course of the interviews, and where relevant, are linked with findings below. Group interviews lasted between 45 and 60 min, varying according to the number of participants and their interests in the topics under discussion.

Analysis

A thematic analysis was carried out, following Braun and Clarke (2006). Over the course of the group interviews, the researchers kept a shared reflective journal. An initial coding framework was based on the distinction described in the literature review between school-centered and parent-centered approaches to parental involvement in mathematics learning. This was then refined with reference to researchers' journal entries regarding themes that were perceived to have particular significance for parents in their discussions. Initial codes were grouped and given working definitions. The three authors then used this initial framework to independently code two separate group interviews, allocating sections of text (anything from a sentence to several lines) to particular descriptive codes. Discussions among the authors then resulted in the number of codes being reduced, with some codes being deleted and others being redefined. A further

trial round of coding then took place to create the final coding framework for the groups. This framework was then used by the researchers to code the entire corpus of transcripts and notes from conversations: each researcher coded a portion of the transcripts. Coding was carried out in NVivo 9 (QSR International).

Findings and Discussion

In all schools, discussions were dominated by school-centered approaches to parental involvement, and the associated difficulties for parents. This was not unexpected; interviews took place in schools, and that context is likely to have had an effect—this alongside the argument set out in the introduction to this article that school-centered conceptions of mathematics dominate. However, there was also talk around parent-centered approaches that could point to opportunities to develop successful models of intervention. This section is thus divided into two parts. The first deals with the difficulties that parents experience in supporting their children's learning of mathematics, including differences between parents' own experiences of mathematics at school and children's mathematics learning now, and difficulties negotiating home–school communication, particularly relating to a perceived power discrepancy between teachers and parents. The second deals with ways in which parents discuss alternative, parent-centered, forms of parental involvement, including the promotion of positive attitudes to mathematics, learning with and from children, and engaging with the mathematics of everyday life.

Difficulties Supporting Children's Mathematics Learning

The difficulties that parents discussed fell into two main categories: difference and dissonance and home–school communication.

Difference and dissonance. This theme concerns the feelings of parents regarding their ability to help their children complete homework, how this plays out in practice, and the emotional response of both parents and children to this practice. All participating parents had experience of trying to support their children in completing mathematics tasks set by teachers to be completed at home. Parents talked extensively about how they found the mathematics tasks that had been set for their children "strange," "weird," and "unfamiliar." They often did not recognize the methods and techniques that children were being taught in school and, because of this, reported struggling to support homework. The sense of the mathematics being unfamiliar was found cutting across participants in all group interviews and was identified and discussed by parents with quite different levels of education (parents who left school early and parents who studied mathematics at university), employment status (unemployed parents and middle-class professionals), and parents from diverse ethnic groups. One parent described the problem in a way that resonated with others in the sample:

> [. . .] my daughter comes home—she's in a support group and she comes home with these bits of paper and I look at it and I go. . . I know the answer, it's very simple, I can't see this explanation of how you've got to work it out, how on earth does that work? And that's where I find myself getting lost.

Reasons why parents found the tasks coming home from school unfamiliar varied across the sample. Some parents said that they struggled with mathematics when they were at school and did not possess appropriate levels of subject knowledge to support their children's learning. Others said that they did well at school but had forgotten what was taught. A slightly more common view among parents, however, was that techniques and methods currently taught to children were different to those taught when parents were at school.

Parents also reported having experienced different teaching styles to their children. Parents schooled both inside and outside the United Kingdom reported experiencing more rote learning than their children. They also felt that the current English curriculum is more method-focused, with children spending longer working out how to solve mathematics problems, and breaking down methods into constituent parts. There were mixed feelings about this focus. While some felt that mathematics was now more "fun," "less regimented," and "easier," others said it was "more advanced" compared with what they were used to. Some parents described the new methods as "convoluted" and "long-winded" and some felt that children are now "given more methods" to use or more "steps" to follow before progressing to more difficult levels. Some parents even described the methods that their children were using as almost like cheating, in comparison with the methods that they learned themselves:

> It feels like they're given lots more methods and in my mind—so it's not cheating, but it felt like cheating because actually we had to do it in columns, it felt like you had to do it that way. . .

The combination of different mathematics techniques and different approaches to teaching and learning created dissonance between some parents and children during homework. Differences between parents' understandings of mathematics and how teachers expected children to solve mathematics problems led to a range of tensions, experienced by some parents as disempowering. A Bangladeshi parent who "loved maths" when she was a girl told us "I cannot help my children in any way," whereas an English parent said "I feel I've lost control over what he's really learning." Parents who struggled to support their children with homework said they felt "embarrassed," "confused,"

"frustrated," and "left behind." This resulted in some being reluctant to support their children's mathematics learning, which sometimes manifested in parents avoiding mathematics, and even hiding from children during homework time. Some parents reported automatically directing questions from children to partners and siblings in the household. Several described getting upset with their children if they were asked to help with homework:

> [. . .] sometimes she shows me things, and I get frustrated because I don't know it, and then I take out my frustration on her, as if like oh just take it in with you tomorrow! And I know it sounds really horrible, but it is a frustration because I don't know it, and then I am upset with myself, that I can't teach her something [. . .]

Parents who tried to support their children by teaching them "old fashioned" techniques made children "confused," "muddled," "fed up," and "annoyed." Some felt their children avoided seeking help from them, and others believed that their anxieties were reflected onto their children, which resulted in heated confrontations.

These findings resonate strongly with some of the research literature on school-centered parental involvement. The participants did not generally report a lack of ability in mathematics, as we might have expected given recent findings of low levels of adult numeracy (Department for BIS, 2011; NIACE, 2011). However, there was widespread expression of frustration about the unfamiliarity of the methods that children were learning to use to solve problems—for arithmetic problems in particular—as seen in Peters et al. (2008) and McMullen and de Abreu (2011).

Home–school communication. The above issues were often framed by parents in terms of perceived low levels of home–school communication. In addition, parents reported that they varied considerably with regard to understanding of school curricula and with respect to their access to resources to help them understand material that was being taught at school. Low levels of home–school communication, combined with parents' limited resources, resulted in parents being dependent on schools providing extra support for children outside of school hours, such as homework club. Schools and teachers were positioned as experts; possessors of relevant skills and knowledge on whom parents become dependent to help with homework.

Parents said that they wanted more from teachers on the mathematical methods and techniques taught in school. They also wanted more information regarding children's progress in mathematics; the amount of time spent doing mathematics in school; the times of day when mathematics was taught; the amount of time children should spend doing mathematics at home (including both prescribed homework task and additional activities such as times-tables practice or preparation for tests). Parents reported that schools employed a variety of means to share these kinds of information, including publishing what was being taught on information boards in playgrounds; sending information home via newsletters; publishing information on school websites; sharing information about children's progress at homework evenings and after school; inviting parents to visit classrooms during the day to support children and learn what was being taught; and running workshop events to share mathematics techniques with parents. Some parents were pleased with the amount of information they were given, particularly when schools held curriculum mornings or workshops to share the techniques currently being taught to children. Such interventions made parents feel more in control of their children's learning insofar as they were able to understand what was happening in class, talk about mathematics with their children in an informed way, and support their children with homework. However, despite the reported benefits of attending workshops, the common view across our sample was that parents were not receiving enough information. Communication boards and newsletters revealed what was being taught in class but not how it was being taught, homework sheets generally offered no guidance on how to do the mathematics, teachers at parents evenings were too rushed to go into detail with parents, and there were too few workshop events or curriculum mornings. Parents suggested that spending time in class, observing children and learning from teachers would be beneficial. This type of activity not only provided opportunities for parents to develop subject knowledge, but would also provide a shared mathematical experience that parents and children could talk about at home.

When relevant information was not forthcoming from schools, some parents talked about the ways they tried to meet their own information needs. Parents described a broad range of resources, which we categorized as familial, personal, material, and financial. Familial resources relate to the ways in which parents can draw on partners and members of the immediate family to support children during homework time. Earlier, we described how some parents avoided children during homework time by directing questions about mathematics homework to other family members. Some parents instead attempted to learn how to complete homework by consulting family members, such as older children. One parent, for example, described not understanding the logic behind some mathematical techniques but developing such understandings through her eldest son.

Parents drawing on personal and material resources were usually middle-class professionals who thought of themselves as good at mathematics. Importantly, these parents had strong English language skills and the confidence and social capital to learn independently. Parents described purchasing published literature (e.g., Lett's study guides) and using the Internet (e.g., YouTube) to figure out how to solve problems using modern classroom techniques. These parents also reported seeking out support from teachers directly and asking for more information about homework.

Under the "financial" resources heading, we noted that some parents reported paying for private tuition to achieve basic numeracy skills. In the following example, a translator described a parent's experience of private tuition:

> Previously, when she was back home in Somalia she was good at maths, but when she came here she found it difficult to transmit what she has learnt to her children. But luckily, she attended classes, maths, and he explained it into how you can explain it in maths, and now she is confident translating to her children.

In addition to paying for extra tuition for themselves, some parents also paid for extra tuition for children when they felt that they could not support their mathematics learning. This was related not just to issues of homework, but to the feeling that schools were not doing enough generally to enable children to achieve the best they could. We found that paying for extra tuition was most common among immigrant parents from deprived areas of the city.

Parent-Centered Forms of Parental Involvement

Parents' talk about alternative approaches to parental involvement was more limited than their talk about difficulties. However, when talk moved away from school-centered approaches, it was notably more positive. Here, we described the three main categories of discussion under this heading: promoting positive attitudes; learning with and from children; and everyday mathematics.

Concern with attitude. Parents expressed awareness of the importance of attitudes to mathematics in determining future attainment and participation in formal mathematics. They were similarly aware of their own role in supporting positive attitudes and avoiding negative attitudes, including mathematics anxiety. This aspect of parents' discussions often arose around the topic of gender. The subject of gender arose, unprompted by the research team, in four of the 19 group interview sessions.

> I think it's a gender thing, I really do. I think that stereotyping starts before they are even born. I think a lot of boys will put across that they are better than girls at maths and things like that at a young age.

As in the above quotation, both mothers and fathers talked about gender as an issue related to mathematics learning. In some cases, mothers in particular expressed a concern that they might be passing on anxieties about mathematics to their daughters.

> Maybe I'm off to project stuff on to my daughter because I actually did alright but it doesn't feel like it.
>
> So, I think my own—there's a danger isn't there? There's something isn't there? Women to daughters, you know, don't pass on that. . . very conscious of that I think.

This concern is in line with research suggesting that parents (Tiedemann, 2000) and female primary teachers (Beilock, Gunderson, Ramirez, & Levine, 2010) can be a source of girls' anxiety about mathematics. However, the majority of these mothers also talked about their intention to reduce the level of anxiety that they passed on, or to develop positive attitudes to mathematics among their daughters.

Related to this issue, some parents linked their children's (again, daughters in particular) achievement (or lack of it) to their children's level of confidence:

> I honestly believe that performance is a link to confidence. So, if someone's confidence keeps getting knocked, "I can't, I can't, I can't," then she isn't flourishing [. . .] to feel like they've achieved something is quite a big impact on their confidence.

Parents' awareness of the importance of positive attitudes toward education and learning, and their awareness in particular of potential anxieties around mathematics, is an interesting finding in the study. There are links between these responses and recent research on mind-sets for learning. For example, Boaler (2013) stresses the importance of developing a growth mind-set (including confidence in one's own potential for learning) for learning mathematics. However, while many parents were aware of the importance of their own role in supporting the development of positive attitudes to mathematics among their children, there were limited suggestions from parents regarding specific, concrete, things they did to achieve this. This suggests a potential opportunity for improved communications to parents regarding ways in which they can contribute to the development of positive attitudes to mathematical thinking and learning.

Learning with and from children. This topic arose most often during discussions about sources of support that parents drew on to help young children with homework, and during discussions about ways in which parents coped with difficulties in understanding their children's mathematics homework.

> I found maths hard as a child and I only really [. . .] realise now that I used to get a lot right by just adding another zero and it would be right and I didn't understand the whole tens and units. So, I've actually learnt it since year 2, tens and units, through my eldest child and now I can see actually why they do it, as they do it, because it does completely explain what's happening.

Parents in five group interviews talked about older children helping with younger children's homework. Some parents report, as in the above quotation, learning with a younger child from an older child. In a second example, the following quotation comes from a mother who learned from her older

daughter both about the mathematics itself, and about how to convey mathematical ideas to her younger son.

> I found it's not really hard but I asked my daughter she's 15 years old, so if struggle with something, yes, it will help me [. . .] Yes my daughter teaches me [. . .] Teach me to teach him [younger son]

This phenomenon is not generally apparent in the research literature, although the work of Gregory, Long and Volk (2004) is a useful source here. This kind of practice is very much in line with research on peer-tutoring, for example, and is likely to be a very positive experience for the older child, giving them a sense of agency and self-efficacy related to their mathematics. It is also likely to be an effective means of support for the younger child. Finally, parents' reports of this practice were uniformly positive—drawing on support from older children in this way provided a means for parents to facilitate both children's learning, while avoiding placing themselves in the role of expert. Further research in this area would be welcome, to understand the effects of support from an older sibling on children's experience of mathematics outside of school.

Everyday mathematics. Although parents often reported struggling to help with homework, when asked to think about alternative ways of engaging with mathematics at home they were able to offer a number of suggestions. Popular examples described by parents involved cooking and money. Parents described how children helped with cooking at home, and so were involved in weighing, measuring and mixing ingredients, timing how long cakes took to bake, estimating portion sizes, and so on. Parents also told us about their children's management of pocket money, and about children accompanying parents on shopping trips where they might estimate the bill or help to find the best value items. Sometimes the concept of money itself was also discussed with children:

> It is interesting when they ask you how much things cost . . . when you do tell them how much something costs and they go, blimey, that's a lot of money, . . . we have quantified in the cost of an iPad before in our house and that would be four iPads, and it's just try and quantify costs in terms of something that they use on a daily basis, or four cans of beans, or whatever.

Parents made use of everyday items in the home environment to create opportunities for mathematical talk and activity, including using rulers and tape measures to measure the height, width, and depth of objects around the house and garden. Opportunities were also taken to count and categorize objects: one parent told us about her daughter counting the number of weeds in the garden, and another described introducing the idea of pulleys while their child was climbing a tree. As well as introducing mathematics in their exploration of the home environment, parents also reported supporting children in using mathematical ideas and language when thinking about their own bodies, such as using height charts, counting using hands and fingers, and playing competitive games such as who can run the fastest or the furthest.

Parents reported working with children to develop an understanding of time. They used time limits for different activities, and used schedules for mealtimes, for example, to draw children's attention to time. Parents talked about children's difficulties in making sense of multiple representations of time (digital/analog; 12-hr/24-hr). To support children in managing these different representations, parents reported two alternative strategies: either using only one particular clock face when talking a time; or by often showing two clock faces together (one parent described placing a digital and analog clock side-by-side next to her son's bed).

> And we started with simple things like, you know, bedtimes at half past seven and it's a quarter to seven, how many minutes have you got downstairs before you need to get upstairs, you know, before bed?

Children also anticipated future events and wanted to know how long it would be until birthdays, Christmas, or holidays. Sometimes discussion about time was combined with speed and distance, and children asked, for example, how long it would take to drive to a certain place, or how fast a toy car would go down a ramp.

The activities, and the mathematical thinking and learning described in this section, resonate with many of the activities reported in the literature (Civil & Andrade, 2002; Winter et al., 2004). However, the discussion of parent-centered engagement was more limited than the discussion relating to school-centered activity, and parents were less quick to contribute suggestions and to agree with one another than they had been during discussion of homework, for example. The activities volunteered by parents almost exclusively involved money, cooking, and time. We did not observe the range of activities reported by Goldman and Booker (2009) or Jay and Xolocotzin (2012), for example, which more directly assessed the range of mathematical thinking and learning taking place in family contexts. These findings do not show that mathematics is not integral to family life and work, but do show that many parents find it difficult to see how mathematics is involved in a diverse range of activity or to describe the mathematics that is involved. We suggest a link with de Abreu's (1995, 1998) concept of valorization of knowledge—parents found it difficult to identify examples that counted as "mathematical." This is important in terms of understanding the steps needed to support parents to discuss mathematics in everyday activity with their children.

These findings can be seen as reflecting the general attachment to school-centered approaches to parental involvement in children's learning that we observed during these interviews. There is evidence in the literature that schools find it difficult to incorporate out-of-school experience in classroom

learning activity (Hughes & Pollard, 2006). Where real-life context is brought into mathematics lessons, it is often rather artificial (Greer, 1997). We suggest that here we see evidence of the converse phenomenon, where parents' understandings of their role in supporting their children's learning is restricted by an attachment to school-centered approaches to involvement. However, there is a positive side to some of these accounts as well. We do see evidence of home practices in line with Goodall and Montgomery's (2014) parental engagement—where parents are defining and reporting carrying out activities designed to promote children's mathematics learning. There is a foundation for building greater breadth and depth whereby parents are supported in developing further knowledge and confidence in everyday mathematical thinking and learning.

Limitations of the Study

The main limitations of this study are associated with the nature of the sample of participants. The sample was constrained by a number of factors. First, the timing of group interview sessions will have meant that some potential participants will not have been able to attend. As explained in the "Research Method" section, we were as flexible as possible in terms of scheduling sessions to meet the needs of participants. However, some participants will have been excluded from the study. It is likely, for example, that families with two working parents will have been underrepresented in the sample. A second issue concerns the fact that the group interview sessions were advertised as being about parents' experiences of supporting children's mathematics learning. Although this was necessary in terms of informing parents about the nature of the study, it will have dissuaded some from participating. The research literature suggests that many adults have uncomfortable relationships with mathematics (e.g., Department for BIS, 2011), either concerning the mathematics itself (including mathematics anxiety) or as a result of negative memories of their own mathematics education in school. As our sample was self-selecting, within the schools we visited, our sample may have underrepresented those with negative attitudes, or anxieties, connected with mathematics. These constraints, regarding the nature of the sample, suggest a need for future studies that are able to reach parents with more negative attitudes to mathematics, and those with a wider range of lifestyles and other commitments. It may be that this could reveal a wider range of practices, or barriers to engagement, which would be of interest to researchers, practitioners, and policy makers.

The use of group interviews will have constrained some of the data that we were able to collect, in the sense that some parents may have been unwilling to share some perspectives on mathematics or on their children's learning, with their peers. However, this constraint is balanced by the fact that the group interviews were successful in terms of allowing discussions to take unplanned turns and reveal unpredicted findings. It would be interesting, in the future, to compare the findings from this study with those of an equivalent interview study involving individual parents, to judge the extent to which parents' responses are more or less constrained by the format of the interview.

Conclusion

The findings help us understand why increasing levels of parental involvement to raise levels of pupil attainment in mathematics can be difficult. This study adds to the work of Goodall and Montgomery (2014) by constructing an understanding of parents' perceptions of activity at both ends of the "parental-involvement"–"parental-engagement" continuum. Parents in the study discussed a number of reasons why supporting children with teacher-set tasks was difficult—and the majority of these chime with recent research literature (Peters et al., 2008). There were also a number of discussions around limitations of home–school communication. On the whole, parent's experiences of school-centered approaches to parent involvement were negative and frustrating. On the contrary, parents discussed a number of alternative aspects of support, including the need to promote positive attitudes (especially among daughters), their own ability to learn from older children, and about ways to experience and learn about mathematics in everyday life. One of the main contributions of this article is the finding that the positive, parent-centered, aspects of parental involvement that parents discussed in this study never included mention of school involvement. This suggests a combination of two things; that there are likely to be significant barriers to schools engaging in parent-centered approaches to parental involvement, and there are significant opportunities for schools that choose to take a less school-centered and more parent-centered approach to parental involvement.

We have seen in the literature review and in the findings of this study that there is potential value to be gained from a parent-centered approach to parental involvement. However, this potential would need to be unlocked with some thoughtful work on the part of both school staff and parents. Although parents could all discuss mathematics in their everyday lives that they did, or could, share with their children, these activities were relatively limited in scope. Most parents referred only to activities involving money and cooking, and so work would be needed to support parents in exploring the mathematics involved in other everyday activity (see Jay, Rose, & Simmons, 2017, for an example of this). Other potential for parental engagement intervention stems from parents' evident enthusiasm and openness toward learning *from* children as a pedagogical strategy and from parents' concern about helping children develop positive attitudes to mathematics. Evidence from previous research suggests that parents have an important role to play in developing motivation and engagement with mathematics learning (Chiu & Xihua, 2008), so it is reassuring to see that parents in our sample

recognized this as a key aspect of their role. Our findings suggest that more and better guidance on strategies for parents to improve attitudes to mathematics would be very welcome. The phenomenon of parents learning from children as a way of supporting learning has been less well explored in the literature. Further research could explore this approach as a way of supporting both parents and children in their mathematical thinking and learning.

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