

Parental involvement in mathematics education in a Canadian elementary school

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This small-scale study, carried out in a Canadian elementary school, explored some of the major influences affecting parental participation in mathematics education and examined the changing nature of the role adopted by parents as their children moved up through the school grades. While parents were less visibly involved in school mathematics as their children got older, in fact a great deal of invisible mathematical activity was taking place at home for children in all grades. The nature, style and strategies adopted by the parents were influenced by factors relating directly to the parents' own mathematical experiences. In contrast to this range of parental responses, teachers tended to view the parents as a homogeneous group, generally lacking confidence and expertise in mathematics. Findings from this study could inform more inclusive school practices for encouraging active participation by parents in mathematics education to the overall benefit of the children.

Introduction

An established body of research examines the relative roles adopted in home school partnerships (Bastiani 1993, Epstein and Dauber 1991). Such partnership initiatives usually arise from within the school, with extensions moving into the home (Merttens 1995). Some researchers have documented the dominance of the school culture and consequent exclusionary practices of this kind of partnership initiative (Brown and Dowling 1993, Macbeth 1995, Merttens 1995). Another body of research examines exclusionary practices relating to gender, race and class

(Crozier 1999, Hargreaves 2000, Vincent 1996). Working on the widely held assumption that effective parental involvement not only increases the self-esteem of the parents and children involved (Sutherland 1991) but also improves achievement of the children, it would seem informative to explore the factors that affect this level of parental involvement. The focus of this research was to explore the approaches of parents as educators in their home settings and to discover factors that might influence their practice and their engagement with mathematics arising from a school setting. Consideration was given to the levels of involvement and roles adopted by parents, to factors that influence their teaching approaches, to the teacher's own perspectives and their practices for developing inclusive partnerships.

The Research Context

This study took place in a single grade entry elementary school in a Canadian city. The school population was largely white and middle class. The first language of most families was English though a few families were bi-lingual French-English. A small minority of families were from other ethnic groups with Chinese, Indian, Lebanese and Somali heritage. The ethos of the school would be instantly recognizable as being based on a child-centred pedagogy (LaPierre 1981).

Parental participation was encouraged and recognition was given to the vital role played by parents as first educators. This was achieved

through various mechanisms. A significant proportion of parents were active within the school and occupied in a variety of tasks including fundraising, social events and direct support as classroom volunteers. Each class had a role of parent volunteers and a considerable proportion of the classes had at least one parent volunteer present on a daily basis. Parents in this setting could be observed helping generally with classroom organization of equipment and accompanying the teacher and children on outings such as those to sporting events. To different degrees, parents were also found working under the direction of the teacher supporting specific individuals or groups of children with the classroom curriculum.

Data was drawn from a questionnaire for parents sent to the whole school population and semi-structured interviews with parents, teachers and the school principal. An attachment to the questionnaire invited parents to volunteer for the interview phase of the research. In all, a total of 26 parents volunteered to participate in this part of the study. This was an encouraging response, but beyond the resources of this small study. 11 of these parents were selected by applying additional criteria relating to the number and spread of their children across the school. By this process, the maximum amount of data could be collected by asking individual parents to reflect on their involvement in both, or in some cases all three, of their children's' mathematics education. This parent sample included 3 fathers and 8 mothers. Between them, they had a total of 23 children in the school: 4 in Kindergarten, 11 in the primary phase (grades 1-3) and 8 in the junior phase (grades 4-6). To protect identities, all adults are referred to as female and all children as male.

The parents' sample was, to some extent, self-selecting. The first group to volunteer all turned out to be confident or fairly confident about mathematics and they were already active within the school in other spheres. At a later date, another small group of active parents approached

the researcher explaining that they would like to have supported the study but felt that they would be of no use because they saw themselves as being 'hopeless with math'. With encouragement and reassurance they went on to provide valuable insights and contributions to the study.

Analysis of the interviews

The interview schedules were developed in light of responses to the original questionnaire. The purpose of the interviews was to learn more about parents' and teachers' perceptions of parental involvement in mathematics education. Interview responses were analyzed under thematic headings developed from the transcripts. For the parents, these themes were:

- Parental attitudes towards mathematics
- Early influences and experiences of mathematics
- Parental perception of their own ability to teach and explain maths
- Mathematical activities that parents carry out with children
- Variation of activity with age of child
- Parental perception of how their children learn
- Partnership with school
- Degree to which parents engage mathematics in adult life

Similar, but reciprocal themes were developed for analysis of teachers' responses.

Three classroom teachers were interviewed in this study, one from each stage of the Elementary school. They were suggested by the school Principal and chosen because of their success in involving parents to support the curriculum as classroom volunteers. As characterized by (Hulsebosch 1991), they were 'High Involvement Teachers' who were typically able to maximize their interaction and involvement with parents. Interviews were conducted with these three teachers and the school principal in order to gather data relating to the teachers' perception of the factors affecting parental involvement in mathematics education. The research additionally examined how such teachers, already achieving

high levels of general parental involvement, engaged parents in mathematics education.

One interesting feature of this study was the privileged position of the researcher as an insider researcher - being recognized by parents as a fellow parent and acknowledged in a professional capacity by fellow teachers. This offered the opportunity for frank and open responses from both perspectives.

Parents' responses

Analysis of parental responses revealed that parents' perception of their own ability, aptitude and confidence with mathematics had more effect on the level of involvement than did simply a question of age variance of their children or the corresponding increased complexity of the curriculum.

In turn, parents were able to suggest early influences in their own lives that had had an impact on the development of their attitudes towards mathematics. These included the form of engagement with their own parents in mathematical activity that was viewed by some as a positive experience.

'I loved it actually, because I was very involved with my dad at that time; we had a very good time.'

Memories of mathematics at school elicited strong responses. Where successful, these early experiences had formed the basis for a lifelong engagement with mathematics.

'I loved it. I was excellent at it. I was one of the top students in the school.'

For others, memories engendered only negative feelings.

'I was intimidated by it at school...so I tend to encourage the kids not to be intimidated.'

By their responses, parents could be grouped into three types according to their attitude towards mathematics, their own perceived ability and their efficacy as mathematical educators of their children.

Some parents acknowledged that they had maths anxiety and managed to avoid maths in all but the most necessary transactions. Generally, these adults recalled negative early experiences of mathematics. They lacked confidence in their own ability to manipulate numbers and harbored a deep dislike of the subject. This group lacked confidence in their ability to support their children's learning in mathematics. This group were labeled the *Maths Evaders*.

Some of these parents reported that they went to great lengths to avoid mathematics in their adult lives. One, a successful designer, described the lengths to which she would go to avoid precise measuring and calculation.

'I don't write down numbers. I just gauge with my calipers to make sure the sides are equal.' Commonly, people who have difficulty with the subject claim that they are not naturally mathematicians. One parent described her friend's son as very capable and quick at mathematics.

'...a little treat for him is math...but for me...it's my idea of torture...for me it would never be math.'

In sharp contrast to this attitude are those at the opposite end of the spectrum who describe their love of the subject, the confidence with which they manipulate numbers and the pleasure and enjoyment they get from solving a problem. They exhibited confidence in their ability to support their children's mathematical learning. This group were labeled the *Maths Achievers*.

'I still love it! I am completely confident with numbers and calculation and still love a good logical puzzle.'

These parents said that early positive experiences with mathematics probably informed their career choices and reported that they still engaged with mathematics in their professional lives.

'I write for a communications company. I read technical papers. I don't use formulas, but the

way these people talk and the framework we work in is mathematically based.’

The group between these two ends of the spectrum exhibited mixed responses and attitudes. These parents record mixed experiences and early influences on the development of their own attitude to maths. Parents in this group value success in mathematics and consider it to be an important subject. They were moderately confident in using mathematics in adult life and in their ability to support their children’s learning in mathematics. This group were labeled the **Maths Advocates**.

Preferred Adopted Parental Teaching Approaches
The study revealed five adopted teaching approaches that developed from analysis of parental responses. These codified the activities that they carried out with their children. Many of these activities were set in a real life context and parents were creative in exploiting mathematical opportunity.

Basics - Basic numeracy practice of four operations and standard written algorithms.
‘When he was little ... he would sit in restaurants and count sugar packets and pizza slices - simple addition and subtraction ... ‘

Skills - Practice of skills and drills e.g. times tables, telling the time, money values. Sometimes materials to support learning being provided e.g. number charts.

‘...so I used to tell them, if they have 25c and want to buy a candy for 5c then they should have 20c change and I would show them the coins - the shapes and sizes - say this is a dime, this is a nickel, a quarter. So we start that early on so they know what to do.’

Curriculum - re enforcing the school curriculum at home by supporting homework using teaching method as advocated by the teacher.
‘We spent some time and, to give him credit, in the summer between grade 4 and grade 5, he

spent an hour a day. He asked me to buy Grade 4 Review Math. Yes, he actually likes it more formal. He’s happy with it more formal.’

Enrichment- Extension activities, exploiting the learning potential in a real life context such as DIY/ home improvements, games, sports statistics, shopping or activities in and around the home: cooking, laundry etc.

‘I never thought of Monopoly as a math game - adding the dice for the youngest - lots of math and money and rents you have to pay for the older one. For example, a good rent of \$50 - well, how many times do you have to collect rent before you get back what you paid for it? - And he’d sit down and figure it out.’

Independent - Teaching new concepts independently of the school curriculum in an opportunistic way e.g. problem solving, engaging in mathematical discussion or mathematical pursuit for the pure enjoyment of it or following the child’s interest and enthusiasm.

‘He brings questions to me. Like this morning was no big deal - ‘Is everything in the world 3-dimensional?’ - It’s just buzzing around his head - so we spent 5 minutes talking about that.’

Analysis of the interview data revealed an overall trend of decreasing levels of parental involvement, both at home and in school as classroom volunteers, as children moved up through the grades of Elementary school. This is not a new observation. Indeed, anecdotally, both teachers and parents had predicted this general pattern and similar patterns of involvement have been recorded by (Epstein and Dauber 1991, Merttens and Vass 1990). However, explanations as to the factors affecting this level of involvement varied considerably between parents and teachers.

Maths Achievers

Typically these parents adopted a teaching style independent of the school curriculum, making the most of the opportunities that arise in family life

to enhance and enrich their children's understanding and appreciation of mathematics. These parents were not reliant on receiving instructions or directions from school in order to carry out mathematical activities with their children. They were not antagonistic towards helping out with homework or explaining school mathematics curriculum but they rarely taught the basics.

'What I almost never do is ask the children to chant their times-tables or get involved in arithmetical calculations.'

They readily picked up on and responded to their children's interest and questions and could exploit the mathematics offered in many situations. Mathematical activity and discussion was a natural and integral part of their relationship with their children. Very few parents talked as naturally as did this group about the ease with which mathematics was integrated into their interactions with their children. They spoke about it being a natural part of their family life, drawing an analogy with literacy and access to books and stories.

'We have a tendency to exploit the educational value in situations but this may not be the case in every family...for example, not just math books but nature, astronomy, plays!...It is important that these enrichment opportunities fit into what is already going on at home...we don't necessarily sit down and do half an hour or a page of a math text book...but they should be extensions of normal family situations.'

Their over-riding wish was to protect this relationship with their children. Some expressed doubt about the formality of approaches adopted in school. These parents were wary that this approach could engender negative attitudes towards mathematics in their children, something they were anxious to avoid.

Maths Advocates

These parents were much more focused on the school curriculum. They demonstrated an awareness of the nature of learning and the development of their children's mathematical

understanding at different stages in their education. This understanding was closely linked to their adherence to the school curriculum and their wish to follow the teachers' lead. These parents emphasized the need for a good foundation in the basics and worked consistently with children of all ages to help them achieve this. Parents often taught concepts and skills such as, number recognition and counting to their children in the Early Years of pre-school and Kindergarten. Parents reported that they were anxious for their children to *make the connection* between mathematics learned at school and maths in the real world. They were aware of the benefits of learning mathematics based on experience and were inventive and creative in exploiting the mathematical potential in many real life situations, particularly with their younger children.

'When he was very young, he used to ask me to read license plates. Finally I asked him if he could read them and, lo and behold, he could! He was 2 or 3 years old then...He was interested, it's always been driven by him. We used to spend a whole lot of time...it used to take us half an hour to get across a parking lot because we would have to read every license plate on the way.'

Once children moved into the Primary Years, the focus shifted to more complex operations and algorithms. Their parents still emphasized the importance of developing mathematical thinking strategies and stressed the need for a meaningful context whilst, recognizing the futility of rote learning. Although rather contradictorily, this is one area in which they retained a degree of independence in practising skills such as *times tables*. This basic skills practice was viewed as an essential tool rather than the root of mathematical understanding.

Parents were anxious to adopt the correct method by which they usually meant the approach currently employed by the teacher. They were more reluctant to teach concepts independently and more likely to follow the teacher's lead and procedures for fear of causing confusion. They

were likely to seek specific advice from the teacher with regard to suitable activities, methods and approaches to be adopted, especially if their child was experiencing difficulties. As children entered the junior years, this pattern was continued. Parents in this group remained fairly confident about the mathematical content of the curriculum and were willing to reinforce it by playing an active part in supporting homework. However parents tended to lose their autonomy at this stage of their children's education. They became very reliant on following the teacher's lead and suggestions. In some cases, parents who actively sought advice attempted to adopt and mimic the teacher's style. Some parents were so concerned about causing confusion that they became over reliant on teacher advice and tended to avoid teaching new concepts or offering explanations to their children.

'I think parents can also get it wrong...there are new and different ways to teach and there may even be counterproductive ways to teach.'

Maths Evaders

The interesting characteristic of this group of parents was that although they expressed a dislike of the subject and in some cases made every attempt to avoid contact with mathematics in their adult life, they were anxious not to transfer this attitude on to their children. Parents in this study indicated that they thought the subject was important and were keen for their children to have more positive experiences than they had had as learners of mathematics. They worked hard to participate in their children's mathematical education. Surprisingly they showed as much awareness of the value of real life activities as the more mathematically confident parents. They often engaged in interesting and creative 'real life' mathematical activities, particularly with their younger children in the pre school and kindergarten years.

Basic numeracy skills and drills formed the major part of their mathematical activity once their children reached the primary years. These parents felt that it was important that their children had a

good grounding in the basics, followed this aspect of the school curriculum closely and felt able to offer support in this element of the curriculum to their primary children. These parents reported that at this stage, they had personally found mathematics uninteresting, but accepted the need to offer support as part of their wider parental responsibilities.

'Just the rudiments - like trying to sort out division. That is something that I do do! And, you know, the big plus and the big minus. I'm the sort of person who would have to check on their work because I'm not big on keeping my attention. I tend to mind-wander because it's boring. I'm good at making sure they check their work.' Once their children entered the junior grades, these parents reported that they felt ill equipped to support their children in the study of mathematics. The curriculum content became too complex for them to handle with confidence and they were very concerned not to convey their maths anxiety and dislike of the subject to their children.

'They lose me around Grade 5 ... I mean, they do things so differently that I just confuse them ... even their dad, you should see them confuse him, and he's good at math. When they're younger it's OK, but as they get older!'

They tended to steer clear of teaching situations altogether, preferring to pass the baton to another person (another family member or in some cases a tutor). These parents did not relinquish responsibility for their children's learning in mathematics. They reported their concern to ensure that their children were actively engaged in mathematics and completing homework assignments on time. At times parents in this group reported re-learning concepts alongside their older children.

Although the overall level of parental involvement decreases as children move up through the school grades, the pattern of adopted approaches was a complex one, closely reflecting parental attitude, ability and confidence in maths as illustrated in Figure 1

Figure 1 - Preferred Parental Teaching Approaches/Varying with age of children

	Kindergarten Junior/Senior	Primary Grades 1-3	Junior Grades 4-6
<i>Maths Achievers</i>			
Basics	*	*	o
Drills	o	*	o
Curriculum	o	*	**
Enrichment	***	***	***
Independent	***	***	***
<i>Maths Advocates</i>			
Basics	**	***	*
Drills	***	***	**
Curriculum	**	***	***
Enrichment	***	**	*
Independent	***	**	*
<i>Maths Evaders</i>			
Basics	*	**	o
Drills	*	***	o
Curriculum	*	**	**
Enrichment	***	*	o
Independent	*	*	o

Key: o Rarely, * Occasionally, ** Often, *** Frequently

In summary, the maths achievers tended to protect their interactions with their children by not engaging to any degree in the school curriculum but continuing to adopt independent and enrichment approaches. The maths advocates developed increasingly conservative approaches to mathematics, conforming to their restricted view of school mathematics and becoming over reliant on direction from the teachers. The maths evaders probably conform most closely to the teachers' perception of parents in general lacking in confidence as co-educators in mathematics.

Teachers' Responses

Teachers in this sample reaffirmed the widely held view (Epstein 1986) that as the mathematics curriculum content becomes more demanding for children in the higher grades, levels of parental involvement tail off. This was attributed not to unwillingness on the part of the parents to offer support to their children but to the demands of the

curriculum itself. Teachers perceived that many parents found it difficult to engage with mathematics at this level and to integrate it into family life.

The teachers in this study already had a history of successfully involving parents in the school curriculum. Even for these teachers, parental involvement in mathematics remained problematic and, despite their efforts, exclusionary practices were occurring. Teachers were able to offer suggestions to explain these practices. The Kindergarten teacher observed that, in the Early Years, many parents were able to take advantage of the home setting to provide a learning context.

'At this level, if parents know what we are doing, 90% will be involved. They will use these simple things around the house to talk about all the different areas of math. They do sorting. They do seriation. They just don't call it math.'

This was qualified by the Primary teacher, who illustrated how parents might over-emphasize basic skills and numeracy at the expense of the wider mathematics curriculum.

Teachers generally agreed that the decline in parental involvement could be pinpointed to the children's move from Kindergarten to the Primary grades. Teachers recognized the dominant role that they unwittingly adopted in making increased use of professional terminology around this phase. One teacher talked about seeing parents, year by year, get less comfortable with the curriculum, unaware of the direction it was taking. This teacher acknowledged that the language that teachers use compounded this feeling of alienation from school mathematics. *'Parents, you can see them thinking ... 'Hey, I'm listening to this; should I be talking that way?' ... and they are ready to relinquish some of that right away.'*

The same teacher recognized that the calm confidence with which teachers talk about the learning process and aspects of pedagogy could be intimidating, but explains that, from a teacher's point of view, it was subconscious. *'... (they) just know something about class management and some have lived with talking about this stuff for so long and I already see that ... subtle little intimidation ... so that leads into math.'*

Teachers generally accepted that parental involvement in the mathematics curriculum at grades 5&6 would be minimal. Reasons given included lack of parental confidence and ability to handle the curriculum as discussed elsewhere. *'Some parents, they stay right off it because they are uncertain about it ... parents are not really sure what to expect ... and they are afraid of messing it up.'*

Additionally, teachers recognized that older children might wish to assert their independence and would not welcome their parents being visible as classroom volunteers at this stage of their education.

'Specifically with a lot of the older children, they emphatically say ... 'I don't want my parents to come in or to help me with this.' ... As they get older, it's part of their developing independence.'

Teachers also spoke about parents who are naturally focused on their individual child and who look for specific guidance from the teacher. *'They might want examples and, say - 'give me exact ideas' or 'specifically, what can I do with my kid?''*

Teachers in this study were acutely aware that establishing contact with some parents was not all that easy. They cited as examples the low level of interest and responses to proposed curriculum workshops, or the lack of support for activity based homework projects in some older grades. They offered explanations for this lack of involvement that focused, not on any lack of parental willingness, but on lack of time due to the increased complexity of peoples' lives and the pressures of balancing a career and a family. Teachers were aware that this was particularly pertinent for single parents. Economic and social deprivation was also offered as reason for low contact. One teacher, aware of the differential responses to homework activities, expressed concern for the children who did not receive parental support with such assignments. Similar issues were raised by (Brown 1990). One teacher had, for a long time, sent home suggestions of practical activities that could be carried out at home - data collection, investigations etc. These had been issued on a class basis and, for some children, had been positive and rewarding shared experiences. This teacher was concerned for those children who, for one reason or another, had not participated.

'Well, I'm more cautious of doing that now because I would find ... the varying levels would come in and the disadvantage would go to the disadvantaged. So I've stopped doing that kind of thing because that was unfair - because kids would come back and they hadn't done it and they

were confused as to what was going on. They'd never get those things done.'

This teacher had switched to sending home assignments and suggestions on a more individual basis, which must be less efficient and demanding of teachers' time.

Conclusions

The findings in this small-scale study can only be generalized to the self-selecting parental sample and small representative group of teachers involved. The distribution of the parental sample raises the possibility that other 'hidden groups' might exist. Assuming that in any population there would be a continuum of responses describing attitudes to mathematics and willingness to engage in partnership, then a group of parents would seem to be missing from this sample. This group might fill a gap between the Maths Advocates and the Maths Evaders. One could speculate that this group might be parents who for one some reason felt unable to contribute their voice and experience to the study. The question remains, who are the missing parents and how can they be reached? This dilemma would provide a fruitful source of research in a school with a tradition of active participation.

The teachers in this sample acknowledged that parents played a major role in their children's education and were keen to develop and extend partnership. They had a long history of success in promoting partnership with parents. However, even these teachers acknowledged particular

constraints in involving parents in mathematics education. Attempts to do so had recorded limited success even with such active parents as those in the study sample. Teachers also demonstrated awareness that despite their best efforts, some groups of parents remain non-participatory.

This study suggests that teachers and parents have restricted views of each other's practices. Parents have a tendency to take a formal view of the school curriculum and display lack of understanding of its breadth. On the other hand, teachers tend to view parents as a homogeneous group and, in higher grades, see them as mainly not engaged in mathematics education due to lack of confidence with an increasingly complex curriculum.

An analysis of the developmental needs of the parent/child relationships would help provide a model for improvement in the quality of parental involvement. Within the scope of this study, exclusionary practices were occurring in the sense that these needs were not identified or addressed directly by the teachers.

This study highlights the need for teachers and parents to develop a system of auditing in order to establish the flow of information from the home to the school. This would allow both parties in the partnership to address the diversity in mathematical ability and confidence within the population of parents assuming their role as co-educators in mathematics.

References

- Bastiani, J., (1993), Parents as Partners - Genuine Progress or Empty Rhetoric?; in Munn, P. (Ed.), *Parents and Schools - Customers, Managers or Partners?*, London, Routledge.
- Brown, A., (1990), Participation, dialogue and the reproduction of social inequalities; in Merttens, R. and Vass, J. (Eds.), *Sharing Maths Cultures*, Basingstoke, Falmer.
- Brown, A. and Dowling, P., (1993), The Bearing of School Mathematics on Domestic Space; in Merttens, R. et al (Eds.), *Ruling the Margins: Problematising Parental Involvement*, London, University of North London.
- Crozier, G., (1999), Is it a case of 'we know when we're not wanted'? The parents' perspective on parent-teacher roles and relationships; *Educational Research*, Vol.4 No.3.

- Epstein, J., (1986), Parents' reactions to teacher practices of parental involvement; *The Elementary School Journal*, Vol.86,3.
- Epstein, J. and Dauber, S., (1991), School programs and teacher practices of parent involvement in inner city elementary and middle schools; *The Elementary School Journal*, Vol.91,3.
- Hargreaves, A., (2000), Professionals and Parents - personal adversaries or public allies?; *Prospects*, Vol.XXX No.2.
- Hulsebosch, P.L., (1991), Beauty in the Eyes of the Beholder: How and Why Teachers Involve Parents; *International Journal of Educational Research*, Vol.15.
- LaPierre, L., (1981), *To Herald a Child*; Report of the Commission of Inquiry into the Education of the Young Child, Ontario.
- Merttens, R., (1995), Teaching not Learning: Listening to Parents and Empowering Children; *For the Learning of Mathematics*, 15,3.
- Merttens, R. and Vass, J., (1990), *Sharing Maths Cultures; inventing maths for parents and children and teachers*, London, Falmer.
- Sutherland, I., (1991), Parent Teacher Involvement Benefits Everyone; *Early Child Development and Care*, Vol.73.
- Vincent, C., (1996), *Parents and Teachers: Power and Participation*, London, Falmer.