Family Math Groups

An Exploration of Content and Style

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Introduction

The Research Question

When the facilitator of a family math group adopts an exploratory and holistic approach to math, what changes occur in parents' attitudes to math and to helping their children with math learning? What are the effects of an egalitarian facilitation style on parents' attitudes to participation in family math activities? I asked these questions in the context of a project that brought together parents (and people acting *in loco parentis*) in small groups to try out a set of math activities I had designed for adults and kids to do together, to give me feedback on the activities, and to help me revise a manual designed for parents who wanted to have fun with math with their kids.

Context of the Research

Situating Myself

I have taught Literacy/ABE for nearly 20 years at the Cowichan Campus of Vancouver Island University (VIU), formerly Malaspina University-College. (The name changed in 2008, during the course of this project.) During that time, I taught English, usually at the basic literacy level, occasionally taking a section at a higher level for variety and to keep abreast of the department's offerings, and I taught math, again mainly at the basic numeracy level, occasionally at the introductory algebra level, for the same reasons. I spent one year as co-chair of the department. In the course of my teaching and administrative duties, I met many students and their families, and frequently taught both parents and their adult children, although not usually in the same class.

Since I am an adult educator, and do not generally work with parents as parents, am not involved with family literacy and am not myself a parent, how did I get interested in this project? The idea grew out of my work with adults who were learning basic math skills with whole numbers, decimals, fractions and per cents. Many students, who are placed in my classes as a result of an assessment, are surprised to find themselves in such a basic class and sometimes resist working on those skills again. They have in fact tried to learn them many times before, have done many workbooks and taken and sometimes passed many tests. They do not want to do fractions again. They may think that they already know how to do them, and that their placement at a low level is arbitrary and punitive, or they may agree that they have trouble with the skills, but approach the study of the material with a lack of confidence and little *joie de vivre*.

I notice that their understanding of the concepts is weak, and they are generally bent only on trying to memorize shortcuts and rote procedures, rather than understanding what they are doing. They are also often reluctant to use manipulatives, drawings or other visual aids to understanding, rejecting them as childish or unnecessary. I wanted to show them that math is everywhere, not just in the worksheets. I wondered if they would be willing to slow down, and play with math, if they did it with their kids. And since many adult students come back to ABE/Literacy classes so that they can help their kids with schoolwork, and by ex-

ample encourage their kids to stay in school, I thought that learning how to teach their kids might be a motivating factor to keep them working on math.

The Community

The Cowichan Campus Management Team (2007) outlines some of the salient features of the community that the Cowichan Campus of Vancouver Island University (VIU) serves: Cowichan Valley Regional District is situated on Vancouver Island, between Victoria and Nanaimo. Forest industries, tourism, agriculture, and commercial fisheries are the most important economic sectors of the area, but the service sectors are the largest employers. Education, health, and public administration make up 25% of the regional labour force. Of its 79,000 inhabitants, 10% are Aboriginal, and this percentage is growing. As is the case with other Aboriginal populations in BC, over 50% of the Aboriginal population in the Cowichan Valley is under 25 years of age. At present, Aboriginal students make up 15.6% of the students in the school district, and 18% of grade 6-12 students. This figure is much higher than the provincial average which shows Aboriginal students represent 9.5% of the total BC public school population (SD #79, 2006).

Of the general population in the region, 27% have not graduated from high school and a further 12% have no training past grade 12 graduation. As in other regions, high school completion rates for Aboriginal students are much lower than for other students. These figures are reflected in the ABE/Literacy classes we offer at VIU, which have a large proportion of First Nations students; indeed, in recent years my classes at the literacy/basic numeracy levels have been more than 90% First Nations students. Administration and faculty at the Cowichan Campus of VIU have developed a strong working relationship with the Cowichan Tribes, and many of the programs and courses on offer have First Nations content.

Community Support

Many groups and individuals in the community generously supported my efforts to do this project by offering me meeting space or helping me publicize the family math groups and recruit participants. Generally they were less interested in the research than in having the family math sessions offered to their clients. They seemed to see immediately that working with parents on math skills for their kids was a useful thing to do, without waiting for research results, and wanted to take advantage of a chance to broaden their program offerings. Five agencies were willing to provide free meeting space, which was a generous gift, since I envisioned needing the space twice a week for 11 weeks.

Literature Review

In this literature review, I will outline the relationship of family math and family literacy, explore the importance of play in developing early skills, and trace the mathematical development of early childhood; next I will review several large and small scale family math programs, and discuss common findings as to what makes these programs successful. Finally, I will note some of the homework advice available to parents, in the context of home-school relationships. Except where noted, the examples are mine.

Family Literacy and Family Math

It is not the place of this review to outline the research that shows that working with parents and children on reading and language skills has many benefits to children and parents alike. A fact sheet on the website of Literacy BC (Literacy BC, n.d.) notes that research shows that parents' expectations play an important role in their children's success in school; that family literacy ties together the family and the community, sends kids to school better prepared to learn, and promotes a positive attitude to learning in the home.

It would seem a logical step to conclude that family math, by which I mean a program that works with parents and children to develop math thinking and math skills, to develop a positive attitude towards math and to encourage parents to do math activities with their children, would have similar results and benefits; there is evidence to show that this is so, which I will outline in subsequent sections of this review.

In spite of their similarities, family literacy and family numeracy have been separate entities. However, after many years of doing family literacy, some programs are incorporating numeracy or math activities into their programs, for example, the Family Literacy Centre of Edmonton, which has recently produced a 100-page manual, (*Linking 1-2-3 and A-B-C*, 2007), for parents, caregivers, and early education specialists, which includes sections on numeracy development, the link between language and numeracy learning, and many activities for parents and children to do together. What seems more common, however, is for math educators, or experts in the development of math thinking in early childhood, to develop family math programs separate from family literacy programs.

This separation in programming mirrors the separation of English and math instruction in the K-12 system, and in Adult Basic Education. It is a separation that doesn't make sense—surely language learning and math learning should go hand-in-hand. It is impossible to solve math problems without using language, and it is impossible to talk or read about anything for very long without including some math concepts (count, size, shape, speed, money, spatial relationships, etc.) And, of course, the pre-school child learns both language and math naturally at the same time. It is only in our educational frameworks and institutions that they are separated.

Why do we have separate streams of family literacy and family math? It may be that many of the people who develop family literacy programs and who facilitate them, and the volunteers who help in them, have the same attitudes about math as the general population—a few love math and are interested in it, and many hate math, or don't feel confident in their ability to use it in their own lives, let alone teach it to their own or someone else's kids. In a culture where people with a high school or university education feel free to admit that they can't figure out the tip in a restaurant, or that they can't balance their household accounts, it is no wonder that family math has been left to the math experts.

A sense of exploration and lightness is often associated with learning language skills, ("word play" and "language play") but few such associations go with the idea of learning math; rather math is associated with seriousness and rigidity. In *Supporting Mathematical Development in the Early Years* (2006), L. Pound discusses this difference: "Language learning is more playful than math learning (but shouldn't be); 'mistakes' are accepted in language, but not in math" (Pound, 2006, p.17). I would offer as an example a child who says "psketti" instead of "spaghetti" for many months before he is old enough to say "sp" correctly. Some parents say "psketti" in sympathy, some parents are careful always to say it correctly, and some parents try to help the child learn to say it correctly, but nearly everyone allows it to be normal to take some time to learn this word. Certainly kids like to eat it

long before they can say it. Yet when the same child is learning to count, the pressure is on to get it right fairly quickly, even though the process of learning to count is complex, including the task of remembering the arbitrary names and order of the numbers, understanding that counting involves the one-to-one correspondence of object and number name, and an understanding that the final number named in the counting process is the number of the whole group of objects counted.

Parents' Involvement in Early Learning

In *Einstein Never Used Flashcards* (Hirsh-Pasek & Golinkoff, 2003) each chapter describes experimental research that shows the importance of parents' involvement in pre-school learning, the importance of play and of the child being in control of the direction of the play, and the relative uselessness of flashcards, organized learning, and academic preparation for kids in getting them ready for school. They say that children whose parents enroll them in various activities that are supposed to give them advanced status when they enter school are later less creative and less enthusiastic about learning; that memorizing unrelated facts does not give them a better memory in the long term, and that learning through play also develops essential social and emotional skills which are not learned if parents concentrate on narrow academic skills development

The authors suggest that parents provide resources for play that stimulate the imagination, although such toys need not be expensive, that they join in the play with the child, and that they follow the child's lead, and go where the child's attention is focused (p. 240-242).

They suggest four principles as a guide to helping young children learn:

- The best learning is learning within reach.
- Emphasizing process over product creates a love of learning.
- It's EQ, not just IQ [E for emotional].
- Learning in context is real learning—and play is the best teacher (Hirsh-Pasek & Golinkoff, 2003, p. 250-257).

Play is Important

The importance of play in math learning is not simply that kids have fun; rather, that kids are in control of the subject of the play. Both Pound and Hirsh-Pasek & Golinkoff emphasize that in free play, kids can model, theorize and experiment with questions that concern them; if they have noticed that the toy boat in the bathtub sometimes sinks and sometimes floats, for example, they can figure out, by experimenting, under what conditions it will sink. Parents may or may not know what question their kids are interested in at any given moment, and if they try to steer the child's play in any particular direction, they risk cutting off the authentic interests of the child, or forcing the child to engage in questions that are too difficult, too easy, or just not interesting, with a consequent loss of intrinsic motivation for learning. Play lets kids think for themselves, imagine, make decisions, think about a situation, and learn to be comfortable with uncertainty (Pound, 2006, p 37).

Process Counts

The experience of learning is more important than what s/he learns. A child following her own interests in the moment, or over time, has the satisfaction of seeing her work/play come to a point where she has answered her question as much as she needs for the moment. She learns the joy of discovery, the value of perseverance and gains confidence in

her ability to learn. From a list of principles subscribed to by authors of the series Pound is in: "The role of the educator of young children is to engage actively with what most concerns the child, and to support learning through these preoccupations" (Pound, 2006, p. vii). This idea has wide agreement in the literature. For example, Hirsh-Pasek & Golinkoff, among others, talk about the importance of following the child's interest rather than leading her where the adult might like her to go, and the value of "scaffolding," by which parents support their children in exploring ideas and relationships. We are scaffolding the child's learning when we see that he is building a tower of blocks that is getting shaky as it gets higher, and we put our hands around the tower as he puts another block on top. We are not building the tower for him, but we are making sure that his lack of dexterity in placing the latest block does not destroy all the work he has done so far. We know our child, so we know what kind and how much support he needs; we give him that support so he can do what he wants, and learn what he needs to learn.

Relationship Matters

Family literacy facilitators realize that reading with your child involves more than speaking the words that are written in the book—the child perceives the story, and the warmth in the parent's voice, and the security of sitting in the parent's arms, as part of the experience that we call "reading." Pound, speaking of conversations, rhymes, and songs, says:

> The words in isolation are not fully comprehensible to the infant, but within the context of interaction between adult and child they create sensations of belonging, communicating, anticipating, predicting and enjoying which will form the basis of all future learning (Pound, 2006, p.6).

Math play also creates those same sensations. A child who is getting out forks for every family member for supper experiences a sense of belonging, contributing to family life, responsibility and so on. The math is the same as the math on a worksheet that shows her a group of dogs and a group of dog houses and asks her to draw a line between each dog and a separate house, but the feeling is different, and the learning is different.

Real learning is Learning in Context

It is important to start with what the kid is concerned with (persistent concerns) and use them to encourage math play (Pound, 2006, p 21). The thesis of Hirsh-Pasek & Golinkoff's book is that children learn in context rather than through flashcards or worksheets, and the authors note that spending the money that he first earned is a lesson in addition and subtraction that sinks in quicker and more deeply than any artificial situation.

Stages of Mathematical Understanding

There are many descriptions of the developmental stages in the literature; the following are generally accepted, and are based on the outline from Pound's book, *Supporting Mathematical Development in the Early Years* (2006). Learning about these ages and stages allows parents to understand some of the child's inner development, which is often different than what appears on the surface. For example, a child who is learning to say "one, two, three…" (starting about age 3) is really only learning by rote, and may well make "mistakes", for example, may say the numbers in the "wrong" order or, when counting a group of five items may start at 3, or miss some items, or count some items twice. It is later that he learns one-to-one correspondence (i.e., that each number corresponds to just one item, and every item has an associated number) and later still that he understands that when

you count a set of objects, "one, two, three, four, five," that the last number you name is the number of the whole set.

Successful family math programs use the knowledge of stages of development outlined below to develop activities that correspond to the stages of children in their groups. This knowledge helps parents know what to expect and what not to expect from their child's math thinking. An awareness of the stages may help parents be patient with the child as he moves through them, and be tolerant of what seem on the surface to be mistakes, but are really only indications of the stage the child is at. Similarly, the fact that the child is ready to deal symbolically with numbers, to read and write the figure associated with the concept of "6," only as he reaches school age, will show the fruitlessness of using workbooks or flashcards while the child is younger.

0-3 years

- The child's representation of understanding is often physical (twirling to show roundness or a circle, or using a marker to make a line while saying "Vroom, vroom" when asked to draw a truck)
- Explores quantity, size, shape, distance, and pattern in rhythms
- Can "subitize" at a few days old (that is, can recognize a group of three objects, and is surprised if an object is taken away or added by stealth)
- Parents support this learning by providing experiences and adding language, such as "up and down," or "just two more sleeps."

3 to 5 years

- At about four, the child wants to count everything
- Will focus on number if environment supports it (sees parents using calendars, calculators, doing sums, estimates, etc.)
- Learns number names, one-to-one correspondence between number name and thing, that the last number named is the number of the group, that you have to start at 0 to count accurately
- Can invent number systems or representations of numbers; measures by non-standard units
- Stories, songs, rhymes are important to learn number names in the right order
- Concrete play is more important than abstraction, *e.g.*, count ants or forks or popcorn as you eat it

From 5 years

- Children begin to be ready to represent ideas or objects with symbols
- Schools need to build on what kids already know, rather than insisting on a single method, and move from concrete to abstract

Family Math Programs

In Canada, Great Britain and the United Kingdom, family math programs have been implemented by many school boards, ABE programs and community groups. According to an ERIC digest on family math by Wendy Schwartz (1999), the most comprehensive program is "Family Math" which was developed by the Lawrence Hall of Science in Berkeley, CA; in

Great Britain, the IMPACT program (Inventing Maths for Parents and Children and Teachers) is widely used. In Ontario, the Esso Family Math program, developed at the University of Western Ontario, has spread widely around the province.

A meta-study done by Brooks, Pahl, Pollard and Rees (2008) looked at international studies of the effectiveness of family language, literacy and numeracy programs. J. D. Carpentieri (2008) reported on the study in a special issued of *Reflect*, the magazine of the National Research and Development Centre for Adult Literacy and Numeracy in the UK. The study done by Brooks *et al* reviewed 19 studies from 14 countries, studies which had generated quantitative evidence. In the area of numeracy, the studies showed that the programs improved test scores of both parents and children. Numerous other benefits were reported, including "improved childrearing practices, increased parental involvement in their children's schools, greater parental self-confidence and increased employment" (Carpentieri, 2008, p.10). Where the studies included follow-up data, most showed that gains from the programs were sustained over time.

Many school boards and community family literacy programs in Canada, the USA and the UK have developed and implemented their own programs. These vary widely in size and comprehensiveness, ranging from a few photocopied activity sheets to complete programs with background information, activities for children, workshops for parents, and so on. As well, education departments at various governmental levels have produced material for families that is available for downloading, or for distribution by other means.

Supporting the K-12 Curriculum

A minority of programs seem more concerned with supporting the school math curriculum than with developing math thinking in a more natural context. Such programs often offer sets of materials for parents to use at home, but do not involve groups sessions for parents. An example is Knapsack Math (Martin, 1993), a program in which kits were developed for ABE students to take home to use with their kids. The activities use materials found around the home, but the activities are closely tied to the school curriculum rather than to home activities; it is suggested that parents set up a special place for math activities as a way of showing how important math is. This practice would also give children the idea that math is somehow separate from real life, not completely entwined with it.

Medina County Kindergarten Home Activities (Neiner & et al., 1995) is another example of a program that is designed to support the school curriculum, and in this case the standardized testing program:

> The suggested activities, carefully chosen by Medina County, Ohio, kindergarten teachers, were designed to reinforce skills introduced in the classroom and to further develop the foundation for competency based education testing and evaluation (Neiner & et al., 1995, abstract).

A Family-Centred Approach

The majority of programs I looked at, especially more recent ones, centre their activities on situations that naturally come up between parent and child. Following are brief summaries of some well known programs.

Family Math

The program was developed at the Lawrence Hall of Science, Berkeley in 1979. Teachers are trained in a three-day session to run a program of six family math nights for parents and children, introducing games and exercises that can be done at home. This program has

been adopted by school districts and other programs across the USA and around the world (Family math).

Family Numeracy Pilot Program (UK)

A one-year pilot program was conducted in 14 local education authorities in the United Kingdom to identify strategies to increase home support for numeracy, and to raise the skills of children and parents. The study ran from Sept-March 97-98, and involved 517 parents, nearly all women, and 515 children. Most parents had low math skills, and were not employed outside the home. There were statistically significant gains for the children in the program, compared to a control group. Test results showed more students in the study scored in the middle and high range than the control group, and fewer in low range; also most (more than 80% in each case) showed gains in confidence, interest, improved concentration and persistence. Adults in the study reported increased numeracy-related activities at home, increased contact with child's teacher and increased participation in school activities. Many completed at least one level of maths qualifications. The model includes separate sessions for groups of children and parents, and sessions with parents and children together, and activities to take home (*Family numeracy adds up. Lessons from the family numeracy pilot programme*, 1998).

This program differs from the others in that it offered a highly structured numeracy program for both parents and children, and reports that parents were most successful at the sites where all the parents had a similar low level of skills. At sites where some parents had higher skills, the needs of parents with low levels were not met as well.

Esso Family Math (Ontario)

This is a program developed at the University of Western Ontario, Faculty of Education, based on the family math program in Berkeley, in which activities are developed and volunteers trained to work with groups of parents, often in schools where students are at risk of early drop out or failure to graduate. There are two programs, one for families with children in junior and senior kindergarten and grade 1 and another for families with children in grades 2-5. Families attend 6 family math sessions, which start with a nutritious supper, and are facilitated by an experienced teacher/leader and five or six volunteers, who have received about 10 hours of training. Sessions are often held outside the school for the greater comfort of parents whose experience with school is not good; activities involve walks, games and experiments, using everyday materials; some of the activities reflect the Aboriginal culture of many of the families involved; facilitators model techniques for interacting with kids (Esso Family Math). A very positive response from parents is reported (Onslow, 2002).

Natural Math

The subtitle of this project is "Early Childhood Mathematics among Children of the Oklahoma Seminole Head Start and Boley Head Start." It was developed to encourage parents of Native American and Black preschool and kindergarten children to use math activities and games at home over the summer. Activities and games included many from Seminole culture. Parents were provided with a set of supplies and instructions for activities, an initial meeting to explain their use, a portable computer lab and a math fair. Students were tested after the summer program (Sears, 1992).

Education Resources Center (ERC), Phoenix

The Education Resources Center (ERC) is a community-based organization that serves students from various elementary schools united by the Phoenix Coalition for Youth and Families (PCYF), which serves the lower socio-economic areas of inner-city Phoenix. A study of

those families and children who had participated in the family math and science program showed its success. There was increased interest in science and math among parents and children; parents wanted their children to study science and math, and, in part because of the kind of instruction they experienced in the program, they believed their children would be able to learn science and math. 164 students in grades 1-6, were surveyed, 54 parents, 8 program instructors and 155 program instructor trainees (Jaramillo, 1993).

Project PACT, Pennsylvania

This program developed about 120 pages of activities for ABE students who interact with children to do first themselves, and then with a child. Emphasis is on keeping things fun, on learning naturally, and having the ABE student thinking about math concepts and how they might be learned, perhaps learning them him/herself (*Project PACT: Parents and children together.*, 1986).

Collaborative Materials Development, Ottawa-Carleton

In a project to develop collaboratively math materials to be used in ABE classrooms, instructor Dianne Bertrand worked with her ABE students to develop math materials and activities to use with their preschool children (Hagedorn, 2004).

Materials for Parents

Government bodies and other agencies have produced material to be used independently by parents. Two such have similar titles, an earlier one by the Government of Ontario ("Helping your child learn math: A parent's guide", 2002) and another by the US Department of Education ("Helping your child learn mathematics with activities for children in preschool through grade 5", 2005). Both are suitable for parents who don't have much difficulty with reading.

Qualities of Successful Programs

What Parents Value

Most programs say that parents are surprised about how much they enjoy the math activities. Diane Bertrand, working with adult ABE students who were parents, says, "[Parents] were pleased to be able to do something educational and fun" (Hagedorn, 2004, p. 68). However, they value more than fun; in a study of parents who all had at least high school graduation, Kliman, Mokros and Parkes (2001) reported that as they understand how the games and activities relate to math learning, parents enjoy watching their children learn, and sharing the "Aha!" moments.

Parents often have "Aha!" moments of their own about math, and come to a rational understanding of processes that they had previously done by rote. Reporting on the Esso Family Math program, Onslow (2002) comments that as parents begin to understand the math through the games and activities, attitudes towards teachers and school math programs may change as well. Parents, who may disapprove of what they perceive as mere "playing" and "wasting time" as their children use manipulatives or take part in discovery activities in their classes, come to see the value of such activities through the family math program, and change their attitudes.

Talking about math, and talking about how we learn math, are two things that most parents do not do in the course of their ordinary life. Yet both these intellectual activities are offered to them during a family math program, and they "enjoy the opportunity to come to-

gether to discuss an intellectual matter such as mathematics with other adults. They are no longer “just” sharing stories about their children and in general about their everyday life, they are now talking about mathematics together" (Civil, 2002, page 2).

Importance of Fun

Given that many parents express surprise at how enjoyable family math activities are, it is apparent that many parents expect it will be difficult and frustrating to work on math with their children, and I can only applaud those parents who come to a program even though they expect to have a bad time. It makes sense that program organizers in all of the programs I read about, or whose material I read, put an emphasis on making the activities enjoyable. Parents themselves should have fun with the activities, and families should have fun doing them together. Project PACT (1986) states it clearly: “Please make learning fun. It is the best gift you can give your child" (*Project PACT: Parents and children together, p. 125*). Andrea Lachance (2007) points out the two aims for family math nights organized at her school: that every participant have an enjoyable experience, and that the night be well organized.

Reading about Math

Reading stories about math is a common practice in family math programs. It is a way to introduce literacy into the program, and provides something the parent can do at home; sometimes when the parents are meeting together, someone will gather the children in another room to read a story. The Esso Family Math Team screened books to meet standards that would ensure opportunities for learning meaningful mathematics. The criteria were:

> an engaging story—more than just counting books, language that encourages mathematical understanding, open-ended rich problem contexts, a springboard that enables families to explore, to conjecture, and to reason logically, mathematics woven into appropriate illustrations and multiple levels of mathematical thinking that address a range of age, developmental levels, and learning styles (Chapple, 2005, p. 2).

Importance of Language

There are several issues around language in family math programs. The first is that the activities should encourage children to talk about math, provide vocabulary to do so, for both children and parents, and model math thinking. For example, Bertrand says,

> “…what is normal daily interaction with a child for me is not necessarily that of my [ABE] students. I am likely more “teachery.” For example, as I take my grandson up the stairs, we count the steps. I don’t know if that is learned or natural for parents but most of my [ABE] students do not do it" (Hagedorn, 2004, p. 29).

The writers of Project PACT again put it plainly for parents:

> The key to many of these lessons is to talk to your child. Tell your child about what you are doing. Explain things as you do them. "Think out loud," so your child will know how you make choices. (*Project PACT: Parents and children together*, 1986, p. 125)

Furthermore, family math programs often stress the modeling and “thinking out loud” techniques as facilitators show parents how to initiate math activities in a flexible, non-directive way that is often different from the more rigid ideas they may have about how to do or teach math.

The second is that material written for parents, if any, be at a reading level suited to them. Many programs are aimed at families whose children are at risk of failing in school, or those in inner cities or of lower socio-economic status, and many parents in these categories also do not have highly developed literacy skills. Bertrand again:

> I had had limited success with encouraging parents to read to their children because of the difficult vocabulary in many children's books. However, the parents were able to explain the math activities and do them together" (Hagedorn, 2004, p.68).

At the Seminole Natural Math Program, they stressed the importance of materials for parents being readable (about the fifth grade level), with culturally relevant graphics (Sears & Medearis, p. 6).

Valuing the Strengths and Knowledge of Parents

Family math programs hold parents interest and attention as far as they value and respect the knowledge and experience that parents bring. As one mother said upon reflecting on her experience in a Math For Parents course:

> For me the relationship with the instructor was very important. It was a relationship based on equality, I don't feel that because one is a teacher he should feel superior to us; this was a very positive relationship in which the teacher used his knowledge in a positive way, always treating us all as equals, and I always felt very comfortable (Civil, 2002, p.2).

In an eight-session program in an inner city Chicago school, teachers who got high parental involvement were less judgmental about families, and noticed many different kinds of involvement, other than volunteering in school programs, which is often hard for low income parents to do:

> The attitudes and practices of the teachers, not only the educational status, socioeconomic or marital status of parents, are important variables in predicting parental success as partners in their children's education" (Landerholm *et al*, p. 5).

Carpentieri reports that in several British studies, it was the "skills, confidence and cultural awareness of recruiters" (Carpentieri, 2008, p. 11) that accounted for success in recruiting participants.

Recruiting Participants

I think the emphasis on fun may have something to do also with trying to recruit participants A parent who attended an Esso Family Math group said, "I could not think of fewer ways I'd like to spend my time, but Mia [her daughter] wanted me to come" (Onslow, 2002, p. 9). After the second night she commented on how much she was enjoying the experience. The Esso Family Math program consists of six sessions, but in order to attract more parents who think that the sessions will be boring or painful, even if good for them, parents are initially registered for only three sessions. At the end of the second night, it is announced that a further three sessions will be put on if the parents would like them.

In the British pilot program mentioned earlier, recruitment was an important issue. The report says that successful recruitment depends on the enthusiastic support of staff at site where it will be held; when they offered "sample sessions" of the program, and registered parents right there at the sample session, recruitment was easier. A caveat in the drive for

recruitment, however: they found it best not to mix more highly skilled parents with parents with lower skill levels in order to top up the numbers, because the less-skilled parents, who are really their target group, will not have their needs met (Family Numeracy Adds Up).

Homework

The issue of homework is a related subject, if not directly part of family math programs. It is a time when families do math together, or when they fail to do math together, and is the most usual way for parents to be connected to their children's math learning in the K-12 system. It offers the other side of the coin from the relationships parents have with math when they are involved in most family math programs. The work a child brings home from school is radically different from the activities parents bring home from a family math group; indeed it may be the same work that many parents remember with dread, or it may come in such a different format that parents barely recognize it as the math they learned in school.

There are many books of advice to parents about dealing with homework and solving the nightly hassle that it is in many homes. Most of the books I read fall in line with the advice given by the National (USA) Council of Teachers of Mathematics, (2009) that is, to encourage, to help by asking questions or giving brief explanations, but not to do the homework for the child. In *Ending the Homework Hassle* (Rosemond, 1990) lists seven values of homework besides the surface practice/extension of work done in class: responsibility, autonomy, perseverance, time management, initiative, self-reliance, resourcefulness, which all add up to self-esteem (p. 23). She suggests the parental role is to be "consultants" rather than over-involved. When the parents take on responsibility, the kids learn the opposites of that list of values. Leonhardt (2000) offers tips for various age groups, and provides practical advice from someone who says that encouraging reading and a love of learning new things is more important than worksheets. *The Homework Handbook* (Cholden & Friedman, 1998) suggests parents can appropriately get involved by showing interest in what the child is doing in school, teaching study skills, praising effort, and providing links between school work and family activities.

At odds with nearly every homework advice book I read is *The Secrets to Good Grades* (Keogh, 1999). Chapters outline rules, shortcuts and memory tricks to help your kid in each subject in each grade. He suggests parents get a copy of the proficiencies that are supposed to be taught in each grade, ask the teacher several times a year to check off the proficiencies that their child has learned, and keep on the teacher about the missing ones as the year closes.

Fuelled by discussion of Alfie Kohn's book *The Homework Myth* (2006), the Toronto District School Board debated the wisdom of abolishing homework altogether, but on April 16, 2008, it reaffirmed its commitment to its homework policy, which outlines homework that is mainly reading with parents for primary and junior grades, progressing to other assignments that should take less than 1 hour in grades 7 and 8, and less than 2 hours in grades 9 – 12 (Toronto District School Board, 2008).

Methodology

When the facilitator of a family math group adopts an exploratory and holistic approach to math, what changes occur in parents' attitudes to math and to helping their children with math learning? What are the effects of an egalitarian facilitation style on parents' attitudes to participation in family math activities?

I proposed to explore the questions by first preparing a draft manual for parents or people acting *in loco parentis,* which would include activities for parents to do with their children, from infants to age 14, and then inviting parents to come to a series of group sessions where they would explore the materials in the group. I would ask participants to try them out with their children, then come back and report on their experience so the activities could be modified, adopted or deleted from the draft manual. I thought that asking them to evaluate and test the manual would reduce the power differential between us by focusing attention on the relative merits of the materials themselves rather than on the individual participant's level of math skill, and that participants' input would produce a stronger, more useful manual. I planned to do preliminary interviews and a pre-test of math skills before the group sessions started, and to do a final interview and a post test after the groups had finished. I planned to meet with each group twice a week for 11 weeks.

Although my question did not ask specifically about Aboriginal parents, I planned from the beginning to include many Aboriginal parents in the study, in groups that were both mixed race and all Aboriginal, so that the materials developed in the group would be inclusive of and attractive to Aboriginal users.

Ethical Considerations

Ethics Committee

I put my proposal to the VIU Committee for Research Involving Human Subjects in May, 2007. The committee had a few questions in response to my initial proposal, mainly concerned with emotional issues that might be raised by participation. To answer these concerns, I arranged to have a counselor available to participants, either from the Student Services Department at VIU or from the agencies where groups were scheduled to be held.

Consent to Participate

All participants signed a consent form (Appendix A), whose salient feature is the plain language it is written in. Since I was planning to recruit participants who might well have difficulty with reading and writing as well as math, it was important the consent form be easy to read. I read over the form with each participant in a private interview, and gave a copy to each one.

Confidentiality

I assured participants that I would not use their names in the body of the report, and further, that comments they made, and test results, would not be identifiable as theirs. I asked if they would like to have their names listed in the acknowledgments section of the manual, and participants gave me the wording of the name they wanted to appear, if any.

Several chose to remain anonymous, and the rest chose to use their first names only, or initials only, or pseudonyms, or their full real names.

I did not set up confidentiality agreements within the groups, but rather reminded people that it is impossible to guarantee confidentiality if they decided to reveal any personal information or stories about previous math experiences. I find this approach to be more ethical than asking everyone to agree to a confidentiality agreement, since if people trust me, they will often carry that trust over to the confidentiality agreement, when in fact their trust in me is not a good indication of the ability or willingness of other group members to keep confidences.

Recruiting Participants

I was looking for adults to participate in the project who were:

- parents, or who in some other capacity interacted with a child as a caregiver (parents, grandparents, aunts and uncles, and an adult older brother participated);
- available to come to group sessions twice a week for 11 weeks during the fall of 2008;
- willing to come in for an individual interview and math test at the beginning of the project and again at the end.

There was no requirement for a specific level of math skills, nor was there any restriction on student status. Some participants were taking courses at VIU, others were not.

I recruited in two ways: directly to parents and indirectly to social workers, teachers, and other professionals who I hoped would refer their clients to me. Recruiting began in June, 2007, intensified in September for groups starting in September, and continued into January 2008, as table 1, page 15, shows. It was harder than I expected to recruit participants, and I found it necessary to double my efforts, even after the first two groups started to meet, to continue to attempt to form new groups.

Reducing Resistance to Participation

I was worried that it might be hard to recruit participants to come and do math, given that I was looking especially for people who did not have high levels of education, who might well resist doing anything they perceive as academic, especially math. I took several steps to reduce this resistance:

First, I put my picture on the poster because I am well known in the community, and well liked by nearly all of my students and ex-students. Over my 20 years at Cowichan campus I have seen many adult students who might remember my face but not my name.

Second, when I talked to groups of potential participants, I did some activity that involved the kinds of things we would be doing at the group—active, fun, "not real math," as non-threatening as possible, and with no right answers.

Third, I offered an honorarium to be paid at the initial interview and test and at the final interview and test; there was no honorarium for attending group sessions. When I talked about the research project, I made it clear that people could drop out at any time, with no penalty. Usually when I said that people could drop out at any time without penalty, someone would poke his neighbour in the ribs and mutter something about it being an easy way to make some money—write the test, get paid and never come back. I always took the opportunity to repeat that I was okay with that—come for the preliminary interview and test,

Date	Message	Direct Recruiting to Parents	Recruiting through Agencies
June 2007	Math groups for parents would be starting in the fall, so look out for them, with contact information but no dates or places.	Posters placed at Cowichan campus, at the public library, at the Cowichan Tribes programs and Ya Thuy Thut and the Reading and Writing Centre.	Background info on the project and the people I was interested in recruiting, along with the posters, sent out to network of the early literacy committee.
Early September 2007	Math groups starting, with places and times and contact information.	An article in the local newspaper Posters at the same places as above. Visits to groups of potential participants at ABE and NITEP classes at Cowichan Campus and at the Reading and Writing Centre; at Margaret Moss Health Centre, at Hiiye'yu Lelum, at Alexander Family Resource Centre, and at the alternative high school; at each visit I did a short activity with the group and talked about the project.	Updates and posters sent out via e-mail as above. Meetings with staff at community agencies either individually or in groups.
October – December 2007		Facilitated an hour and a half "sample session" at Growing Together Child and Parent Society to give potential participants a taste of the group that was slated to start in January. Facilitated similar sessions at "Mothers' Morning Out" and at AFRIC	Continued contact with child care society and AFRIC to try to set up a group at each place.
January 2008		Posters, site visits and phone calls to potential participants at Growing Together Child and Parent Society.	

Table 1 Recruiting Participants

and drop out without question or penalty whenever it suited you. I was betting that I could use the initial contact to let people see how informal and un-math-like I could be.

Recruiting Difficulties

Several agencies in the community offered me free space for the group sessions, and others helped me recruit participants. With all this community support and enthusiasm, I was surprised at how difficult it was to recruit participants. Instead of the 60 I had hoped for (in 6 different groups), I ended up with only 29 participants in 3 groups. Even though I was discouraged about not being able to recruit as many parents of the kind I was looking for (mainly First Nations, mainly people who had not done well at school math) I resisted the temptation to start recruiting others who didn't meet my criteria. I thought of putting an ad in the paper, for example, or sending an invitation to the network of home-schooling parents in the area, or recruiting the friends and families of colleagues at the Cowichan campus, but decided against all these. While I thought such strategies might have produced more participants, I expected they would be people who were accustomed to respond to ads and stories in the newspaper—people with higher levels of education who were used to signing up for courses advertised in that way. I knew that the more I was successful at recruiting white participants, and those of all races with higher levels of education, the more difficult I would make it for the parents I was most interested in to thrive and take part in the group sessions.

As I began to interview the people who were willing to come in to see me, I began to get a sense that most of them loved math in their school years, even those who described the activities they had loved in such a way that I could see they had been working at a very early elementary level, no matter what their age or grade at school leaving. (For example, someone said they loved "pluses and minuses.") What was the secret of my failure to attract parents who hated and feared math? At the final interview, many participants expressed surprise at how much fun the activities were, having expected the kind of activities they were familiar with in school. One said, "I expected it to be a lot of work—more work than fun," and another commented, "I expected more the math sheets and math book. It turned out to be fun." The fact that participants were expecting traditional school math activities, in spite of my posters, talk and demonstrations during the recruitment phase, may explain why so few people who hate/fear math were willing to sign up for the project. People who don't like math may simply be unable to believe that spending time on math activities could be enjoyable in any way. When I posed this question to the group of participants who met at the Reading and Writing Centre, one of them confirmed my suspicions by saying, "Most people don't realize it will just be fun activities, not more worksheets or being pressured into doing something you don't want to do." Other group members agreed.

I had been feeling frustrated myself at my inability to recruit more participants. As I sensed that I was mainly getting people with a positive attitude to math, in spite of my friendly outreach, my demonstrations of the types of activities I planned for the math group, the offered honorarium and the support from other professionals who had contact with potential participants, I wondered what more I could do to attract people who don't like math to a math group!

Participants' Attempts at Recruitment

As people signed up for the groups in the couple of weeks before they started, and during the first couple of weeks they were in session, some participants began to try to recruit their friends and family members to join in. The new recruits came to see me more or less willingly, depending on the persuasive powers of the participant bringing them in. The following examples gave me some insight into the difficulty I was having.

One participant brought in her adult son and his partner, because "They were sitting around at home doing nothing," and she thought it would be good for them. I went over the consent form with them, invited them to stay for the session, and arranged to do the interview and test afterwards. As it happened, both had been competent in math in their previous schooling, and one had always liked it. Even though they joined the group late, they continued to participate until the end.

Another participant brought two young men in, her nephew and his friend. She thought it would be good for them, and told me they wanted to come. The three arrived about ten minutes before the group was scheduled to start. I spent about five minutes with the two young men, explained the consent form, invited them to stay for the session and remain afterwards to do the preliminary interview and test and get their honoraria. They both agreed to do so. I remarked that there was about five minutes left before the session would begin, and they had time to help themselves to coffee or go out for a smoke if they wanted. They said they would go out for a smoke, and vanished, never to come back. My impression at the time was that they were more interested in the honorarium than the group, but even the thought of money was not enough to get them to sit in a two-hour session, take the test and talk about math.

A third participant brought her friend along to be interviewed and tested, which I did. The friend had a history of failure and frustration in school math, hated it still, and came to only one group session.

At the end of a session, about a week after her group started, one of the participants lamented to me that the group was so small. She said she was really enjoying the group activities, and had been talking it up amongst her friends, but that no one she knew wanted to join; as soon as they heard about the test, they said, "No way!" I knew that she had a good job and family income, and assumed that her friends were in the same situation. Thinking that they would not be tempted by the honorarium I was offering, I asked her if she thought her friends would come to write the test and do the interview for $100. She replied that she didn't think they would come for any amount of money.

I tried for several months to recruit participants at the Growing Together Child and Parent Society, which operates a child care centre next door to the alternate high school. It was difficult to recruit participants at this site, although the director of the Centre was enthusiastic and very interested in making the group available for the parents she worked with, many of whom attend the alternate high school. In September I spoke for about 10 minutes at an assembly at the school, but no one there was interested in participating, nor did posters and encouragement from the director have any results. In November, long after the other groups started, I did a "sample" group session at the day care for any parents who wanted to come; this was not part of the research, and no one was interviewed or tested; they were simply invited to come and have some fun learning math activities they could do with their kids.

The director of the Centre worked hard to get people to come out, and we were pleased that eight parents showed up, including a couple of fathers. At the end of the session, in which we made sidewalk chalk, I talked about the research project, and everyone said they would be interested in participating in a group we planned to start in January, and gave me permission to phone them to let them know the details.

I phoned them during the week between Christmas and New Years, and again in January in the week before the first session was to start, to remind them that we were starting, and asking them to come in for initial interviews. Most said they were still interested and would be there. None of them came in. Three other people came in for initial interviews and tests, and signed up for a group on site, but none of them came to any group sessions, and the group was cancelled. All of these three were taking math classes at the alternate high school.

The director of the Child Care Centre surmised that the idea of taking a math test would prevent people from coming. She was working hard to recruit participants, because she thought the groups would be a good resource for the young parents who are her clients, and she would have been happy to have no tests and interviews. I also thought that it would be easier to recruit participants without the preliminary interview, and especially without the test; however, since those things were part of my research project, I had to be open about them in advance, and not spring it on people after they had agreed to participate.

I wonder also if it was harder to recruit parents attending the alternate school than attending an ABE program because the former are still so involved in school math themselves. The participants who attended an ABE program were generally older than those who signed up at the day care centre, and had been away from school for years. Perhaps that was time enough to have forgotten the specific details of their math difficulties and be willing to try it again. Perhaps during the intervening years they had developed a self image that was not mainly concerned about their achievement in school subjects, and so could come to the family math groups with a more relaxed attitude to math.

Shifting the Focus in Audience

As I was forced to the conclusion that it was nearly impossible to recruit participants who did not like math, I began to see that it was pointless to write a manual for such parents. I shifted the focus for the manual to professionals who work with children and parents, and wrote two new sections to the introduction. One new section was geared toward facilitators of programs such as family literacy, Strong Start and other family service programs, day care workers, nursery school, kindergarten and primary teachers; the other was aimed at ABE/literacy math instructors. Even with this shift in audience, however, I continued to write for parents who would read the material on their own (mainly those who like math), and for parents who would read the material as it was presented to them in the context of one of the groups named above. To this end, most of the introduction and all of the directions for activities are written in plain English.

The Participants

In the end, 29 people signed up to take part in the project, from 18 to 50 years old. Their skills in math ranged from being unable to do an addition problem involving carrying to having passed advanced university math classes; the majority were at the lower end of the range. They were mainly parents or grandparents, with a few who said they would try the activities with a niece or nephew or younger sibling.

Participants' Previous Math Experience

An analysis of participants' early experiences with math shows that my impression of their love of math was correct. Table 2, page 20, shows that 25 of the 29 participants (Types A, B, C, and D) reported positive memories of school math, either in the K-12 system or in adult programs. Of the remaining four participants, two (Type E) had been successful at finding solutions to their difficulties with math, and had passed high school and college math classes, although they continued to find it challenging and frustrating. The end results were satisfying, even if the road to success was rocky. Very few people who disliked math signed up for the family math groups; in fact, *only 2 of 29 participants (Type F) reported an early dislike of math with no success at math at school or in an adult upgrading program.*

I was most interested in recruiting parents who had not been successful in school math, however much they may have liked or disliked it. Such parents indeed were the most numerous, 18 in total, and fell into three types, A, B and F. These three types had the lowest average score on the pre-test. I was also interested in working with parents who may have been successful at math, but who didn't like it much, Type E. The seven participants who were Type C or type D, who had good early experience with math, and who had done well academically, provided a nice balance to the groups and interesting dynamics as we went along.

Family Math Groups

Participants signed up for group family math sessions at one of three places, the Reading and Writing Centre, the main Cowichan Campus or the Growing Together Child and Parent Society.

The Reading and Writing Centre

Participants at this group were students at the Reading and Writing Centre, the basic literacy program of the Cowichan campus, which is located in a storefront in downtown Duncan. Math skills were generally low; people who are placed at this level may have difficulty with counting and reading numbers and basic whole number operations; certainly when they start at the Centre they are usually unable to understand and solve problems involving fractions, decimals and percents. Most also have difficulty with reading, and would be at levels 1 and 2 of the International Adult Literacy Survey (IALS) measures.

Type	Previous Math Experience	n	Pre-test Scores Range/Average	Comments
A	Participants who liked math but didn't succeed in passing courses in K-12 system	10	12% to 100% Average 66 %	All of these participants were, at the time of the study, enrolled in an upgrading program. Although they talked about memories of working well below grade level in the K-12 system, they enjoyed it. They said such things as "Numbers excited me," "I loved it," (got to grade 5) and "I had fun," (getting the hang of times tables in high school). A couple spoke of a good relationship with a father who helped with math homework.
B	Participants who had trouble with math in K–12, but have had a more positive experience in an upgrading program.	8	31% to 92% Average 66%	Participants in this group were in three different upgrading programs, with at least four different math teachers; they variously spoke of feeling secure or safe with their current teachers, able to ask the teacher questions or get help from classmates. Of their early school experience, they commented on not getting enough help from some teachers, being scared to ask for help, and moving often from school to school.
C	Participants who had early success/love of math, but trouble in High School	4	92% to 100% Average 96%	All of these participants solved their problems with high school math (tutors, taking an extra class) and went on to succeed at university or college math. Perhaps their early experience gave them a solid foundation, and a sense of themselves as able to do math, so that they could imagine themselves successful in high school and so were motivated to figure out a solution to their problem. One attributed her difficulty in high school to changing provinces, another to being placed at too high a level in a competitive atmosphere.
D	Participants who always liked math and did well	3	65% to 100% Average 87%	Two of this group of three finished grade 11 or 12 math. The other didn't finish high school but has done lots of construction and building work. They commented, "My teachers helped me understand it." "I always found it interesting and enjoyed it. I got pretty good marks." "My mind works well with numbers. I've always had that." They were confident and matter-of-fact about their math skills.
E	Participants who didn't like math but passed courses in K-12	2	81% to 93% Average 87%	One participant went to grade 11, with above average marks, but said, "I got the math done, with help, but yuck!" The other passed the requisite statistics course at university, but always found math frustrating, and needed to find extra help, such as a peer tutor. "It's frustrating to the point that I avoid it. I have a mental block." Both continued to attend the group until the sessions were over. I wonder if the past experience of finding a way to succeed in spite of the frustration helped them to stick to it in this project, unlike the participants in Group F.
F	Participants who hated/feared/were frustrated with math as children, did not pass courses, and still feel the same way about math	2	69% (only one of these participants wrote the pre-test)	In school they memorized but did not understand; one still feels scared of failing in his upgrading class; the other is motivated to participate in order to help her children. One dropped out of the project after attending only one session; the other signed up for a group but did not attend any sessions.
		29		

Table 2. Participants' Previous Math Experience

Cowichan Campus

The group at the main campus in Duncan included a wider range of math abilities, and a much higher level of education. Five had some university level math; a couple of people were doing ABE math at the grade 10-12 level; one who didn't have much formal education was used to using math in daily life and working in the trades, and one who had minimal math skills.

Growing Together Child and Parent Society

Participants here were mothers of pre-school children, who were taking classes at the alternate school located next door to the Centre, and whose children attended the day care centre.

Attendance

Attendance was sporadic, but attendance seemed to make no difference to any changes in attitude, marks on the post test, or positive evaluation of the group sessions.

The group who signed up at the Reading and Writing Centre was the largest, at 15. Two of these participants never attended a single group session; six signed up at the beginning of September, but for various reasons they did not start attending until after the group had already been meeting for four to six weeks; three dropped out in the first month, after attending fewer than 4 sessions, and two more dropped out near the end of the set of sessions. One person attended nearly every session from the beginning to the end, an exception to the rule. The pattern of drop-outs and late entries meant that for the last eight sessions, there was a core group of seven engaged participants, with an average attendance of about five at each session. This pattern of late entry and drop-out reflected the attendance pattern of the program at the Reading and Writing centre. For the majority of these students, the instructors at the Centre were aware of the circumstances that caused the poor attendance, and they worked to help students solve these problems (finding day care, for example), or encouraged them to make a late entry when circumstances allowed. Attendance at the parents' sessions was closely associated with attendance at the Centre. While it would have been easy to continue at the Centre program, but drop out of the parents' group (no one did), it would have been difficult for someone who had dropped out of the Centre program to continue to show up there for the parents' group.

Ten people initially signed up for the group at the Cowichan Campus and did the pre-test and initial interview. Of these, there was one no-show, and two attended only one session. On the third week, I changed this group from Monday and Wednesday to Tuesday and Thursday for administrative reasons, and this change made it difficult or impossible for some participants to attend. Others could not attend every session because of changing work schedules, no matter what days it was held. For all these reasons, this group was much smaller than the one at the Centre. We ended up with a core group of five participants, but a usual attendance of three or four, and occasionally only one or two people, at each session.

Three people did the preliminary test and interview and signed up for the group at Growing Together Child and Parent Society, but no one attended a single session, and I cancelled the group after two sessions to which no one came.

Causes of sporadic attendance

I wanted to know what caused the low attendance rate, and especially I wanted to know if the activities themselves were to blame, or if my facilitation of the groups was putting people off. However, since I had told people when they signed up that they were free to drop out at any time, no questions asked, I couldn't probe their reasons, or pester them with phone calls or e-mails. Changing the meeting day gave me a legitimate reason to phone or e-mail everyone in the group that met on campus, however, and they gave no indication of dissatisfaction with the group or the process. During my life as a teacher I had phoned many a student with sporadic attendance, and these phone calls had similar results: they cheerfully assured me that they had every intention of coming, but something in their life was preventing them coming at the moment.

At the end of the sessions, the project evaluator phoned the contact numbers we had for all 29 participants, and, when she made contact, asked specifically about reasons for not attending, and about their opinions of me as a group facilitator. Those who attended only once or a few times gave the following reasons: daycare challenges, family responsibilities, schedule changed, and a busy life (Evaluator's Report, Jan 2008). No one suggested that the content of the group, or my facilitation, had any bearing on their lack of attendance. "Participants surveyed had very positive feedback for Kate's performance as the instructor… (They) commented that she was patient, a good listener, an experienced instructor, astute and respectful" (Evaluator's Report, Jan 2008).

Moreover, attendance or lack of it had no relationship with participants' evaluation of the usefulness of the group, which was positive for everyone who came to the final interview and test.

Facilitation Issues

I planned to use my usual egalitarian approach to facilitation with the groups. By this I mean that I acknowledged differences in power between me and the participants, and attempted to reduce such differences by acknowledging the strengths participants brought to the project we were working on and recognizing the importance of their knowledge of their children, and the vital importance to the project of their review and assessment of the activities under review.

I tried to establish a sense of comfort and safety by building on parents' strengths and experience rather than their deficits. I was very concerned to set a tone in the sessions that recognized the strengths parents have in knowing what would work with their kids. I set it up as a partnership--I would bring my knowledge of math and my experience of teaching experientially, and they would show me how to adapt what I had developed to make it more suitable, and they would give me directions for new games and activities that families could use.

I took an exploratory and holistic approach to math, which means that I encouraged participants to do the activities to see what might happen, rather than being focused on coming to a pre-determined conclusion. A holistic approach meant that the

activities engaged the participants' minds, bodies, hearts and souls. I developed the activities for the groups based on my reading and my experience teaching math to ABE/literacy students, which I write about in *Changing the Way We Teach Math* (Nonesuch, 2006).

I chose and developed activities that would not look like the kinds of school math that parents might remember, hoping to avoid emotional carry-overs from past memories. I wanted to give the parents a chance to start fresh, with confidence that they could work with their kids on these activities, even though they might have given up on helping their kids with homework or worksheets. My experience in ABE made me aware that life often gets in the way of parents attending regularly, so I developed activities that could be completed in one session, and not carry over to the next.

I emphasized the importance of play, that there were many ways to do the activities, that there was no "right" answer, that the experience of trying things out and the satisfaction of making something or doing something that had consequences in the real world was the purpose of the activities, and that a good measure of success was to ask how much fun they had.

I wanted my attitude to contribute to the sense of comfort and safety in the group, to the openness about math learning, and I also wanted to model interactions that I hoped the parents would use with their children. I love math. But more than that, I am fascinated by how people approach things, about the various ways their experience brings them to think about math-related problems. I let my fascination show during the group sessions.

The Draft Manual

I prepared a draft manual, which I called "Parents Teach Math," before I started to recruit participants and form groups. First I approached Harold Joe, Sr., an elder, artist and carver of the Cowichan Tribes, to ask if he would take on the job of doing the cover art for the manual. I described the project to him, and asked him what he thought might be appropriate for the cover. He thought for a while, and then said that the beaver would be good to represent the project. The art and some of Harold's explanation appeared in the preface to the draft manual, and remain in the revised manual:

[Harold] chose the beaver because the beaver is a hard worker that never stops caring for the lodge and the family. When the pups are young, the parents start to teach them. The pups learn to be beavers—a way of living and working. Beavers take good care of their cubs, and are good teachers. The beaver stands for family togetherness.

The beaver uses determina-

> determination and creativity to build houses and dams. It can do things that we would use math to figure out, such as: How many trees will it take to build the dam? How thick will the walls need to be to stand up to the water pressure? How can we build a roof that doesn't cave in?
>
> The old people learned how to build houses by looking at beaver lodges. Harold says, "We learn from every animal. We honour every animal" (Nonesuch, 2008, preface).

The draft manual, which came in a three-ring binder, had about 30 pages of material. A short introduction encouraged parents to value play and family activities, such as doing the laundry, as opportunities for fostering math thinking in their children; it also encouraged them to think they could help kids with math even if their own math skills were limited; finally, it presented a set of general strategies to foster in their children. In this introduction I tried to set the tone for the group sessions themselves, that is a sense of openness and playfulness, a sense that math was more and different than the school math they remembered, encouragement to invite their children to fun activities that would develop math thinking without necessarily being labeled "math." The introduction was followed by activities, projects, rhymes, and card and dice games. The final manual is more than 100 pages long, and includes many more examples of the same kind of activities, as well as a section on school math.

The Kit

The kit that went with the draft manual was a large pencil case that hooked into the three rings of the binder. Inside were two decks of cards, five dice, a glue stick, a pair of adult-sized scissors, and a pencil. A pad of score sheets for a dice game was tucked in the pocket of the binder. As time went on, the need for other items, a measuring tape and a set of measuring cups and spoons, became apparent.

The draft manual and the kit were given to each participant at the first group session.

Sources of Data

Preliminary and Final Interviews

I invited each participant to a private interview before the group started and after it was over. At the initial interview I went over the consent form, explained the project and asked if the participant had a child/children with whom they could try out the activities. I attempted to get a brief history of their K-12 math experience, and asked how they felt about math at this time in their lives, where they use math in their daily life, and whether they did math with their kids. Then, for each child in their care, I asked about the child's math skills and how the child felt about math, and, if the child was of school age, about grades and about what the parent and teacher talked about in relation to the child's math.

During the final interview, I asked about what they liked and didn't like about participating in the group, what they learned about math, and how they feel about math now. I asked the same question about where they used math in their daily life, and

whether they did math with their kids. Finally, I asked what activities from the group they had tried at home, and with what results. For each child, I asked exactly the same questions as in the preliminary interviews.

The forms I used to ask questions and take notes during the preliminary and final interviews are in Appendix B.

Math Test

I gave each participant a pre- and a post test to gauge their level of skills at the beginning of the research and at the end, because I wanted an indication of what math skills they had in order to plan activities for the groups, and I wanted to be able to detect small changes in skill levels if they occurred. I considered standardized tests for this purpose, but decided to prepare my own tests. The reasons in favour of standardized tests are obvious—they are standardized to national norms; two different forms of the same test will produce results that can be compared with confidence; a wide range of math skills can be tested on the same form; they are easy to mark. Against them are the facts that they are more intimidating than teacher-made tests; the features that make them easy to mark make them harder for students to use; further, I thought that the range of math skills covered by such tests would be wider than most of my participants had, and would leave them with a sense of failure if they were unable to attempt many or most of the questions on the test. Since I did not expect people to jump grade levels after only 33 hours of group participation, I decided that a teacher-made test, similar to the ones often used before and after a unit of instruction, would be more useful to my purposes.

To that end, I developed a pre-test that had 26 questions, including addition, subtraction, simple division, some of which included decimal numbers, a few questions each to test understanding of fractions and per cents, and finally three word problems that gave a situation and a question, and asked what operation would be used to get the answer. The post test was exactly the same as the pre-test in length, format and type of question, but the numbers were different. The full form of each test is in Appendix C.

Group Discussions

In each group session there were opportunities for parents to report on what they had done with their kids during the preceding week. Once during the project, about mid-way through, I spent an entire session on a group interview/feedback session, with a secretary present to take notes on what participants said.

Project Evaluator's Report

The evaluator attempted to contact every participant, whether they had attended sessions regularly or not, and interviewed them by phone, asking them about their participation in the group, reasons for not participating, their evaluation of the activities and the facilitation of the group.

Data Analysis

One Parent's Story

Generally participants reported only positive outcomes of attending the group, whether they attended for most sessions or very few. The most extreme example of this, however, was reported by a participant who attended only one session of her group. She met with me for the preliminary interview and test the week before the groups started, and came to the introductory session, which was attended by only 4 people. I did a round asking participants to introduce themselves, and I introduced myself and the project, emphasizing that I was asking for their help in trying out the math activities. I gave a brief talk about how parents can help children learn math, from the introductory section of the manual, handed out the manual and the kit, showed them how to play Yahtzee and gave them 15 minutes to play in pairs while I went around to give individual help and make sure everyone understood how to play and keep score.

That participant didn't come to any more sessions, although we had some e-mail contact. She continued to say she was interested in the group, but other commitments got in the way. In December, when I called and e-mailed all participants to invite them to the final interview and test, she agreed to come in. Although I did not expect her to have got much benefit from the group, I was happy to interview her, and totally unprepared for what she had to say.

Fortunately, I didn't allow my assumptions to change my interview format, and simply asked my first question, "Has coming to this group made any changes in your life?" She answered with a decisive yes. She said that she and her husband got along better, as did the kids. There was better communication amongst family members. She sees her daughters helping each other with school math by using a ruler or calendar, explaining, not just giving the answer.

When I asked what had made the change, she said, "Yahtzee." She reported that she went home after the group session and showed her family the new game. They began to play it every evening, which meant more family time, and less TV. Although her tendency was to "rescue" her kids by telling them the answers, she and her husband agreed that they would not jump in to help, rather they would let the kids try to get the answers themselves, by counting the spots on the dice. She reported that when the family was playing together, she often wanted to leap in with an answer, but she and her husband would exchange glances, and she would hold herself back. Whenever the kids asked for help, the parents helped them.

She noticed that the positive side of this family play time was "learning how to laugh together," "developing teamwork," and the pleasure of "watching the kids learn to help each other." She said that waiting for the kids to ask for help "develops their self esteem and helps them ask questions at school." As well, she said that waiting for them to get the answers themselves helped her learn the signs of frustration—making faces or rubbing their heads, and she noted that she showed the same signs when she was frustrated.

She said that playing Yahtzee with her family also affected her as an ABE math student. “Encouraging the kids to ask for help gave me the courage to ask [her own math teacher] for help.”

She concluded by saying that before she introduced Yahtzee to her family, things had not been going well, especially between her and her husband. However, she reported that recently he had sat her down and said, “I want to thank you for bringing it (Yahtzee) to us. It brought us together.”

It was lucky for me that she was so articulate a participant, and had clearly done a lot of reflecting on her family dynamics. Her story clearly shows that playing math games led her family down a path that led to more communication, better relationships over what had previously been difficult issues, and that the benefits extended to the children’s school and the parent’s school as well.

Changes in Attitudes to Math

Feedback came informally at group sessions, at a more organized group feedback session with a recorder, and at the final interviews. In this section, data from all three sources is incorporated. Parents did some in-depth reflection on the effect of the group and of using the activities at home with their kids, and some surprisingly varied effects were noted: they all had more fun than they ever expected; they found themselves more interested in math and less frustrated with it; they learned some specific strategies to help their kids with math (especially school age kids); they found a new way to communicate and work with their kids which resulted in changes in the kids and a more positive adult/child relationship. One commented on a more global level, “It’s a lesson learned, to take an interest in new things.”

Fun and more fun

Overwhelmingly, they liked taking part in the project. Especially they liked and were often surprised by how much fun it was to participate in the group sessions and by how much fun they had doing the activities with their kids. They found it much more fun than they expected, in spite of the fact that all of them had reported at the initial interview that they liked math. (The only two participants who didn’t like math dropped out of the project early on, and did not come in for the final interview.) Nearly everyone mentioned the word “fun” and in particular they had fun with card and dice games, and making things—chalk, cookies, play dough and boxes. Practical evidence of fun and engagement was displayed when participants went out of their way, or spent their own money, to continue or expand the activity. After we played Rummoli in the group a couple of times, one tried to buy a Rummoli set, and another got one from a sister who had a set, but didn’t know how to play it. Two asked for copies of the cookie recipes and for more score sheets for Yahtzee. Another reported buying more stickers to finish more calendars to give for Christmas gifts. In short, their change in attitude is summed up by one participant’s comment: “I saw it could be fun and not all hard work.”

The title of the draft manual was the same as the title of the project, “Parents Teach Math.” The group at the Reading and Writing Centre came up with several suggestions for a new title, including the one that we used on the revised version, *Family Math Fun!* The words “fun” or “play” appeared in four of the five titles they suggested.

Increased interest in and less frustration with math

Many participants reported an increased interest in math. One said, "I feel different from when I was going to middle school. I find myself getting into it, really." Many participants said they had discovered that math could be learned in many ways; moreover, they found out that math was everywhere in life, not just in school. "You could be doing math without knowing it was math."

Some participants reported that their knowledge and skill levels had improved. "I can do more math now," one said. I noticed, as the weeks went on, that participants showed an increased willingness to stay in a position of not knowing as they looked for a pattern or compared several people's thinking processes as they were doing an activity. They could suspend their frustration while they wondered what might be happening. One example of this was the electric atmosphere in one session while a parent explained how she could quickly figure out the sum of a series of doubles, after all the others had been painstakingly adding number after number as they doubled a penny ten times. The parent made several attempts to show her method; her first couple of explanations were not easy to understand because she was working out for the first time how to articulate her thinking; then she had to explain it a few more times in answer to particular questions from the group. The uncertainty was compounded by the fact that I wasn't sure that her method would work, so I took a minute or so to check it mentally. All in all, about five minutes of uncertainty, yet no one in the room gave up, or asked for a quick answer to get them out of uncertainty, which I notice are two common responses to frustration.

Helping Their Kids with Math

Parents reported that participation in the family math groups helped them work with their kids on math ideas. Besides the specific strategies they learned, they reported calmer interactions with kids and better communication.

Specific strategies

Participants reported that they learned some specific ways to work with their kids with math. This was especially true of parents who had kids in school, who found some ways to help their kids with homework. One parent reported that she would now use ordinary examples to explain more abstract math problems her kid brought home; another said she learned to be more specific with directions, and gave the following example: "Flip it over halfway, not all the way." Another reported, "I can tell my kids what they need math for, like culinary arts or carpentry."

Others reported they had learned to make math fun for their kids. One said, "My intention is to use the blocks and the games, making it fun and imaginative play." Another said, "I'm buying tens blocks for my kids for Christmas; I would never have thought to buy math toys for them before."

Better communication and a more positive adult/child relationship

Some parents reported that relationships with their kids improved because the parent had learned how to communicate better. One mother talked about the impasse she had previously come to in dealing with kids' homework. The process had become so frustrating that she would refuse to continue to work with her child. "Before I used to say, 'Just leave it (homework) then. If you fail, you fail.' Now I can

help.... Now I can show my son without getting frustrated and getting him frustrated."

One mother showed insight into the causes of her frustration with helping her kids when she said, "I see that the kids have the same trouble as I do."

Many said that the improved communication stemmed from an increased ability to remain calm and not get frustrated or angry. "(My son) went from D in math to C+ because I'm able to be more calm. He is an FAS kid." "I don't lose my temper with the kids since I started the group." This improved communication sometimes generalized into a more positive relationship: "We get along more. We can communicate better," and "I spend more quality time with my kids."

Although most of the reports of improved parent/child relationships came from parents with children in school, one mother told an interesting story about how she used math to help socialize her two-year-old son, who loved the math activities she did with him. He did not have much language ability and was having problems relating to other kids, and often got into fights with them. She reported, for example, that sharing was a concept he found hard to understand or do, and telling him he had to share often resulted in tears or fights. When she focused on the math component of sharing ("One for you, one for me, one for you...") he got focused on the counting and it drew his attention away from the fact that he was giving up something. His mother said, "He has a chance to talk about social relationships in math terms, and he [understands] it, so there is less need for hands-on intervention and discipline."

Messages for parents

When I asked each group to brainstorm a list of important messages that the revised manual should get across to parents, I was happy to see how closely it resembled the list of underlying principles I had started with when I began to plan for the manual and the sessions. They said:

- Kids learn math naturally. As they learn and develop they pick up more concepts.
- Try not to push math, let them learn by experiences.
- Open your eyes to the fact that we are always teaching through our everyday activities.
- Many ideas in the manual can be incorporated into daily activities.
- Try not to get frustrated, especially when you have to repeat things.
- Don't push your kids when they are upset, confused, or frustrated; leave it until a better time, when they are ready.
- Get out of your own "bubble." Instead of "This is what we should do," follow the lead of your kids.
- Sometimes we make things too complicated. Kids see things in much simpler terms.
- We all have that little kid in us that likes to have fun.
- Kids are more receptive if math is fun, not just "teaching."

Although I did not directly question them about ideas for teaching math in the preliminary interview, I still conclude that the ideas above were new to them, and arose

out of their experience in the group. I base this conclusion on the fact that so many of them expressed surprise that math could be fun, or that activities that seem to have no math in them in fact can be used to develop math thinking. When I did the group feedback session at the Reading and Writing Centre in November, after we had been meeting for seven weeks, a participant said she was having fun with the activities, but she didn't see how they were about math. I asked the group to make a list of all the activities we had done so far—Yahtzee, Rummoli, play dough, measuring, making chalk, human numbers, doubling money, art with shapes, and telling time. We agreed they had all been fun, and then went over the list again to say where and what the math was in each activity. Participants were able to do see the math when the task was set in front of them, but had not been focusing on that aspect of the activities.

Parents' Evaluation of the Group

When the project evaluator asked participants to rate the value of the group sessions, they overwhelmingly gave it a five on a five-point scale. Every one of the 18 participants who came for a final test/interview showed enthusiasm ("Great" "I liked it a lot,") or said it was interesting or fun, or all three. They liked the chance to learn informally and experientially, to express their opinions and to meet other parents. One person attributed these characteristics of the group to the facilitation style when she said, "The instructor was gentle, open, and got parents interacting with each other" (Evaluator's report).

They generally characterized the facilitation style as "informal" and liked it because it included everyone, even the kids who sometimes came to one of the groups. One said that the informal atmosphere, with the emphasis on activities rather than on mental processes, meant that "the Instructor was able to slow things down and make space for me to understand."

Experiential learning

Making things was another activity that parents enjoyed for its own sake. At different sessions we made sidewalk chalk, and play dough. The parents knew about both those things, had bought them for their children, but had never thought about making them They enjoyed finding out for themselves how easy it was to make them, and the fact that it was cheaper to make yourself was a bonus. The group at the Reading and Writing Centre made the play dough, because they had a stove available, and I took in two different recipes. Half the group used one recipe, half the other, and everybody tried out some of both kinds, and a discussion ensued about which recipe was better. When I asked which recipe I should put in the manual, someone said I should put both in. She said, "Half the fun was making them both and comparing them." Several others agreed. Similarly, when the group made cookies, there were two different recipes, and again part of the fun was in comparing them—both the results and the difficulty/ease of making each one. One participant summed it up: "The hands-on approach was good, and allowed for a visual and tactile approach."

Meeting other parents

Meeting other parents was important to many participants; they liked getting to know one another, and said they learned from each other. Most liked to work in pairs on the activities, and they were interested in the variety of ways people went

about solving problems. One said, “Everyone had a different learning style and approach and they were all right.”

Participants rated highly the fact that they could see in the group that people approached problems in very different ways, and that there was no one, right way. They said it gave them confidence that their way would be acceptable, and would work.

Changes they would like

When asked, in the final interview, what they didn’t like about the group, many said, “nothing.” I pushed them a little on this, by saying that I wanted future groups to be the best they could be, and I’d appreciate any feedback that would make it better. To this, I got replies, that they would have liked each session to be longer, or to have more sessions. They mentioned they would like more baking and more Rummoli. One commented that she had enjoyed playing Rummoli several times in several different sessions, and would have liked to repeat some of the other activities as well. Only one person suggested that he would have liked worksheets and more traditional math activities.

Conclusion

Parents who participated in the family math activities in this project developed a deeper understanding that math is everywhere in daily life, and began to see math as more than just school math. They developed a new awareness of the possibility of helping children with math, and some strategies to do it. Many of them improved their ability to communicate about math to their kids. Especially in light of the difficulty of recruiting participants, and in the light of sporadic attendance by participants, several conclusions can be drawn about recruiting participants and about the most fruitful shape and format of the math groups and activities: draw on parents’ strengths, develop and use activities that are fun and different from school math; use a holistic approach; focus on the importance of developing skills through play; emphasize the unimportance of getting the right answer; and use an egalitarian facilitation style.

Recommendations

Based on the findings of this study, recommendations about content and facilitation of family math groups can be made in several areas.

Recruitment

Establishing a sense of comfort and safety is of paramount importance, even before the group starts. Posters, information sessions, and other publicity should establish

that the sessions and the activities will not expect parents to already know math before they can work with their kids. Nearly every participant in this study expressed surprise that family math could look so different from school math; while it may be impossible ahead of time to convince potential participants of this fact, it is important to give them an idea of what to expect if they participate. If you are trying to recruit parents who themselves did not do well in school math, they may not trust you no matter what you say. The best recruitment tool may be word-of-mouth advertising, so it may help to feature parents who have previously attended a group on the posters or at information sessions.

Don't attempt to interview or test people before the sessions start. Both of these were barriers to participation in this study.

Draw on Parents' Strengths

Parents know the interests of their own children, and know which of the activities you offer are most likely to appeal to their families. Furthermore, the math experiences parents have from home, work, leisure activities, and community life inspire them in working with their kids, and provide a rich source of experience and example. Better the activity that comes from the parent's work than from the facilitator's text book.

Activities

Fun, Fun, Fun!

It can't be repeated too often. It is important the activities be enjoyable for parents too. For example, if parents enjoy nature, or make it part of their spiritual or family life to be out of doors, then they are more likely to incorporate math thinking into hiking or camping, which they already do, than to take up some other new activity for the sake of doing math.

Given the factors in parents' life that make regular attendance the exception, not the norm, activities should fit into one session, and not carry over to the next. Parents should not have to have attended the previous session in order to enjoy the current one, and they should be able to go home at the end of every session with something to do with their children, not wait until the next session to finish things up.

Different from School Math

Activities should not look like the kinds of school math that parents may remember. This will avoid emotional carry-overs and past memories, but also give the parents a chance to start fresh, with more confidence that they can work with their kids on these activities, even if they have given up on helping their kids with homework or worksheets.

Use a Holistic Approach

As a first principle, activities should appeal to and develop the spiritual, emotional, physical and mental parts of our beings. The introduction to *Family Math Fun!* expands on this first principle:

Spirit: We want to nourish the learning spirit, so that children become aware of themselves as learners. Activities such as counting out plates for dinner help kids feel that they belong to the family and contribute to family life. They develop a sense of themselves as people who can solve problems. Looking at shapes, numbers, and patterns in nature makes them aware of the beauty and order that surrounds them.

Heart: When adults do these activities with children, the children feel loved. When the children are successful at the activities, they feel confident and happy to take on another challenge. When the activities contribute to family life, children feel responsible, and proud of their ability to take part.

Body: The activities here all involve doing something. It is not enough to think about things. When you do something in the real world, there is usually a reaction—someone or something does something back. The reaction teaches you something, and you may begin to think in a different way because of it. Sometimes we can't think of what to do, but something says, "Just try this…" and we do, and it works.

Mind: When we think of math, we often think of school math, but children begin to notice and think about numbers from the time they are born. The activities in this book all involve math thinking without worksheets or tests. Making a collection, taking a bath, making a box, braiding your hair, making art—if you do any of these things, you are thinking mathematically.

Spirit, heart, body, and mind are all connected in our lives, and they are connected in the activities in this book. Math is not "all in the head." When we keep it only in the head, we are out of balance, and cannot do it well. When we balance the spirit, heart, body, and mind, math becomes part of our whole lives, and is not a beast or a barrier (Nonesuch, 2008, page 1-2).

Make Time for Parents

It is essential that there be time for parents to do the activities together, without the kids, for three reasons: First, the parents need time to understand the activity, so they can do it easily, feel secure in their knowledge, and be comfortable showing it to their children. Second, parents need to experience for themselves the value of the activity, whether it be the enjoyment of figuring out a strategy for a game, or having the flash of insight that we usually call the "Aha!" moment. This allows them to be genuine when they invite their children to take part in the activity. It also allows them to watch their children discover the enjoyment, or experience the "Aha!" which is the pleasure teachers look for, and increases the parents' enjoyment. Third, while the parents are doing or learning the activity for the first time, the facilitator has the opportunity to model a generous and open approach to the activity, to comment that there are many ways to accomplish an end, or to think out loud to make the math concept transparent, a technique that parents can pick up through this modeling

For these three reasons, it is Important to repeat activities such as card or dice games so that parents really know the rules and strategies well, so they enjoy play-

ing them and can invite kids to join the fun, rather than making them do something that's "good for them."

Main Messages for Parents

Learning through Play

Downplay the value of worksheets or rote learning, and emphasize the value of learning through play or through family activities, and the value of activities that allow the child to come to understand mathematical concepts for themselves. Two examples from the manual show the emphasis on play and on giving the child time to learn what there is to learn, without worrying about "right" ways, or getting it quickly.

> Put some empty plastic tubs into your child's bathtub…your child will use one tub to fill up another, will try to pour all the water in a big tub into a smaller one, will find out that many dips with a small tub are needed to fill a big one, and will feel the difference between pouring a small tub over his head and pouring a big one. This is math learning (Nonesuch, 2008, p. 20).
>
> An older child can put away mugs and cups. What to do with the handles is an interesting problem, especially if there are lots of mugs and not very much space to put them in. How much space do things take up? How can I fit things into a tight space? Both these are problems that a kid can work on without even knowing that she is doing math (Nonesuch, 2008, p. 35).

There is No Right Answer

Emphasize that there are many ways to do the activities, that there is no "right" answer, that the experience of trying things out and the satisfaction of making something or doing something that has consequences in the real world is the purpose of the activities, and that a good measure of success is to ask how much fun they are having.

An informal, non-competitive atmosphere goes a long way to helping parents enjoy each other's company and value the contributions each person brings to the group. Dispelling the myth that there is only one way to get the right answer reduces stress, and one way to dispel the myth is to focus on different strategies various participants use to do the activity

When we value and cherish different ways of tackling a problem or arriving at a solution, we value and cherish the people who follow those different ways. When parents see that there is no single "right" way, it gives them confidence to try something new.

Facilitation Style

Use a facilitation style that establishes a sense of comfort and safety in the group and a shared power arrangement with participants. Demonstrate the attitudes and

the messages you want to get across to parents. Let your fascination with math show. Let your interest in the variety of ways people approach problems show, too.

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Appendix A Consent to Participate

Consent Form

Parents Teach Math

Kate Nonesuch is looking for parents or other people who look after children to try out her ideas about helping kids do math. She is writing a book about how to do it. She also wants to see if adults get better at math when they teach the kids.

If you agree to take part, you will:

- ☐ Meet with Kate to talk about math and your kids (hour)
- ☐ Do a short math test (½ hour)
- ☐ Come to groups with other parents and adults (twice a week for 10 weeks, 1 ½ - 2 hours each time.) In the group you will learn new ways to teach math to your kids, and give Kate feedback about how her ideas work and how to make them work better.
- ☐ Work with kids on doing math (as much as you like)
- ☐ Meet again with Kate to talk about math and your kids (1/2 hour)
- ☐ Do another short math test (1/2 hour)

You can decide to stop taking part in the study any time you want to, no questions asked, no penalty.

At the front of the book and the report there will be a list of names of people who took part, to say thanks for helping with it. If you want your name in this list, it will be there. If you don't want your name in the list, Kate will not put it there. Your name will not be anywhere else in the book or report. No one else will know what you said about math, or how well you did on the math test.

Kate will keep the information you give locked in her office. She will not let anyone see it unless they are working on this project (for example, the secretary). She will shred all the papers and delete the computer files in December, 2009.

If you take part, what could hurt you?

- ☐ You might remember some bad times you had doing math before. These memories might stress you out.
- ☐ You might feel nervous or embarrassed, especially at the beginning, when you are thinking about math in the group.

If you take part, what will you get out of it?

- ☐ You will learn some new ways to teach your kids some math
- ☐ You will learn some ways to help with math homework
- ☐ You will learn some math yourself
- ☐ You will have fun doing math
- ☐ You can feel proud to help make a book that will help other parents do math with their kids.

- ❑ You will get a copy of the new book for parents.
- ❑ You can keep all the things we make in class to help do math with kids.
- ❑ You will be paid for the first meeting with Kate, and for writing the test, and you will be paid again for the last meeting with Kate, and for writing the test. You will not be paid to come to the groups, or to work with your kids on math.

After the project is finished, we will celebrate the book you helped make. Kate will tell you everything she learned about how parents can help kids learn math, and give you a copy of the new book for parents.

****

I have read the words above. I understand what I read; I understand that I have a choice to take part or not to take part. I understand that I can ask questions or leave the project at any time.

I, _____, agree to take part in the project Parents Teach Math.

_____ _____

Participant's signature Investigator's signature

_____

Date

The book and the report will be on the internet (www.NALD.ca) and Kate will tell hundreds of teachers and day care workers and other people interested in family math to go and look at it. Do you want your name in the book and report, on the list of people who took part? (Initial your choice)
no _____. yes _____. Write my name like this: _____
(You can change your mind about this any time.)

You can get in touch with Kate or with her boss, Vicki Noonan, if you have any problems or questions about this project.

Date of approval by Malaspina Committee for Research Involving Human Subjects: June 4, 2007

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Appendix B Interview Questions

Parents Teach Math Preliminary Interview Questions

Date
Name
Address
Phone e-mail
mark on preliminary test _____

How old are the kids in your care?
Boys _____ Girls _____
What is their relationship to you?
children _____ step children _____ grandchildren _____
nieces, nephews, other family members _____ day care _____
other _____

Tell me about what math was like for you in school?

How do you feel about math now?

Where do you use math in your daily life?

Do you and your kids do math together? If so, How and where?

For each child:
Name _____ Age _____ Grade _____

What does s/he like to play or play with?

What does s/he have the most trouble with in math?

What is the easiest part of math for him/her?

What are his/her grades like?

What do you and the teacher talk about in relation to this child's math?

How does this child feel about math?

Parents Teach Math Final Interview Questions

Date
Name
Address
Phone e-mail
mark on final test _____

Tell me what you liked about participating in the group.

What didn't you like?

What did you learn about math in this group?

How do you feel about math?

Where do you use math in your daily life?

Do you and your kids do math together? If so, How and where?

Has anything changed in your life because you took part in this project? If so, what?

What made the change?

For each child:
Name _____ Age _____ Grade _____

What does s/he have the most trouble with in math?

What is the easiest part of math for him/her?

What are his/her grades like?

What do you and the teacher talk about in relation to this child's math?

How does this child feel about math?

Appendix C Math Tests

Parents Teach Math Pre-Test

Name_____ **Date** _____

Example: 3 + 2 =
- ○ 7
- ○ 5
- ○ 10
- ○ 3

---

32 + 25
- ○ 67
- ○ 55
- ○ 57
- ○ 100

127 + 293
- ○ 421
- ○ 420
- ○ 320
- ○ 410

---

341 −120
- ○ 461
- ○ 271
- ○ 221
- ○ 99

224 − 167
- ○ 167
- ○ 67
- ○ 111
- ○ 57

---

17 x 10
- ○ 107
- ○ 170
- ○ 770
- ○ 17

205 x 16
- ○ 3280
- ○ 400
- ○ 1425
- ○ 4005

$5\overline{)125}$
- ○ 21
- ○ 15
- ○ 25
- ○ 22

$3\overline{)\$9.63}$
- ○ $32.00
- ○ $3.21
- ○ $3.33
- ○ $28.89

3.1 + 22.4 + .05 =
- ○ 255.5
- ○ 260
- ○ 30.5
- ○ 25.55

1.1 x .2
- ○ .22
- ○ 2.2
- ○ 22
- ○ 22.2

Circle the one that is bigger:

$10.10 $10.01

35.791 136.2

$\frac{1}{2}$ $\frac{1}{4}$

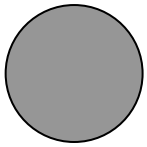
$\frac{5}{8}$ $\frac{3}{8}$

Circle the one that is bigger:

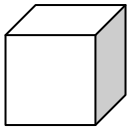
$\frac{1}{4}$ $\frac{4}{8}$ $\frac{9}{7}$ $\frac{11}{15}$

What is the name of these shapes?

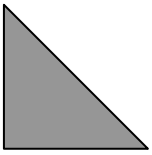
- ○ circle
- ○ cube
- ○ rectangle
- ○ cylinder



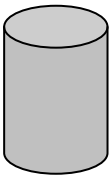
- ○ circle
- ○ square
- ○ rectangle
- ○ triangle



- ○ circle
- ○ cube
- ○ square
- ○ cylinder



- ○ circle
- ○ cube
- ○ rectangle
- ○ triangle



- ○ circle
- ○ cube
- ○ square
- ○ cylinder

What is 50% of $12.00?

- ○ $50.
- ○ $6.00
- ○ $5.00
- ○ $12.00

3 is 25% of what number?

- ○ 3
- ○ 6
- ○ 12
- ○ 25

Martin put $2.00 in his piggy bank. The next day, he put in 50¢ and the day after that, he put in $1.00. What did Martin do?

- ○ Add
- ○ Subtract
- ○ Multiply
- ○ Divide

Pat was cooking eggs for supper. Six people were home to eat, and she wanted to make two eggs for each person. Pat knew she would need one dozen eggs. What did Pat do?

- ○ Add
- ○ Subtract
- ○ Multiply
- ○ Divide

Joe had 15 candies and three grandchildren. He decided that each kid would get 5 candies. What did Joe do?

- ○ Add
- ○ Subtract
- ○ Multiply
- ○ Divide

Parents Teach Math Post-Test

Name_____ **Date** _____

Example: 3 + 2 =

- ○ 7
- ○ 5
- ○ 10
- ○ 3

---

45 + 13	○ 48 ○ 55 ○ 58 ○ 100	234 + 156	○ 380 ○ 290 ○ 390 ○ 410

---

257 −130	○ 99 ○ 127 ○ 117 ○ 387	334 − 257	○ 77 ○ 591 ○ 177 ○ 67

---

15 x 10	○ 500 ○ 105 ○ 15 ○ 150	106 x 23	○ 530 ○ 2438 ○ 1426 ○ 1318

$5\overline{)160}$	○ 32 ○ 16 ○ 30 ○ 40	$4\overline{)\$8.48}$	○ $10.00 ○ $4.22 ○ $2.12 ○ $16.15

2.1 + 13.5 + .02 =	○ 16.8 ○ 15.8 ○ 15.62 ○ 1562	2.3 x .1	○ 23 ○ 2.3 ○ .23 ○ 23.1

Circle the one that is bigger:

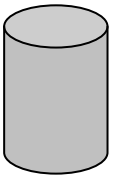
$5.20	$5.02	121.7	26.736

$\frac{1}{2}$	$\frac{1}{4}$	$\frac{5}{6}$	$\frac{3}{6}$

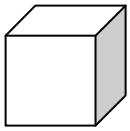
Circle the one that is bigger:

$\frac{1}{8}$ $\frac{5}{10}$ $\frac{7}{5}$ $\frac{12}{17}$

What is the name of these shapes?

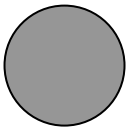


- ○ circle
- ○ cube
- ○ rectangle
- ○ cylinder

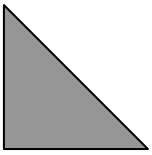


- ○ circle
- ○ square
- ○ cube
- ○ triangle

- ○ rectangle
- ○ cube
- ○ square
- ○ cylinder



- ○ circle
- ○ cube
- ○ rectangle
- ○ triangle



- ○ circle
- ○ cube
- ○ square
- ○ triangle

What is 50% of $14.00?

- ○ $50.
- ○ $7.00
- ○ $5.00
- ○ $12.00

3 is 25% of what number?

- ○ 3
- ○ 6
- ○ 12
- ○ 25

Joe's dad gave him $2.00 to spend. His mom gave him $1.00 and his auntie game him $5.00. Joe said, "Great. I've got $8.00!" What did Joe do?

- ○ Add
- ○ Subtract
- ○ Multiply
- ○ Divide

Jean had 15 felt pens for her 3 kids. She decided that each kid would get 5 pens. What did Jean do?

- ○ Add
- ○ Subtract
- ○ Multiply
- ○ Divide

Martin has 4 grandchildren. He wanted to buy 3 chocolate bars for each grandchild. He figured he would need to buy 12 chocolate bars. What did Martin do?

- ○ Add
- ○ Subtract
- ○ Multiply
- ○ Divide
