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“It’s helping your child experience the world.” How parents can use everyday activities to engage their children in mathematical learning.

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This paper presents the content and preliminary findings of the Everyday Maths project workshops for parents. Research suggests that support from parents and/or carers can have a significant impact on children’s mathematics learning. While parents are motivated to help their children learn, they often have little confidence engaging with mathematics as presented in the school curriculum. The Everyday Maths workshops were designed to help parents reflect upon and find the mathematics in their everyday lives, and support parents in developing conversations with their children around everyday mathematics. Workshops were run once a month in four primary schools in the Southwest of England, from November 2013 to February 2014. Preliminary findings suggest that through the workshops some parents were afforded opportunities to develop a ‘mathematical lens’ which led them to identify the mathematical reasoning underpinning decisions and actions in everyday life. This inspired parents to initiate conversations with their children about mathematics and construct activities which engaged children in mathematical thinking.

Keywords: qualitative research; everyday mathematics; parents; workshops.

Introduction

This paper outlines the development and implementation of workshops for parents, which aimed to empower them to support their children’s mathematics learning. We discuss ways in which parents engaged with the workshops and how their thinking and identities relating to mathematics developed over the course of the workshops.

Existing literature on parents’ roles in children’s mathematics learning often focuses on parents’ abilities to help children with classroom tasks. While most parents are motivated to help their children with school work, many face anxieties around helping with mathematics. These include anxieties around knowing the right answer, anxieties about knowing the methods that the children use, and pedagogical anxieties around how best to support their children (Jay, Rose & Simmons, 2013). Alternative forms of parental involvement are less dependent on schoolwork and resourced by household activity. Families often face situations of problem solving requiring 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, 2004; González, Moll, & Amanti, 2005). Earlier 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).

The everyday activity of parents is expected to provide a rich source of contexts for engaging in effortful and meaningful mathematics practice. Our own research (Jay & Xolocotzin, 2012) indicates that young children and their parents participate in a range of household situations that can be addressed mathematically. In line with Goldman and Booker (2009) we have found that family activities can entail a range of mathematical operations, often involving arithmetic and counting but also including logic, geometry, optimization, combinatorics, measurement, and algebra. Other processes important for using mathematics can also be observed in everyday situations at home, such as explanations, generalizations, representations and the development of problem solving strategies and approaches. Collaborative construction and use of tools, including calculators, rulers and other measuring tools, computers and visual representations, is also important. By resolving everyday problems with their children, parents can share their mathematical knowledge by modelling, prompting, or disclosing the solution.

The Everyday Maths project

The Everyday Maths project reported in this paper aimed to empower parents to reflect upon their uses of mathematics in everyday life, and to discuss these with their children in order to support their children's mathematics learning. Jay et al. (2013) reports on the first stage of the project, in which focus groups with parents from 16 primary schools were conducted, to discover how parents felt about mathematics, and about helping their children with mathematics. The second stage of the project involved four one-hour-long workshops, at approximately one month intervals, for parents in each of four primary schools.

Workshops

The workshops were facilitated by the authors of this paper, and aimed to support parents to reflect upon and discuss their uses of mathematics in everyday life, in order to support their children's mathematics learning. The workshops were run from November 2013 to February 2014, across four primary schools in Bristol. Schools were chosen to provide variation in terms of socio-economic characteristics of the area, ethnicity of the pupil intake, and results at Key Stage 2. One school was in a mainly white, affluent, suburb of the city; one was in an inner city area of relative deprivation, with the pupil population mainly made up of Somali children (many of whose parents were first-generation immigrants with English as an additional language); once school was situated in a mainly white working class area characterized by low educational engagement and aspirations; and one school was in a mixed demographic area with a wide range of ethnicities attending the school, and a large number of different first languages spoken among the pupil population.

Parents in all these schools had participated in focus groups or playground interviews for the first part of the Everyday Maths project as reported in Jay et al. (2013). In September and October 2013 parents were informed of the workshops in many different ways. Posters (in some cases in a range of languages) were put up around the school, and flyers were handed out in the playground. These used clear and simple language, and included a photo of the researchers who would be running the workshops. The third author of this paper spent time in school playgrounds at school

drop-off and pick-up times to talk to parents about the workshops which were being planned. An initial pre-workshop meeting was held with parents in each school, during October, to introduce the idea of the workshops to the parents, share their aims, and describe how the workshops would be run. The preparation work was an important part of the project, to ensure that parents understood that the workshops were not about school or curriculum mathematics, that they were not expected to have any particular level of expertise in mathematics as we would just be discussing the kinds of activities they did with their families on a day-to-day basis, and that the workshops were informal and parents did not have to commit to coming to all of them. The effort put into developing relationships with parents at this stage helped parents feel more at ease in discussions with the researchers, with some parents commenting that they felt relaxed because the researchers were friendly and informal.

Workshops lasted approximately one hour (depending on the nature of the conversations, the numbers of parents attending, and whether any wanted or were able to stay longer). They were held in a space in the school, for example the dining room, or a study room, with tea, coffee and biscuits provided.

The workshops were designed to be parent-led, using parents' experiences and social and cultural funds of knowledge as starting points for discussion. However, prior to the workshops, all the authors of this paper had kept a personal diary of the kinds of activities they did in their everyday lives, highlighting the kinds of mathematical thinking that occurred: this enabled us to provide examples of activities to start discussions off, should that be needed. Table 1 shows the topics that each workshop aimed to focus on.

Table 1: Topics covered by the four Everyday Maths project workshops.

Workshop number	Focus of discussions in workshop
<i>Workshop 1, November 2013</i>	Different activities parents do at home with their children, and ways of documenting those activities
<i>Workshop 2, December 2013</i>	The mathematics that can be found in activities which parents do with their children
<i>Workshop 3, January 2014</i>	The ways in which parents can discuss with their children the mathematics that appears in everyday activities
<i>Workshop 4, February 2014</i>	Sharing experiences of discussions with children, and evaluation of the workshops

In practice, while this was the approximate structure of the workshops, the numbers of parents attending fluctuated widely between workshops (numbers attending varied between 2 and 12 parents) as well as between schools, and in some cases parents who were at one workshop had not been at the previous one. This meant that the workshop plan was only loosely adhered to and sometimes the content of two workshops was combined.

With the permission of all parents, conversations at workshops 2, 3 and 4 were recorded and later transcribed for analysis. Notes were made on the discussions held at workshop 1. Other data collected included mind maps and notes made on post-its by parents in the sessions. Data were considered at an individual workshop level, and at a school level in the analysis. Each author of this paper read through the transcripts and discussed topics and ideas which they saw in the data. The first author of this paper then read through the transcripts again and developed a set of descriptive codes, arising from the previous conversation and from the content of the data. These codes were applied to all the complete dataset.

What emerged from this process were patterns and interlinked themes in parents' conversations which developed over the course of the workshop. These

related to parents' interaction with mathematics, and ways of discussing mathematics with their children.

Results

From "I can't" to "we do"

In the focus groups at the start of the project (Jay et al., 2013), and at the first workshop, parents spoke about their frustrations with, and fear of, mathematics. Many parents were apprehensive about engaging with mathematics, particularly that which their children were doing in school because they were unfamiliar with the methods used in contemporary classrooms. Discussing mathematics with their children was reported as stressful, confusing, and something parents tried to avoid. Parents spoke about how they felt as individuals about mathematics and their own personal anxieties, with little or no reference to enjoying maths with their children.

As the workshops progressed, however, more and more parents started to talk about the activities they did *with* their children and coming to realisations *together*, as this discussion from workshop 2 in School 3 illustrates:

Parent: I've just thought of another one to do with day and night: 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.

Interviewer: It's a challenge, isn't it?

Parent: So we had to pick that apart on the way to school. Don't think we finished that conversation actually.

These types of comment suggest that parents were positioning themselves as learners and explorers of the world alongside their children, rather than feeling the need to separate themselves from their children, in the position of teacher or experts.

From abstract to embodied

This idea of exploring and experiencing the world seemed to be key for some of our participants in terms of thinking about mathematics, and supported parents reflecting on possibilities and ideas for conversations with their children. Episodes in the workshops that seemed to trigger discussions around potential for exploring ideas with children included finding a rope swing, playing Jenga, whittling wood, and swimming. These embodied experiences enabled parents to discuss physical sensations and how they related to mathematical concepts. This conversation from Workshop 2 in School 4 about the weather sparked off discussions about cause and effect:

Parent 1: One question I had from mine on holiday was "why in England we haven't got all the rain we have here?" as in we went to Mexico and obviously we explained about the tropical rain and when it rains it really pours. So they did what I used to do as a child, sometimes the water just coming from the roof and he thought in a certain way it's just like a shower – really heavy, really strong – have a shower and just play.

Parent 2: It's the same in Pakistan, we have the same type of monsoon rain as well.

Parent 1: Let's say if it's rainy season you've got all these weather systems building up in the ocean bringing rain across and obviously it will drop heavily, and normally it's just the way all the... different weather systems...

Parent 2: This is the system, this is the rain, and maybe it is a mode of having trees as well that brings you rain. This is the main thing why we are having less rain now because we are cutting down the trees very fast in Pakistan especially – not here. This is the thing; mountains are the reason, seas are the reason. These are the different things that take part that cause rain like cloud. But to explain this to a child is not that easy...

Parent 1: Yeah, we are putting the things together: "This thing happened, this thing happened," so that is to draw a conclusion.

This example is similar to others in the dataset, in that parents worked to develop ways to incorporate mathematics in their talk with children to help make sense of their lived experience.

From answers to questions

Parents began to realize through conversations with each other that they did not have to be able to answer every question their child asked about mathematics. They started to discuss the importance (and fun) of asking questions about the world with their children, exploring ideas and thinking about possibilities through mathematics. Asking questions became more important than knowing answers, as these extracts from parents in Workshop 3 at School 3 shows:

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

and

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.

and

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.

What is interesting is the nature of the group in facilitating parents coming to these conclusions. The dynamics within the workshops, where parents seemed to develop their confidence and their ideas through interaction with each other, was important in allowing parents to develop their mindset and change their thinking.

Practicalities of the workshops

Some practical issues were faced in running the workshops. While it was explained that the workshops were not about curriculum or school mathematics, and we would not be teaching parents how to do maths, some parents still came to the workshops expecting to be shown what their children were doing in school, or wanting help with their children's mathematics homework. Despite the emphasis on parent-led

discussions, some parents expected the researchers to lead the discussions, show them examples of activities, and say where the maths was in parents' own activities. This was possibly due to parent confidence, and to expectations about interaction in a school environment: parents are used to positioning teachers as experts/leaders of learning within schools. Although we are researchers not teachers, it was hard for some parents to shift their perceptions to seeing themselves as leaders of their own learning. This points to the need for careful management of the dynamics within workshops, if teachers were to run workshops in their own schools. We suggest that teaching assistants may be better placed to facilitate workshops, as this might make it easier for parents to move beyond positioning themselves as "pupils".

Conclusions

The journey taken by parents over the course of the workshops was revealed through the notes and discussions. Initially, parents wanted to define mathematics but struggled to. There were discussions about what it was, and parents wanted to make sure that they were including "proper mathematics" in their conversations. This highlights the anxiety that they felt around curriculum mathematics, and the perceived paradigm of school mathematics as being about answers, and about being right or wrong. However, as time went on, some parents began to realize that uncertainty was fine, and asking questions and asking "what if...?" was exciting and fun – it was ok not to know. The opportunity to discuss experiences they had shared with their children was crucial to these changing ideas about what mathematics was about, and to enabling them to develop or change their mathematics identities from reluctant problem solvers (or non-solvers!) of mathematical problems, to those who explored with their children the world around them, and were not afraid to ask questions to which they did not yet know the answer.

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