Finding "Mathematics": Parents Questioning School-Centered Approaches to Involvement in Children's Mathematics Learning

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Abstract

This paper reports on a study of parental involvement in children's mathematics learning in the context of a series of workshops carried out in four primary schools in the United Kingdom. Previous research suggests that, while there are high correlations between parental involvement and positive student outcomes, it can be difficult to raise student achievement via parental involvement interventions. We suggest that part of the reason for this, at least in relation to mathematics, is that parents experience considerable difficulties in negotiating school-centered definitions of and approaches to mathematics. We employed a design and analytic approach informed by Derridean concepts including decentering and différance. We encouraged parents to work with their children to "find the math" in everyday life and activity. A significant component of the discussion in each school involved sustained, critical reflection about the meaning of "mathematics" and about parents' interpretations of parental involvement in children's education. We made sense of parents' discussions during the workshop by offering an account whereby parents grappled with mathematics as a socially constructed domain, dominated by school-centered ideology. As parents became more confident in their own analysis of the mathematics in everyday family life, they developed new strategies for sharing this mathematical thinking and awareness with their children. Implications for school parental engagement strategies are discussed.

Key Words: mathematics, parental involvement, primary schools, family engagement, workshops, children's learning, Derrida, United Kingdom, England

Introduction

The work reported in this article developed a novel approach to parental involvement and engagement with children's learning. We explored parental involvement in children's mathematics learning from an exclusively parent-centered perspective. We did this with two main aims in mind. First, we wanted to develop our understanding of the issues that parents experience when supporting their children's learning. Research has started to reveal a number of important barriers and motivating factors that help explain parents' behaviors around parental involvement in education. However, we used a novel methodological approach, including the creation of an environment that put parents at the center, to allow further depth of understanding about these barriers and motivations. Secondly, we tested an approach to parental involvement intervention that has not been described before in the research literature; this is important because most approaches to intervention that have been described up to now have generally not been effective or sustainable in raising levels of parental involvement or of children's achievement.

In developing our parent-centered approach to parental involvement in children's mathematics learning, we draw on concepts derived from the work of Derrida (1978, 2013), in particular, *deconstruction* and *différance*. Our reasons for using Derrida as a source for this work are principally that we see this project as involving a thorough (although possibly temporary) restructuring and reframing of symbolic representations of both "parental involvement" and of "mathematics" for both the research team and for the participants involved in the work. Derrida offers a means by which to conceptualize, instantiate, and reflect on this restructuring.

In the literature review section that follows, we examine recent research on parental involvement in children's mathematics learning and draw attention to a problem that is becoming increasingly apparent as the research base grows, namely, that while evidence suggests that parental involvement is almost always beneficial for children's learning,[1] interventions designed to raise levels of parental involvement—especially in mathematics learning—are rarely successful. As there is evidence to suggest that this may be due at least in part to school-centered (i.e., curriculum-oriented, with a focus on arithmetic procedures) approaches to parental involvement, we consider the research literature around the potential of out-of-school experience as a source of mathematics learning. We then explain how Derridean theory has informed our conception

of parental involvement in mathematics learning and how it has contributed to the design of a series of workshops for parents to explore parent-centered approaches. This section as a whole thus sets the scene for the method section, where we describe the design and conduct of the workshops in greater detail, and the findings section, where we engage in an analysis of key transitions in parents' thinking about mathematics and of ways in which they supported their children's learning during the workshops.

Parental Involvement in Children's Mathematics Learning

Schools and governments say that they are committed to increasing levels of parental involvement in children's education. In some cases, this is enacted in policy (e.g., Scottish Schools [Parental Involvement] Act 2006), and in others, advice, guidance, and research reports published by governments describe various benefits of parental involvement (e.g., Department for Children, Schools, & Families [DCSF, U.K.], 2008; Department for Education [DfE, U.K.], 2010; Department of Education [U.S.], 2014; Mapp & Kuttner, 2013). Reasons cited for this approach include a number of large-scale correlational studies showing associations between various forms of parental involvement in children's education and children's attainment on assessments at primary and secondary school levels (e.g., Flouri & Buchanan, 2004; Melhuish et al., 2008; Sheldon & Epstein, 2005). While such evidence suggests that parental involvement can have positive effects on children's achievement and attitudes, recent systematic reviews have found only limited evidence that parental involvement *interventions* result in improved educational outcomes. Desforges and Abouchaar (2003) concluded that evidence for parental involvement interventions was too weak to come to any firm conclusions about their efficacy. Gorard and Huat See (2013) reviewed 756 evaluations of parental involvement (of these, only 68 met criteria for design quality) and found no evidence for improvement in educational outcomes:

> Overall, we found no evidence that primary-age interventions to enhance parental involvement are generally effective in increasing children's attainment. In fact, the better studies suggest the interventions can be harmful (p. 7).

Conflicting evidence is provided by Jeynes (2012) in the form of a meta-analysis of 51 evaluations of the effect of parental involvement programs on pupil attainment. Jeynes found an average effect size of .3 overall, suggesting a small but significant effect, with programs focusing on shared reading and on partnership between parents and teachers having the largest effects. It is not clear why the conclusions of Gorard and Huat See (2013) differ so dramatically from those of Jeynes (2012). However, Gorard and Huat See had stricter

criteria for inclusion in their review, and Jeynes included a number of studies with small sample sizes. Both Gorard and Huat See and Jeynes make a case for further research that addresses the reasons why parental involvement programs succeed or fail in raising student achievement.

There is little discussion in the literature specifically regarding the reasons why parental involvement interventions may fail. One reason may be that too few programs involve a comprehensive approach (Redding, Langdon, Meyer, & Sheley, 2004). Redding et al. (2004) argue that, if it is to be successful, a parental involvement program must be built on a foundation of trust and respect and must connect parental involvement strategies with students' learning objectives. Some recent review articles suggest some further potential candidates. Hornby and Lafaele (2011) reviewed the literature on parental involvement and posited several potential barriers to parents becoming involved in their children's education. Many are based on the fact that parents' and teachers' aims around parental involvement, while similar in some ways, differ in important respects. For example, Hornby and Lafaele point to research showing that teachers' aims are often to improve the school or wider society, whereas parents' aims often relate to their individual child's well-being or performance relative to the child's peers. Implicit in Hornby and Lafaele's review is the idea that some difficulties around parental involvement stem from parents' and teachers' understanding that parental involvement is to be engaged with in the service of school- and government-defined measures of attainment. Based on this and on related work (e.g., Jay, Rose, & Simmons, 2013; Peters, Seeds, Goldstein, & Coleman, 2008) that describes parents' own negative experiences of schooling, we contend that many parents experience a distance from and a lack of ownership of the formal school curriculum that contributes to the difficulties they experience in supporting their children's school learning.

This article focuses specifically on parental involvement in children's *mathematics* learning—an area that seems to be associated with particular difficulties for many parents. For example, a meta-analysis of research on parents helping children with homework indicated that parents' support with mathematics homework had a negative association with children's achievement, especially when help consisted of supervision rather than more engaged forms of guidance (Patall, Cooper, & Robinson, 2008). It is possible that this association could be due to parents being more involved when they know their children are struggling with mathematics; this would resonate with the findings of Shumow and Miller (2001) who indeed found that parents were more involved with homework when their children were having difficulties with the subject. However, notably, in Patall et al. (2008), the negative effect of parental involvement with homework was not observed in domains other than mathematics,

including reading, where a positive correlation between parental involvement and children's achievement was observed. It is still important to be cautious in drawing conclusions about parental involvement and achievement, but there do seem to be particular issues around parental involvement and mathematics learning. Parents' challenges in helping with children's mathematics learning, including supporting children in completing homework, may stem from parents' negative perceptions of their own mathematical ability or negative perceptions of their own experience of mathematics at school (Jay et al., 2013).

The majority of published research on parental involvement in mathematics learning has taken a school-centered approach. By this we mean to say that this research has focused on mathematical activity and outcomes that are defined by governments, schools, and teachers. For example, parents are often asked to help their children learn their times tables or to work on routine calculations using the four operations. There is evidence to suggest that this approach may represent a significant source of parents' struggle in supporting their children's learning (Schnee & Bose, 2010).

Part of the difficulty parents experience in supporting children's mathematics learning stems from the mathematics itself. Peters, Seeds, Goldstein, and Coleman (2008) note that many parents are troubled by differences in arithmetic methods used today compared to when those parents were at school themselves (see also Jay et al., 2013; McMullen & de Abreu, 2011). We argue that school-centered approaches to parental involvement in mathematics learning often emphasize formal assessment and unfamiliar arithmetic methods that may serve to create barriers for parents supporting their children's learning. However, there can also be more subtle issues around parents' and schools' expectations of what engagement means and what kinds of activities it can encompass (Jackson & Remillard, 2005).

Out-of-School Mathematics Learning

Research on mathematics in the home consistently shows that families often draw on distinctive funds of knowledge that include skills and strategies that can be qualitatively different to the mathematical knowledge that children are taught in school (Baker & Street, 2004; González, Moll, & Amanti, 2005). Families often engage in problem solving which requires considerable mathematical knowledge and practice (Goldman & Booker, 2009). Attempts to connect home and school mathematics demonstrate that day-to-day household situations offer a context that is rich in opportunities for children to learn and apply different forms of mathematics (Winter, Salway, Yee, & Hughes, 2004). Similar research (Jay & Xoloctozin, 2012) indicates that young children and their parents participate in a range of household activities that involve

mathematical thinking. 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. Monetary practices such as receiving pocket money, spending, and saving were also frequently described as part of everyday family situations. There were outstanding cases in which children described how their parents help them to apply sophisticated concepts such as investment and profit in authentic contexts such as craft markets or internet trading platforms.

Significantly for this article, there is evidence suggesting that both parents and children often fail to recognize or value the mathematics in out-of-school activities (Jay & Xolocotzin, 2012). This may make it difficult for parents to feel confident in their own mathematical ability from which they can draw to support their child's learning. We argue here that many parents' conceptions of "mathematics" are firmly in line with school-centered definitions—often with a focus on algorithms for solving arithmetic problems—and that this limits the extent to which they recognize the potential to engage with and support their children's learning outside of school.

Derrida and Deconstruction

We draw on Derridean concepts of deconstruction and différance in order to construct a theoretical framework for this study. The aim here is not to offer an exegesis of Derrida's work but to explain how use of these concepts can provide a means to understand the problem of parental involvement in mathematics learning as well as a means to inform a methodological and analytical approach for this study.

Textbooks introducing Derrida's work sometimes begin by offering a cautionary note about the complexity of Derrida's language and his refusal to offer clear and simple definitions of the terms he used. The anxiety of authors writing secondary texts about Derrida is exacerbated by the fact that Derrida's work challenges stable, unquestioned, and fixed meanings (e.g., the finality of definitions). Herein lays the ironic definition of one of Derrida's key terms (and something we will be applying to data in the next section): "deconstruction." Deconstruction is a term used to describe a process which creates ambiguity or undecidability of meaning in a text. Some have interpreted this as meaning that deconstruction is a way of "reading" which gives rise to undecidability, what Powell (1997) has referred to as avoiding "a submissive mode of reading authoritarian texts, or any texts" (p. 6). Deconstruction begins "from a refusal of the authority or determining power of every 'is,' or simply a refusal

from authority in general" (Lucy, 2004, p. 11). In other words, deconstruction challenges understandings of texts or utterances which presuppose a singular, authoritative, or unarguable meaning. We see here an immediate affordance for Derridean theory in working with parents' conceptions of mathematics. Mathematics certainly represents a domain where there is a feeling among many parents that there is an authority who they should look to for meanings and understanding. As described above, there is evidence in the literature to suggest that a school-centered approach is dominant in parents' conceptions of mathematics and of parental involvement in learning. This suggests an opportunity to support parents in some critical activity to destabilize or *decenter* this conception and to encourage deconstruction in parents' readings of "mathematics." In Powell's terms, we aimed to encourage parents to avoid submissive readings of "mathematics" and of "parental involvement" and to seek alternative ways of engaging with both. We suggest that this can be a first step in working towards productive forms of parental engagement with children's mathematics learning, by allowing parents to recognize their own nonschool activity as mathematical. This approach hinges on our working hypothesis that an active (in Derridean terms), rather than passive or submissive, reading of "mathematics" will enable parents to explore and develop their own ways of engaging in mathematical thinking and learning with their children—other and different to those ways of engaging in mathematical thinking that have been defined by schools and teachers.

Derrida does not offer a "tool kit" or explicit instructions informing readers how to go about deconstructing texts. For Derrida, deconstruction is not a method that is applied to texts ("deconstructionism"). Instead, it is something that happens *within* texts:

> The way I tried to read Plato, Aristotle, and others, is not a way of commanding, repeating, or conversing this heritage. It is an analysis which tries to find out how their thinking works or does not work, to find the tensions, the contradictions, the heterogeneity within their own corpus….What is the law of this self-deconstruction, this "auto-deconstruction"? Deconstruction is not a method or some tool that you apply to something from the outside.…Deconstruction is something which happens inside (Derrida, 1997, pp. 9–10).

Derrida finds tensions and contradictions inherent in the texts he reads, and this leads to self-/auto-deconstruction (the text is always already deconstructing itself). He discovers these tensions and contradictions by analyzing the "functioning" and "disfunctioning" of the works he reads (Derrida, 1997, p. 10). Linking this to the mathematics education research literature again, we see a deconstruction in Esmonde (2013), although Esmonde does not use the

term "deconstruction." Esmonde presents an analysis of the U.S. television program "NUMB3RS." In this program, Esmonde reads an inherent contradiction between a phrase in the introduction to every show, "we all do math every day," and the way in which the show represents mathematics as distant, impenetrable, and for experts only. Esmonde goes on to question institutionally endorsed accounts of mathematics and ask what effect these accounts have on learners. One conclusion is that many learners (perhaps especially, but not exclusively, those from minority groups) are likely disenfranchised by these accounts as they represent a mathematics that is not easily reconcilable with any representation of mathematics that is developed through family and out-of-school activity. Our interpretation is that this assessment may very well apply to parents, too, who are likely to experience similar difficulties in reconciling institutional accounts of mathematics with the mathematics that is enacted in everyday family life.

Différance

Différance is a term intimately linked with deconstruction:

> Différance marks the opening of a system of differences in which everything acquires meaning and value according to what "we believe we know as the most familiar thing in the world" (OG, 70-1) —that the outside is not the inside.…Everything differs, which is to say that everything differs from other things.…It is also to say at the same time that, in so far as it *defers*, it defers endlessly its "own" constitution as an autonomous or fully complete entity, whether as sign, truth, subject, or the like. Différance, then, names this work of differing and deferring that makes differences possible which is suppressed in the metaphysical idea of difference. (Lucy, 2004, p. 27)

Différance is Derrida's neologism, meaning both to differ and to defer, and was coined to show how signs lack self-enclosed identity (Deutscher, 2005). To say that meaning is derived from difference is to say that there is no inherent link between signifier (e.g., a word, such as "dog") and signified (an object, such as a dog). Instead, the word "dog" gets identity because it is slightly different from "hog," "fog," and "mog" (etc.). The word "dog" depends on its difference from other words—other signifiers—to distinguish itself from them. What is more, our concepts (the signifieds) have no independent meaning in and of themselves—our concepts are distinguished by what they are not, by their difference from other concepts. The concept of "dog" gains its identity by being different from the concepts such as "cat," "cow," or "horse." This is what is meant when Derrida says that meaning is derived from *difference*. To say that meaning is *deferred* is to say that there are no stable signifieds (words)

or a stable meaning. If you were new to the English language, you could look up the word "dog." However, the definition would include a range of concepts such as "domesticated," "carnivorous," "mammal," and so on, which themselves would need defining (requiring more reading in the dictionary, leading to more concepts in need of definition). This sense of "chasing" meaning, then, is what Derrida means by *deferral*, and to say that meaning is derived from différance and deferral is to say that words (and concepts) resist being reduced to stable meanings.

The concepts of deconstruction and différance are useful in the context of this article, as they offer a means of understanding ways in which parents relate to mathematics. Evidence from the literature discussed above suggests that a major component of the difficulties that parents experience when trying to support their children's learning consists in negative associations with mathematics and inconsistencies in representations of mathematical methods. For example, many parents report not having enjoyed mathematics at school, and many parents express frustration related to differences in the ways that children learn now compared to when the parents were at school themselves (Jay et al., 2013; Peters et al., 2008; Rose, Jay, & Simmons, 2014). Derrida's approach reminds us that it could be useful to focus not on parents' difficulties with mathematics *in itself* but on what "mathematics" signifies for parents and what *associations* mathematics has with other signifiers for parents. It also suggests that there may be potential to support parents in redefining "mathematics" in ways that facilitate their engagement with their children's learning.

The Present Study

At the beginning of this section, we set out the aims of this study as developing a better understanding of parents' experience of parental involvement in their children's education and as trying a novel approach to parental involvement intervention. Based on the literature review above, a particular focus of the study was on investigating the extent to which parents' school-centered conceptions of mathematics may limit their ability to support their children's learning of mathematics in out-of-school contexts.

We designed for parents of primary school children a series of four workshops that supported parents to seek alternatives to school-centered accounts and definitions of mathematics, starting with a process of supporting parents to "find the maths" (U.S.: "math") in their everyday life and activity. In carrying out these workshops, we hoped to engage in a *decentring* and *deconstruction* of "mathematics" with parents and to record what happened as a result. As the workshops progressed, we expected to hear reports from parents about their exploration of ways of sharing their new perspectives on mathematics with

their children through new forms of mathematical talk and activity at home. We expected parents' active engagement and reading of "mathematics" to be associated with growing confidence and a sense of empowerment with regard to mathematical activity with children. Our use of différance consists primarily in the development of our framework for analysis—we looked for occasions where parents negotiated definitions of mathematics in their interpretations of everyday activity.

Method

This article reports on part of a larger project. In the first stage of the project (Jay et al., 2013), we investigated parents' motivations and attitudes towards their children's mathematics learning and towards their own uses of mathematics through group interviews and informal playground discussion. The current paper explores the second stage of the project, which involved designing workshops to empower parents to reflect upon and share their social and cultural funds of knowledge relating to mathematics with their children.

Participants

Head teachers from four primary schools in Southwest England allowed us to carry out a series of workshops in their schools. The schools were recruited from a group of 16 schools that had taken part in the previous focus group study on parental involvement (Jay et al., 2013). The four schools were all primary schools for children aged 4–11 years old and were all situated in an urban environment. The four schools were approached to provide a range according to proportions of children with English as an additional language, proportions of children eligible for free school meals (a common indicator of low socioeconomic status in English schools), average attainment at Key Stage 2 (national tests of English and Mathematics taken at 11 years), and the level of engagement of parents in the focus group part of the study. Participants in the workshops were parents and carers of children in Year 3 and Year 4 (they all had at least one child who was between 7 and 9 years old). Workshops were attended by between 6 and 15 parents, with an average of 12 in a session.

Running the Workshops

An introductory session was run in each school to explain to parents what the workshops were about and how they would work. Workshops were held in the mornings after parents had brought their children to school. This time was chosen following consultation with parents prior to this part of the project taking place. While this was parents' preferred time, we acknowledge that

some parents were not able to attend and that, ideally, we would have offered an alternative time, possibly in the evening after other parents had finished work.[2] To support recruitment of parents, the researchers spent time in the playground during the mornings and evenings of the week leading up to the introductory session and to the first workshop, distributing flyers and chatting with parents about the workshops. Participants included mothers, fathers, grandparents, and carers; we use the word "parents" here for simplicity.

Part of the project's aim was to empower parents and develop their confidence around their own mathematical understanding, so the positioning of parents as experts was a crucial part of the workshop strategy. This led us to think carefully about the dynamics of the relationship between us, the researchers who were facilitating the workshops, and parents, who we were hoping would be empowered through the workshops. It was important not to set ourselves up as "the experts," but in a school environment we recognized that may not be easy: parents are used to positioning teachers as experts, and teachers often interact in a context where they share their knowledge and expertise with learners. We emphasized from the start that we were not teachers and that we were interested in helping parents build their confidence in mathematics. Our attempts to establish a relationship where we were *facilitating* rather than directing parents' activity took time, however. Initially, many parents looked to us for confirmation that their ideas were legitimate or correct and to identify and label the mathematics that they were using.

The workshops employed the phrase "Everyday Maths" as a counterpoint to the school-centered approaches to mathematics described in the previous section. The workshops were introduced to parents in each of the four schools as having a focus on supporting their children's mathematics learning by finding and sharing the mathematics in everyday life. Each workshop was facilitated by two researchers, who guided the general direction of discussions and, when necessary, gave a few illustrative examples to support and encourage parents' contributions. Workshops were held two weeks apart, and each session lasted between 60 and 90 minutes. In order to encourage an informal, friendly atmosphere, each session began with a short amount of time for participants to help themselves to a drink and to have a chat with each other or with the researchers.

At the first workshop,[3] we began by asking parents to discuss the kinds of activities they did with their children. This was key to our approach; we wanted to treat parents as experts and to start with ideas of parents' family activities, rather than mathematical concepts. With regard to this second point, we made use of Stevens' (2013) concept of mathematics *in* activity, not mathematics *as* activity. Some of the home and family activities that parents discussed and shared with us were familiar, and others were less so, and perhaps more specific

to their cultural background. At the end of the first workshop we asked parents to start to explore the mathematics that was inherent in those activities. We prompted this by asking participants to think about one of the activities they had been discussing and saying, "You wouldn't normally have a conversation about mathematics during this activity, but if you did, then what might it be like?" At this point the researchers facilitating the session were careful to allow parents to lead the discussion and not to make suggestions of their own. At the end of the first session, the researchers asked parents to come back to the next session ready to discuss some further examples of everyday activities which they had done with their children after the first workshop, and gave parents digital cameras, books, and pens as tools to document activities, if they chose to use them. For some parents this worked well as a motivator to record their thoughts. However, some parents' responses to us giving them books and digital cameras to use to record family activity suggested that some parents positioned the workshops as school-like activities, with themselves as learners and us as teachers. These parents found the recording task too much like homework, despite us emphasising that it was their choice to use them or not.

In the second workshop, parents discussed the mathematics that could be found in their examples of everyday activities and started to talk about how they could introduce those ideas in conversation with their children. The majority of this session involved parents talking in small groups about particular activities that they had been involved in since the previous workshop session. Each group was asked to "find the maths" in their activities and were given large sheets of paper and pens to note down their thoughts. The researchers' role during this part of the session was to facilitate and encourage participants to make suggestions, but not to make suggestions themselves; it was important for us to stick closely to the "parents as experts" principle we had set for ourselves.

The third workshop focused on how parents experienced introducing mathematics into conversations with their children. This built on the previous session, as participants had naturally started "finding the maths" in activities with their children. Parents were asked to share examples of ways in which they had started a conversation around mathematics that they wouldn't have started before taking part in the workshops. They discussed what kinds of conversations had transpired and which had gone nowhere and shared what kinds of conversation starters appeared to engage children in mathematical thinking.

The fourth workshop continued to explore the range of conversations that parents had been attempting with their children and also addressed parents' views on how useful they found the workshops. This final session was an opportunity for the research team to evaluate the success of the workshops. This evaluation primarily consisted of prompts for parents to discuss ways in which

participation in the workshops had changed the ways in which they engaged in mathematical activity at home. Researchers also prompted parents to discuss barriers and enablers for out-of-school mathematical learning following participation in the project.

Dependent on the number of parents attending the workshops, most conversations were held between pairs or small groups of parents before coming together as a whole group—this was to enable greater levels of participation and also help parents develop confidence in expressing their thoughts with a few other parents before sharing them with a larger group. Some activities, for example in workshops one and two, used flip-chart paper and post-it notes to allow parents to draw or write down some of their activities and explore the mathematics in those activities.

Researcher/Parent Relationships

We recognized that parents' sense of expertise had to be developed gradually over the duration of the workshops. In the first workshop, we started by focusing on family activity, in which it was relatively unproblematic for parents to see themselves as experts. Parents spoke about all manner of activities they did with their children, from sports such as football and swimming, to housework and preparing food and gardening, to journeys and outings (to name a few examples). When it came to discussing mathematics that appeared in those activities, however, parents initially seemed more prone to looking to the workshop facilitators to describe the mathematics. In these cases, we usually started by highlighting a couple of examples (e.g., planning the quickest route to visit different shops or coming up with examples of mathematical thinking provoked by a day out at the zoo, such as noticing the different shapes and sizes of enclosures that different animals need) and then asked parents to respond to those examples and think of times when they may have experienced that kind of thinking or reasoning.

While we were not teachers, we were "researchers from the university," and therefore parents may have been likely to position us as having particular expertise that we would share with them. (In fact, through discussion we learned that some parents assumed that we had backgrounds as teachers, which was only true for one of the researchers!) We facilitated workshops in pairs. One researcher was less confident in mathematics and was present at all the workshops; the other two researchers were more confident in using and seeing mathematics, and each facilitated workshops in two of the schools. A researcher going through the same "journey" as parents, all discovering that they did actually use mathematics in a range of ways, helped to emphasize our facilitation role to parents and highlight that we were not necessarily the "experts."

This was sometimes hard to maintain in all interactions, with parents seeking to replicate a teacher/pupil relationship at times (and as facilitators, we had to be vigilant so that we did not fall into that pattern of interaction). Another strategy that we used involved wearing casual clothes, not suits or "smart" clothes, so that we were less distinct from parents in appearance. This was noticed—one parent spontaneously commented that she thought we seemed friendly and approachable because we weren't wearing formal clothes, but instead were wearing cozy jumpers (i.e., sweaters).

The relational aspect of the researcher/participant dynamic, in which we were trying to avoid hierarchy, was mirrored in terms of our approach to the hierarchy of everyday mathematics and curriculum or school mathematics. We wanted to recognize that the mathematics found in the curriculum was important, but also to present everyday mathematics as another, complementary, way of engaging in the subject which did not cause the anxiety so familiar to many parents when engaging in curriculum-based mathematics. This emphasis on parents' expertise as another route to engagement in mathematics, but not contradictory to school mathematics, was an important part of the ethos of the project. This reflects the Derridean theoretical stance taken throughout the project. We were aware that parents would construct their identity relative to others involved in the workshops. By explicitly positioning ourselves (researchers) as participants in the workshops as opposed to experts, we opened up a space for parents to think of themselves as experts. We considered holding the workshops in locations other than schools, as we felt that this would further enable parents to position themselves as experts, but decided that it would be difficult to find locations that were as accessible and available at suitable times for participants.

Data Collected at the Workshops

Notes were taken as a record of the first workshops; we wanted to establish trust with parents and ensure that conversation was not inhibited by recording. In subsequent workshops, we asked permission to record conversations between pairs or small groups of parents and whole-group conversations. These audio recordings were later transcribed. They were analyzed thematically using the NVivo 9 software package (QSR). Initial codes were developed through discussion, in part in response to our experiences in the workshops and in part through our theoretical positioning. A first categorization of the data using these codes resulted in further refinement of the codes and a rereading and recategorization of the data using the refined codes. The content of these codes then led to the development of the themes presented in this paper. The research was conducted in accordance with the ethical principles of the British Educational Research Association (2011) and of the researchers' home institution.

Findings and Discussion

This paper addresses the nature and focus of parents' discussion in the workshops and how it developed over the four sessions. As the workshops progressed, there were shifts in the focus of discussion. In the first two workshops in each school, the majority of discussion was focused on the meanings of "mathematics" associated with experiences of family life outside of school and the potential for alternative meanings to those defined by schools. In the third and fourth workshops, parents negotiated a position for themselves between school-centered definitions of mathematics and definitions of mathematics that were accessible to them outside of school and worked to develop practices to help support their children's mathematics learning.

This section focuses on a series of illustrative episodes of parents' talk that each emphasize parents' reflections on meanings and associations around mathematics. The talk in the episodes presented here are from a number of different parents, but are presented in chronological order, representing the ways in which many of the parents participating in these workshops developed new understandings of mathematics and of ways in which they could engage in mathematical talk and activity with their children.

Finding "Mathematics"

The first two workshops had a focus on parents "finding the maths" in everyday family life. This activity gave rise to a number of discussions about what "counts" as mathematics and whether and how mathematics can be found in different examples of family activity. These first two workshops were designed primarily as an opportunity for parents to consider alternatives to their school-centered definitions of mathematics. This constituted the *decentring* of "mathematics" that we hoped that parents would experience through the workshops. These discussions often revealed unexpected findings regarding parents preexisting conceptions. For example, in the second workshop in one school, there was a discussion of a family day out that involved going for a walk and finding a rope swing at the top of a hill:

> Parent 1: No, on the rope swing…I had a little chat about why you swing and how fast should you swing and the idea that, in theory, you should swing to the same height on the other side. It's always difficult, that, because of course in practice you don't get…you let the rope go on its own, it doesn't go anywhere near, which is always a bit tricky. But, yeah, I couldn't get much more out of that.

There was a particularly strong feeling among many parents that the support that they gave children at home should be as similar as possible to that

provided in the classroom. This was apparent in some of the discussion around the excerpt above in two ways. Firstly, parents questioned whether talk and activity around a rope swing was sufficiently "mathematical" and whether it was a problem that the talk might be straying into the domain of science rather than mathematics. These were questions that occurred in other contexts, too; for example, one parent questioned whether a discussion around supply and demand might be about economics rather than mathematics, and others had similar questions about issues that might be about geography or history. At the time, these questions were somewhat surprising to us as the researchers and workshop facilitators, but in hindsight they highlight a particular aspect of parents' school-centered definitions of mathematics. In many classrooms, mathematical activity is clearly differentiated from other activity. In schools, there are mathematics lessons, mathematics textbooks, and mathematics assessments and tests—these all serve the function of separating mathematics from other subject areas. Parents' discussions, in the first two workshops in particular, indicated that this (relatively arbitrary) division of disciplines had carried over to their out-of-school lives and to the ways that they supported their children in their learning.

The second issue connected to the above quotation was an association between mathematics and "right answers." The parent speaking in the quotation was (mis)remembering a rule about pendulums that had been learned at school. The first thought about how to use the experience of finding the rope swing to support the child's learning was to impart this knowledge, "the idea that, in theory, you should swing to the same height on the other side." However, a lack of security with this knowledge (note that the misremembered knowledge is likely to be Galileo's observation that the swing of a pendulum always takes the *same amount of time*—not that the swing will always be the same length or rise to the same height) meant that, for this parent, it was difficult to maintain the talk. On a number of occasions during the first two workshops, many other parents expressed this idea—that they found it very difficult to engage in mathematical talk with their children when they did not know the "right answer." It is possible that there may be a parallel to be drawn here between parents' ideas of transmission models of mathematics teaching and learning in schools and their desire to enact a transmission model of teaching and learning at home. A transmission model is clearly only possible to enact when the "transmitter" has the "right" facts at hand to submit.

These two associations with "mathematics"—that it is distinct from other subject areas, and that it is about "right answers"—were the two most evident ways in which parents' talk with their children was restricted by a school-centered approach. When these issues arose during the first two workshops,

they provided an opportunity to question the parents on whether a school-centered approach was useful in allowing parents to engage in mathematical talk and activity out-of-school, or whether this approach might be unnecessarily restrictive. This questioning and the ensuing discussions represented the *deconstruction* that the workshops had been designed to provoke. This deconstruction opened up possibilities for parents to redefine mathematics and explore new ways to engage with their children's mathematics learning outside of school. Derrida's work allows us to begin theorizing what is at play in the above passage. By introducing the idea of "Everyday Maths" to parents, we created or drew attention to a binary opposition (school mathematics / "Everyday Maths"). What emerges from this is not an automatic acceptance of "Everyday Maths" (a freezing or inversion of the binary), but a resistance to what are perceived as challenges to the authoritative or central concept in the binary, that is, school mathematics. "Everyday Maths," assumed to be unhelpful for homework purposes or for supporting classroom learning, is the marginalized, ignored, or repressed term and is relegated to a secondary and inconsequential status. Even when parents like Parent 1 attempted to talk to their children about mathematics outside of school, they drew on conceptual resources from their own experience of school mathematics. Thus, school mathematics is pervasive in the sense that Parent 1 struggled to think outside of that paradigm, and conversations about mathematics in the world were restricted to those that took the form of models taught in school.

Negotiating Between Binary Opposites

Some parents were very aware of their attachments to school-centered definitions of and ways of working with mathematics. The following excerpt illustrates the kind of difficulty that parents thought that they needed to negotiate:

> Parent 2: Okay. So one of the problems is that at school they're mostly concerned with…multiplication and arithmetic rather than all this other stuff [Everyday Maths] which, admittedly, is maths. So then, I guess the problem is, I'm always thinking, "Well, how am I going to reinforce the stuff they're doing at school? How do I make that relevant, because actually it's not?"…So it's almost like you're arguing for a different maths course right at that point. You wish the children did the maths that was relevant to the world rather than trying to make the world relevant to the maths they're doing [in school].

Many of the parents in this study expressed similar frustrations, and it was evident that this difficulty was a significant barrier to parents taking a broader approach to talking about and doing mathematics at home. However, the awareness of tension between school-centered and other approaches to

mathematics demonstrated in this quotation can also be seen as evidence that this parent is beginning to engage in the deconstruction that these workshops were intended to provoke. The workshops allowed or *gave permission to* parents to take a leap of faith in order to try out some new ways of thinking and talking about mathematics with their children that they would otherwise have found very difficult due to their attachment to school-centered approaches.

Supporting Children's Learning Outside of School

In the third and fourth workshops, many parents shared examples of conversations that they had been having with their children that they said they would not previously have had. For example:

> Parent 3: My children were asking me this morning how many hours there were in a day, and I said "24 hours," and then they said, "But how many hours are there in a night?" And then I was explaining to them when the day was and when the night was and how many hours that worked…and then it was different at different times—they really tripped me up. So we had to pick that apart on the way to school.

This represents an example of ways in which parents became more comfortable with uncertainty. The conversation moves from a definite answer of "24 hours" to a more subtle discussion in which the mathematics of this situation depends on the way in which the language is understood. This parent made time to continue the conversation and "pick that apart." Making time for talk around mathematics and allowing themselves some uncertainty were two things that many parents reported as the workshops progressed.

Parent 4 (quoted below) responded positively to the idea of "Everyday Maths" in the sense of feeling inspired to engage her children in mathematical reasoning ("It's new, we never did that before"). Parent 4 described engaging the children in a range of activities which contained mathematics both inside and outside the home. For example, following participation in the workshops, she let her children operate the washing machine (i.e., by putting in the clothes and setting the timer), gave their children a tape measure to discover the size of objects around the house and convert these from centimeters to inches, counted steps with a younger child when climbing up and down the stairs, and recorded children's growth on height charts. In the following excerpt, this parent describes her children using a bus timetable:

> Parent 4: We live near the bus stop; sometimes…we go to the shop, and we check the time the bus is coming; we have to run. Check the time, maybe it's bus time; "We have to go" they tell me, and we have to run, and we have to take the bus, and if we miss this one, when the next one is coming; its 20 minutes.

This parent not only engaged her children in "Everyday Maths," but she created games which simulated the mathematics found in everyday contexts. In the following example, the parent describes playing "shopping" with her children using real food and money:

> Parent 4: We have to bring all the groceries, all the shopping, at home. They have to label it…29p, how much they cost. We have to play that game using real money. She is the seller, and I am the cashier, and I give her a calculator, how much I have to pay, and I have to give the real money, and she has to give the change; it's real. So we have to make the kitchen messy everywhere.

What we see with Parent 4 is a partial inversion of the school mathematics/"Everyday Maths" binary. Although the play described in the quotation involved some kinds of activity that one might expect to see in a classroom (e.g., arithmetic involving money), the parameters of the game are set by parent and child together, and the resources used are authentic—note the repeated use of the word "real" (cf., Lowrie, 2011). The parent told us that before the workshops she found mathematics "hard" when helping her daughter with homework, "but now it's like, really like home, everything much easier." Unlike Parents 1 and 2 speaking in workshops 1 and 2 above, whose statements represent the ways that parents often began the workshop series privileging school mathematics over "Everyday Maths," after Parent 4 attended the workshops, her imagination was sparked, and she began including her children in conversations and activities that she would not have previously. Interestingly, this parent felt that the new approach was impacting positively on her daughter's school work. The daughter originally disliked mathematics ("she hates it") but came to enjoy the subject and has been improving at school; "Even at school I was told that she likes the maths…she's keeping moving well." Some parents (as shown under "negotiating between binary opposites" above) found this idea counterintuitive at times—that spending less time on school-centered tasks and more time on the mathematics of everyday family life could have a more positive impact on children's experience of mathematics in the classroom. However, by the end of the workshops, a majority of parents reported positive experiences for both themselves and for their children as a result of taking this approach.

Beyond the Four Workshops

The following excerpt is a conversation between two parents during the fourth workshop in their school. They discussed ways in which they now felt able to help their children with their learning:

Parent 5: I think what you're saying is a really important part of that. It's about knowing the right questions to ask rather than the right things to say.

Parent 6: Because sometimes you feel like saying it straight away, and you're like, "Oh, I need to put the dinner on." It's like with me…you really want them to say it, and they're not saying anything: "Shall I say it now, or shall I not say it?"

Parent 5: Yeah. And what words can we use to sort of—

Parent 6: When do we jump in and…yeah.

Parent 5: Yeah, so that we're sort of using the right maths-related language—

Parent 6: Without making them feel like it is maths.

Parent 5: Yeah. And questioning, that's it, so that it's just like planting seed: "Yeah, where is the pattern in that?" And even if they can sit with that and not really—they can mull it over, even if they don't answer you at first because they're involved in their thing.

Parent 6: Yeah, because sometimes they're so involved in it they don't want to see.

Parent 5: Yeah, but you're sort of feeding in the right language or the right ideas for them. But then it's like, at what point do you say "Maths," do you identify it as maths?

There are a number of features in this excerpt that illustrate both the ways that parents started to develop new approaches to supporting their children, and some of the difficulties that still remain. At the opening of the excerpt there is a statement that resonates with many of the discussions that we observed during these workshops, "It's about knowing the right questions to ask rather than the right things to say." This was an approach that parents felt allowed them to achieve a number of goals. Importantly, it allowed parents to dissociate themselves somewhat from the role of "expert mathematician." It also allowed children to take a lead in their learning. This was reinforced by the later comment, "it's just like planting seed." This was a departure from school-centered approaches, where activity and outcomes are perceived by parents to be more closely directed.

The questions that these parents were asking themselves in this excerpt (including "when do we jump in?") represent continuing attachment to ideas of school-centered approaches to mathematics and a focus on doing things in the "right" way. However, parents note their transition to a point where they now prefer to leave some time for children's talk and thinking before giving children

a correct answer or rephrasing children's thoughts using correct mathematical language—although they clearly find this somewhat uncomfortable. This questioning ("at what point do you…identify it as maths?") also appears to represent evidence of these parents' awareness of différance around their understanding of mathematics. This dialogue demonstrates a wish to postpone a definition in order to allow their children to take a lead in mathematical thought and activity in the home context, but at the same time a feeling that the label "maths" will be needed at some point.

Some parents engaged in sustained reflection about the meaning of mathematics that led to significant changes in the ways that they planned to support their children's learning. For these parents, the workshops presented a space to imagine and debate the emergence, function, and practice of mathematics. A common theme for parents engaged in such reflection was "nature"—parents examined the relation between people and nature and the role of mathematics in that relationship. For example, one parent suggested that mathematics was a way of describing a "felt, sensory, direct experience of the world." The parent felt that "the invention of mathematics" involved the classification of experienced objects (i.e., it is easier to say "square" than "a shape with four equal straight sides and four right angles"). However, some parents moved beyond seeing mathematics as a descriptive exercise to understanding it as a range of concepts that help us render the world intelligible:

> Parent 7: I don't see maths as a separate entity that's kind of divorced from the world. I think there is a time in the world when maths didn't exist but that people were still having experiences of the world, and there would be an experience of these things being in this container but without the concept of number to be able to count them, and that maths just has a—people over time have developed concepts to help us explain and understand aspects of the world, and over time, a collection of those concepts has been put into another category and said, "We'll call this maths."

What is important here is not the historical accuracy of Parent 7's account but the fact that his understanding of the origins and purpose of mathematics feeds directly into how he engaged his child in mathematical talk. For Parent 7, mathematics presupposes our engagement with the world—it has a functional value which serves our experiential interests and cannot in its entirety be abstract or detached from the world. This framing of mathematics fed directly into the way Parent 7 thought about talking about mathematics with his child in everyday out-of-school contexts:

> Parent 7: I do really enjoy that thing of being with a child and like, "Wow, this is an amazing experience, isn't it? How are we going to

> make—oh look, feel this. Actually, I have got a bunch of concepts that I've kind of learnt from school that you haven't come across yet, but let's stick with how you're experiencing this," and then maybe slowly I can say, "Well, look have you noticed there's a kind of shape to this. We call this a square."

Parent 7 took pleasure in experiencing the world with his child, sharing the child's wonderment in this experience ("this is an amazing experience, isn't it?") and being attentive to the senses ("oh look, feel this"). For Parent 7, this raw or immediate experience was prerequisite to introducing mathematics in conversations in out-of-school contexts. Unlike Parent 1, who experienced a lack of appropriate subject knowledge to support the child's mathematics learning, Parent 7 felt that he had sufficient mathematical knowledge to impart to his son in everyday contexts: "Actually, I have got a bunch of concepts that I've kind of learnt from school that you haven't come across yet." However, for Parent 7, the concern was to avoid introducing mathematics to conversations too quickly. Instead, Parent 7 preferred to "stick with how you're experiencing this" before "slowly" introducing concepts such as shapes to classify experiences. This account resonates strongly with the experience of other parents in the study, as in later workshops we noted a growing trend of parents encouraging children's focused engagement in an activity leading to a noticing of and reflection on the mathematics in that activity.

While some parents looked outwards for inspiration when defining mathematics (i.e., by looking at nature), one grandparent reflected about the nature of her own body in the world, and this shaped her understanding of mathematics:

> Parent 8: I took [my granddaughter] swimming the other day, and I thought, in that there's tons of maths. You know, talking about, you know, the weight of your body in the water, how does it feel differently from when you're climbing out of the pool—you feel really heavy, and then when you get in you feel really light, and you know, how fast can you go in the water, and how deep can you go, and how much do you have to push to get back up, and…we had this ring, this little ring that we were throwing to each other for, it must have been half an hour… so throwing it, trying to catch it on your arm.…So, yeah, there's, there's motion, there's all kinds of experience going on.

Parent 7 theorized a time before mathematics came into being in order to postulate its original purpose (e.g., in order to classify, describe, and support the replication of nature). By contrast, Parent 8 "found" mathematics in her embodied sense of self when reflecting about how she relates to and engages with her immediate environment. This led directly into suggestions of topics for discussion with her granddaughter when swimming. For example, Parent

8 described the change in sensation between getting in and out of a swimming pool ("when you're climbing out of the pool—you feel really heavy, and then when you get in you feel really light"), as well as a change in a sense of affordances when in the water ("how fast can you go in the water, and how deep you can go, and how much do you have to push to get back up"). These direct experiences of her body were intertwined with her understanding of the world—concepts of weight, force, energy, depth, pressure, and so on emerged through a direct sense of her body and her capacities to act in the water. Parent 8 extends these insights to her interactions with her granddaughter, too—throwing a ring in the swimming pool can be understood in terms of force and motion.

Parents who attended the workshops were asked to reflect upon and find the mathematics in their everyday lives with the view of discovering that mathematical reasoning was commonplace. Put differently, the aim was to show that parents—regardless of their self-perceived mathematical ability—engaged in some form of mathematical awareness or activity on a regular basis which could be shared with children. By introducing the idea of "Everyday Maths" to parents, we created what Derrida referred to as a binary opposition (i.e., school mathematics vs. "Everyday Maths"). For Derrida, each binary pair consists of a dominant concept and a marginalized concept. For some parents (e.g., Parent 1), school mathematics remained the dominant concept insofar as parents prioritized supporting their children's learning of school maths and avoided engaging children in "Everyday Maths." Sometimes parents took "Everyday Maths" to mean the discussion of school mathematics in out-of-school contexts. Arguably, this is another way of school maths dominating the binary relationship, as these parents struggled to think outside of what was being taught in schools and attempted to maintain the transmission approach to teaching that they associated with the classroom. By contrast, other parents (including Parents 4, 7, and 8) found the concept of "Everyday Maths" inspiring insofar as it motivated them to engage their children in practical mathematical activity, to have fun simulating events involving mathematics (such as playing shopping with food and money), and reflecting on and noticing the mathematics in everyday life. For these parents, "Everyday Maths" may even have become the dominant concept or mode of interaction around mathematics. Using Derrida's (1995) words, parents engaged in "dislocating, displacing, disarticulating, disjoining, putting 'out of joint' the authority of the 'is'" (p. 25; i.e., a school-centered meaning of "mathematics"). We can make sense of this process by applying Derrida's notion of différance to the data. Différance consists of two ideas about meaning, namely: (1) meaning is derived from difference not sameness, and (2) meaning is never fully present but

is always deferred or postponed. To say that parents' understanding of mathematics emerged through difference is to say that parents debated the meaning of mathematics by differentiating it from other subjects. Parents wanted to know how mathematics was different from other school subjects, such as biology, physics, and geography. However, upon consideration that the boundaries between these subjects are often blurred (e.g., that mathematics permeates the study of science), some parents began to theorize and imagine where mathematics had come from, why it emerged, and how it was originally practiced. There was also discussion among parents of how "mathematics" differs from, but yet is emergent from, activity—this is visible in quotations from Parents 5, 6, 7, and 8 (above). However, despite parents' attempts to pin down the meaning of "mathematics," they experienced deferral of its meaning. To examine this deferral more closely, we have a quotation from the fourth workshop, where a parent reflects on personal experience with the project:

> Parent 9: It's still almost needing a definition of…maths. That it's a way of…sort of exploring or…the phenomena of the natural world or something, do you know what I mean? It is about inspiring wonder, and inspiring wonder in maths comes down to this sort of stuff, really about just how incredible the world is and how it works.

Here we see différance in action. This parent has engaged with the workshops in some depth and has put effort into the reconception of mathematics, away from the dominant school-centered perspective, and yet a stable definition is still (and may always be) out of reach. While in some ways this may be perceived as unsettling, for this parent, the experience of "finding mathematics" opened up a space for productive questioning and for greater depth of engagement with their child's learning and experience of the world.

Conclusion

The workshops reported in this article gave rise to a number of findings that would have been difficult to access by other means, in particular those around parents' preexisting understandings and representations of mathematics. The approach employed by the study allowed parents to set the agenda and so allowed issues around parental involvement to emerge that were not evident from the literature beforehand. The parent-centered nature of the workshops also allowed parents time and space to develop their understandings of ways to support children's learning and to share these with the research team.

The Derridean analytic framework provided a means of structuring the analysis of a very large and complex set of data. This framework directed the focus of analysis towards episodes where there was evidence of parents engaging

in some way with meanings and associations around "mathematics." Through the four workshops, we identified excerpts that represented important points of transition in the ways that parents conceived of and related to mathematics. Especially towards the end of the series of workshops, parents shared examples of ways that these changes in the ways that they conceived of mathematics had changed the ways that they engaged in mathematical talk and activity with their children.

Evidence from parents' discussions shows that many of the participants began the workshops with conceptions of mathematics that limited the ways that they felt able to support their children's learning. Parents had an understanding of mathematics as a subject that had right and wrong answers. This meant that they avoided talking about mathematics when they were not confident of ending up with the right answer. Parents also had an understanding of mathematics as being separate and distinct from other curriculum subjects. This meant that they avoided talking about mathematics at home in the context of science, history, geography, and so on. These findings were in addition to the usual barriers to parental involvement found in the literature, including anxiety about mathematics, differences between parents' experience of mathematics and children's experience, lack of time to spend with children, and so on (e.g., Peters et al., 2008). It is important that schools and teachers, if they want to raise levels of parental involvement in children's learning, are aware of and respond to these kinds of attitudes and beliefs. Otherwise, there is a clear risk that parents' engagement with their children's learning will be affected in a negative way.

There are links between the findings reported here and discussions around "hard-to-reach" parents. As such, we suggest that this work provides a useful additional perspective on Crozier and Davies's (2007) hard-to-reach-parents versus hard-to-reach-schools discussion. Crozier and Davies argue that the term "hard-to-reach" is often used by school in a way that "pathologizes the parents, laying the blame on them for something which, as we argue, is, to a large extent, out of their control. It also serves as an excuse [used] by schools for not being more proactive" (p. 296). We see a similar phenomenon around mathematics learning when schools continue to attempt to engage parents using methods and activities that experience and research evidence have shown can be alienating and counterproductive. We also see examples of parents' engagement that is not recognized as such by schools (Jackson & Remillard, 2005). This is not to say that schools deliberately set out to fail to engage parents, but that schools can often take a "one size fits all" approach that, while working for some, may fail to recognize "the nature of the parent body or their particular needs or perspectives" (Crozier & Davies, 2007, p. 309). What appeared

to work well in the present study was the way in which a parent-led approach, building on the skills and experiences of the parents involved, allowed them to set the agenda, to build on existing strengths, and to take ownership of the outcomes. While a school-centered approach runs the risk of employing a "one size fits all" approach that in reality does not fit all, a parent-centered approach allows parents to tailor their approach to their own context.

The workshops allowed parents to discuss and develop ways of sharing mathematics with their children that avoided some of the barriers listed above. By focusing on finding and engaging with the mathematics in everyday family life, parents could avoid some of the high-stakes issues, including needing to know the "right answer" and needing to take on the role of expert mathematician or teacher. Parents instead focused on open-ended questioning, allowing time for children to think, and supporting children in reflecting on an activity. We argue that this is likely to represent a more powerful support for children's learning than many typical homework tasks set by schools. This is partly because parents can help children make connections between school and out-of-school mathematics and engage in sustained one-to-one dialogue around mathematics in a way that teachers in classrooms cannot. It is also partly because this is a role that parents came to take ownership of during the project in a way that they had not previously been able to when supporting their children's mathematics learning in a school-centered way. While there are some limitations to this study, these findings do provide evidence for the potential efficacy of this type of parent-led intervention to support parental involvement.

The main limitations of the study are related to its scope and scale. We only worked with parents, not with children, so we only have parents' reports for evidence of behavioral change at home. It would have been very helpful to have been able to augment this study with further work to explore any changes in parent–child interactions that may have resulted from these workshops, as well as any changes in children's conceptions and attitudes around mathematics that may have been associated with these. The workshops took place in four different schools with very different contexts, so it is not possible to generalize from this study to any great extent. However, the study does provide a new perspective on parental involvement in children's learning and draws attention to the need for further work to develop our understanding of ways to support and promote parents' engagement.

We hope that this study is a catalyst for further research in parental involvement in mathematics learning. We argue that it provides a useful counterpoint to reports of school-centered approaches to parental involvement. At the least, this study has shown that there are groups of parents in England who have been able to overcome some limitations associated with school-centered approaches

and develop new ways of engaging in talk about mathematics with each other and with their children. This may be a useful platform on which future work can build.

Endnotes

[1]An exception to this is the recent finding that parents with mathematics anxiety are more likely to pass on mathematics anxiety—and associated low attainment—to their children when they are more involved in their children's mathematics learning (Maloney, Ramirez, Gunderson, Levine, & Beilock, 2015).

[2]Indeed, where schools have facilitated these workshops themselves, with our support, they have sometimes been run in the mornings but also sometimes in the evenings.

[3]Further details of the workshops and resources to support teachers in leading them can be found at http://www.everydaymaths.org

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Authors' Note: The project reported here was funded by the Nuffield Foundation. The Nuffield Foundation is an endowed charitable trust that aims to improve social well-being in the widest sense. It funds research and innovation in education and social policy and also works to build capacity in education, science, and social science research. The Nuffield Foundation has funded this project, but the views expressed are those of the authors and not necessarily those of the Foundation. More information is available at www.nuffieldfoundation.org

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