Investigating Parental Roles of Mathematically Gifted Students

Brenda Bicknell
Massey University
b.a.bicknell@massey.ac.nz

This paper reports on the parental roles of Year 6 and Year 8 mathematically gifted students. A survey is used to evaluate the parents' roles as motivators, resource providers, monitors, mathematics content advisers and mathematics learning advisers. Interview data provides further insights on parents' perspectives on children's mathematical development from early years to current schooling and future aspirations. The results provide evidence that dispels the myth of the 'pushy parent' and raises implications for parent-school relationships.

In New Zealand there is a growing recognition of, and acceptance for, gifted education. This interest has been supported by the Ministry with the implementation of a series of initiatives. These include the publication of a handbook to help schools identify and provide for gifted students (Ministry of Education, 2000), as well as national research (Riley, Bevan-Brown, Bicknell, Carroll-Lind, & Kearney, 2004) and a change within National Administration Guidelines mandating schools to identify and provide for gifted and talented students. Programmes for gifted students with a focus on intellectual and academic areas are becoming increasingly available (Riley et al., 2004). The results reported and discussed here are taken from a larger study investigating provisions for and perspectives of mathematically gifted students. In this paper, the focus is on parental roles of mathematically gifted students.

Theoretical Background

The literature on parental involvement in children's and adolescents' education supports the assertion that parental involvement benefits children's learning (Eccles & Harold, 1993; Epstein, & Dauber, 1991; Fehrmann, Keith, & Reimers, 2001; Hoover-Dempsey, Bassler, & Brissie, 1992). Parents as children's first teachers see the interest and advanced abilities displayed by their gifted children from early years and assume roles in their children's education. According to Matthews and Foster (2005), parents can optimize learning experiences for gifted learners in a variety of ways. They "not only espouse the value of certain activities, fields or achievements, but they model attitudes and behaviours that foster achievement, direct the interests and activities of their child to these areas, model participation and achievement within the talent areas, and monitor and structure their children's time and participation" (Kulieke & Olszewski-Kubilius, 1989, p. 42).

The models for parental involvement most commonly used in the literature are based on the assumption that student outcomes are influenced by parental involvement which, in turn, is influenced by factors such as socioeconomic variables or attitudes. These models do not allow answers to the following question: In what way do parents become involved in their child's education? Hoover-Dempsey and Sandler's (1995) model however, provides a theoretical basis for examining parental involvement in children's education. The focus is on variables most salient to the parent involvement process and therefore is potentially subject to specific intervention. In this model, the authors believe that parents become involved in their children's education for three major reasons. "(1) their personal construction of the parental role; (2) their personal sense of efficacy for helping children

succeed in school; and (3) their reaction to the opportunities and demand characteristics presented by both their children and their children's schools" (p. 313). As a consequence of this role construction parents select levels and forms of involvement in educationally-related activities both consciously or otherwise, in both the home and school setting. If they choose to become involved, that level of involvement is based on a variety of factors such as the parent's specific skills and knowledge, total demands (which include family and work), and demands for involvement from children and school.

The focus of this study is on the nature of parental involvement. The role that parents play in terms of their children's interest and development in mathematics learning is examined with a focus on variables deemed to be of major significance in Hoover-Dempsey and Sandler's model. The essential elements of the model are: (1) the parental involvement decision; (2) the parents' choice of involvement forms; (3) the mechanisms through which parent involvement influences child/student outcomes, (4) tempering/medicating variables; and (5) child/student outcomes. The model provides a theoretical framework for examining variables that are deemed to be of importance in parents' decisions to become involved in their children's education and the forms that involvement takes. Data were analysed according to the themes/variables detailed in the framework.

The Study

The children in the study had been identified by their teachers as gifted and talented in mathematics and parents were invited to participate in the study along with their children and their teachers. There are 18 students (6 girls, 12 boys) from a Year 6 withdrawal or pullout programme, 10 Year 6 students (2 girls, 8 boys) from regular classes in two different schools and 5 Year 8 (2 girls , 3 boys) from a fulltime special class for gifted students at an intermediate school. The parents of all of these students completed the survey and twenty-two were interviewed. The parents have already indicated a certain level of interest and involvement by agreeing to participate with their children in this study.

A pilot study was initially conducted to evaluate the survey and interview questions. The survey uses Cai's (2003) Parental Involvement Questionnaire (PIQ) (with the author's permission). Minor changes were made to two questions. In Question 16 (*I think I know enough about algebra to help my child*) the word 'algebra' was changed to 'mathematics'. Although algebra is delineated in the curriculum statement as a separate strand teachers give the topic less explicit emphasis in the primary school than other strands so children are often unaware that the mathematics they are doing is algebra. Also, given the age of the students in the study it made more sense to keep the general term 'mathematics'. In Question 14 (*I am always aware of my child's mathematics requirements by checking notebooks, using learning line, or through phone calls to school*) the term 'learning line' was deleted as this is not an approach used in New Zealand schools. Parent interviews were conducted after classroom observations over several weeks and after interviews with the students. This sequence of events was strategic as it was intended that the researcher had observed and talked with the students prior to interviews with the parents giving a meaningful context for parents' comments and an opportunity for triangulation of data.

The purpose of the survey was to gain an understanding of the roles that parents play in their child's learning of mathematics and the level of that involvement. The 23 PIQ items assess the five parental roles of motivators, resource providers, monitors, mathematics content advisors and mathematics learning counsellors. There are either four or five

questions in each category. The PIQ is recognised as a reliable and valid instrument for assessing parental roles in students' learning of mathematics. For each of the PIQ Likert-scale response items the parents chose from strongly agree, agree, disagree or strongly disagree. Those statements worded in a positive way were scored from 4 to 1. The scoring was reversed for any statements written with a negative connotation, for example Question 11 (*I seldom spend time talking with my child about his/her progress*).

The semi-structured interview was used to validate survey responses and to gain further information about parental decisions and choice of involvement forms in relation to Hoover-Dempsey and Sander's Model. Parents were also questioned as to when they first recognised their child's mathematical giftedness, the indicators (behaviours, interests, and attitudes), their level of school involvement, and also given the opportunity to describe any related issues, and future educational aspirations for their children.

The results are discussed in relation to the patterns and roles of involvement activities identified in Hoover-Dempsey and Sandler's model. They are followed by implications for research and the strengthening of parent-school relationships.

Results and Discussion

Overall, parents in this study have strong positive attitudes about parental involvement. They showed a strong acceptance for the important role that mathematics plays in their children's futures. The survey questions are grouped according to the five identified roles of motivator, resource provider, monitor, mathematics content advisor and mathematics learning counsellor. A mean score of 3.0 on the complete survey indicates a relatively strong level of involvement. The mean scores for each role are shown below (see Table 1).

Table 1

Mean PIQ Scores on Each Parental Role

Motivator	Resource Provider	Monitor	Content Advisor	Learning Counsellor
3.2	3.0	3.0	3.1	2.9

The parents clearly supported their children by encouraging and motivating them in their study of mathematics. Efforts are made to provide a home environment conducive to learning (91%). For example, the majority of parents provided a variety of games and puzzles to encourage the development of mathematical skills and concepts. The public library was used as a resource by 61% of the parents and 58% bought mathematics-related books for their children.

The majority of the parents (73%) were not concerned about monitoring the amount of time their children spent on mathematics at home and many (45%) were not aware of their children's mathematics homework requirements. However, 91% of the parents spent time talking with their children about their progress in mathematics. According to the literature, parents see themselves as having an active role to play in their children's homework (Hoover-Dempsey, Bassler, & Burow, 1995). This aspect of the monitoring role was seen as multifaceted — structuring homework activities, motivating children, working with them on their set tasks, and interacting with the teacher about homework. The parents in this

study (91%) believed that at home it is important for their children to keep a balance between mathematics and other subjects.

Most of the parents (88%) felt that they could help their children to solve mathematical problems although two respondents added the proviso "at this stage" of their children's mathematics education. Most parents felt that they had sufficient mathematics content knowledge themselves to be able to do this and to also make links with mathematics to every day life. The majority also made an effort to understand the mathematics that their children were studying.

In terms of their role as learning counsellors, 85% of the parents felt that at this stage they had strategies to help their children but nearly half of the parents were not aware of the approaches used to teach mathematics at their children's school. In contrast nearly 80% attempted to figure out good approaches themselves for helping their children learn different mathematics topics. Over 85% of the parents tried to match expectations with their child's potential.

It is worthwhile to compare this sample with the sample in Cai's study. Cai compared the roles parents play in their children's mathematics learning between 138 Unites States of America parents and 295 parents in the People's Republic of China. The mean scores for each role are given in Table 2 to show that this New Zealand sample of parents of gifted children does not differ greatly from that of the US parents. The ranking of roles for the parents in this sample is the same as the US sample. It places motivator first followed by mathematics content advisor, resource provider, monitor and finally learning counsellor. In the Chinese sample the chief role was also motivator but this was followed by monitor and then learning counsellor.

Table 2

Comparison of Mean PIQ Scores

	Motivator	Resource Provider	Monitor	Content Adviser	Learning Counsellor
United States	3.2	3.0	2.9	3.1	2.9
China	3.1	2.9	3.1	2.7	2.9
NZ	3.2	3.0	3.0	3.1	2.9

The results from the interviews in the current study showed that all the parents were aware of their children's propensity for mathematics from an early age. The parents offered both direct and 'vicarious experiences' that supported their children's mathematical interests from an early age. They reported that their young children showed some of the classic indicators of mathematical ability - interest in puzzles, symmetry in patterns, time and the differing intervals, a concept of number (sequential, odd, even, smaller than larger than and large numbers), playing with calculators and computers, sophisticated constructions with materials such as Knex and Lego and an ability to converse with adults and work independently for a sustained period of time. The children appeared ahead of their peers or siblings at the same age and were easily bored. One parent described one of her son's pre-school self-initiated tasks: "He spent an entire morning at kindy, he must have been four sitting at the front gate with a chart he'd asked the teachers to make for him, counting cars, marking off the cars and what colour they were in what box and then added up the different colours. The whole three hours he spent counting cars".

Diezmann and Watters (2000) explain that "this heightened sensitivity to learning in a particular domain may result in a child wanting to spend extended periods of time working on a task" (p. 41). Another parent described one of her child's pre-school initiatives: "They would make a circus and [ ] would go off and make tickets for everyone and they would have numbers on the top and they would all be consecutively numbered". These parents were supportive of the pre-school learning environment that allowed their children to work independently for a sustained period on a particular task. As a result of being informed about the event the parents were able to become involved in the child's activity by showing interest and support through questioning and conversation.

The parents described a variety of early indicators of mathematical giftedness with some of the children showing analytic abilities (facilities with number) and others geometric or harmonic (a mix of the two) (Krutetski, 1976). The analytic type tends to think in verbal-logical terms and operate confidently in the abstract. The geometric thinkers strive to solve a problem using visual supports and the harmonic type displays the characteristics of both analytic and geometric. Those with strong spatial abilities as young children become immersed in constructions and jigsaw puzzles. Two parents described how their 'geometric' children approached jigsaw puzzles by filling in the middle completing sections based on pattern and shape and not by competing the perimeter first as is the more common approach. Another parent explained how her child walked before he talked and the very first thing he said to her was; "Ma, it turns". She explains: "He always wanted to turn things, to see what they could do… His first artwork was straight lines and arrows, nothing like hills and rivers or things like that he'd draw straight lines". The parent's positive response to this was to encourage her child to spend time with his grandfather, a watch and clock repairer.

When their children began school, all the parents said that they took a 'wait and see' approach. They were aware of their children being ahead of their peers and all had a sound number knowledge with many knowing basic facts; one child carried a notebook for recording computations such as long division that he just wanted to do for fun. The parents took a 'hands off' approach in terms of their child's schooling until they felt that their children were becoming bored and then they assumed the role of advocate. Assouline and Lupkowski-Shoplik (2003) comment that parents are their children's primary advocate and "in advocating for their children, parents are not "pushing" their children" (p. 19).

The year that most parents stated as being the most significant in terms of talking to teachers about their child's interest and achievements in mathematics was in Year 3. (Coincidentally, the majority of the students in the study also commented that Year 3 was the year that they realized that they were gifted in mathematics). As one parent responded when mentioning their child's frustration and boredom; "I couldn't accept that from an eight-year old!" Another parent who decided to advocate for her child received the comment from the teacher "I've been waiting for you to come". The teacher admitted that she had recognised the child's abilities in mathematics but felt inadequate about being able to help the child.

Several parents noted it was also in Year 3 that their children 'struck gold' in terms of the quality of the teacher. Parents described such teachers as brilliant, encouraging, valued mathematics, gave my child confidence, loved mathematics, and had a sense of humour, were dedicated and interested. Of course there were a few who described negative attributes of their children's teachers — lack of enthusiasm, no regular programme. The parents felt

that when their children 'crashed' or became bored they could only put it down to the teacher. In response to this, three of the parents had sought external help from a private company offering an individualised computer-assisted learning programme in mathematics.

Only one of the students in the study now attends this after-school programme and two of the students attend a One Day School for gifted and talented children. Their reasons are very different; one of the parents is dissatisfied with her child's present education. The child is seen as different and has continually been bullied at school, lacks social skills and has recently been labelled as suffering from Asperger's syndrome. The other parent is very pleased with her child's school programme but feels her child benefits from One Day School because he experiences different types of activities and contexts for study. She also feels that he has a wider group of like-minded peers to bounce ideas off and to "think outside the square".

Parents see the opportunity for their children to participate in competitions as very important. They were interested to see how their children performed against others outside of the school. Competitions are viewed as a valuable aspect of gifted children's education as they give students an opportunity to put their talents to the test (Riley & Karnes, 1999). The reasons given for supporting their children (small monetary cost) in partaking in competitions was in response to the children themselves. They felt that their children relished the idea of competing against others outside of their own school network. Students from all of the four schools competed in a local competition, three schools used a national competition and all participated in the Australian Mathematics Competition (although one school's application for 2005 had been mislaid). The children, according to parents, were, on the whole, modest and results sometimes not known until they were published in the school newsletter. Several of the children achieved 'high distinction' (top 2% of year and region).

All of the parents were questioned about their expectations for their children as they made the transition to another school. One group (n=22) of Year 6 students have gone to intermediate schools (two different schools), another group (n=5) to intermediate schools within integrated secondary schools (two different schools), one to a private boys (Year 4-8) school and of the Year 8 students, one of the girls to a co-educational secondary school, the other to a large secondary girls' high school and the three boys to a large secondary boys' high school. All of the parents had made the choice of school in collaboration with their children but they had based their decisions on a variety of different reasons. The reasons given by the Year 6 students were siblings, friends, and proximity. For the parents of Year 8 students it was knowledge of the school's reputation for providing for students' advanced academic abilities and other interests such as music and sport.

All parents expressed a desire for their children to be challenged, to continue to work at an advanced level and to have their children's interest and passion for mathematics maintained. The Year 6 parents explained that they would be more concerned about their secondary school choice and would be looking for deliberate acceleration or extension programmes. As they explained it was another decision to be made in the future. "It's intermediate but when he's eleven or twelve and going to high school then we will have a preference". The parents had all had the opportunity to provide information to be passed on to the reception school and had all indicated that they wanted their child's special provisions in mathematics to continue. As one parent explained; "I have faith that the child will be accommodated."

Conclusions and Implications

This survey of and interviews with parents of mathematically gifted students offers information not previously gathered in New Zealand about parents' practices and level of involvement in their children's mathematics learning. The findings are limited by the fact that parents volunteered for the study and the data is derived from two sources: a survey and a single interview with each parent. The parents were all invited because their children were identified by their schools as gifted. The schools all reported that they were catering for their mathematically gifted students. Thus, the following conclusions are based on a small sample of a special population.

Parents of mathematically gifted New Zealand students assume similar roles to that of United States parents. These roles can also be ranked in the same order from motivator, followed by mathematics content advisor, resource provider, monitor and finally learning counsellor. The majority of parents of these mathematically gifted students encourage their children to work hard on mathematics problems and believe that mathematics plays an important part in their lives. They try hard to provide a pleasant learning environment for their children to do mathematics and are prepared to monitor their child's progress in mathematics. Over 90% believe however that it is important that their children keep a balance at home between mathematics and other subjects. At this stage nearly all parents believe that they know enough mathematics to be able to help their children and also have strategies to help them. Knowing that their children are mathematically gifted, nearly all parents try and match expectations with potential.

All parents interviewed articulated identification of varying signs of mathematical giftedness in their children from an early age; many from two years. Based on the parents' descriptions, the children fit into the three mathematically gifted categories of analytic, geometric and harmonic (Krutetski, 1976). In their children's early days of schooling parents took a 'hands off' attitude but by Year 3 were prepared to get more involved if their child showed boredom, stagnation or frustration. The teacher was recognised as a key factor in the children's interest, excitement, fascination and appreciation for mathematics. The parents strongly supported their children in participation in competitions at local, nation and international level. The parents all had an opportunity to provide information to be passed on the students' next school (all students are involved in a transition). The parents of Year 8 students expressed greater concern for the type of programme their children would experience as secondary students than the Year 6 parents who realised the decision that had been made was only for the next two years.

The themes and parental roles identified hold important implications for schools. The following questions arise: How many students go unidentified as gifted on entry to school? Why are parents prepared to wait until Year 3 before taking a more active advocacy role? Parents' focus on their own child's characteristics, interests, attitudes, and abilities, and so schools should take a child-centered approach listening to parents and pre-school educators. Assouline & Lupowski-Shopalik (2003) maintain that schools should acknowledge the different needs of the mathematically gifted child and be aware that parent nominations in this domain are usually reliable. It would be hopeful that schools communicate effectively with parents in the early stages of identification and provision for mathematically gifted students.

Further studies are needed to examine the roles of parents in students' learning of mathematics for the generalised population; it would be useful to compare these results

with parents of regular students. It would also be informative to have parents representing a range of socio-economic backgrounds, to examine links between different school communities and to also link to school practices in terms of parent-school interactions. Parental involvement is a process that requires school leaders, teachers, students and significant others in the school community to make efforts through consultation, planning and reflection. Individual teachers' attitudes and practices could be examined to consider how they influence the level of parental involvement.

References

Assouline, S., & Lupkowski-Shoplik, A. (2003). *Developing mathematical talent: A guide for challenging and educating gifted students.* Waco, TX: Prufrock Press.

Cai, J. (2003). Investigating parental roles in students' learning of mathematics from a cross-national perspective. *Mathematics Education Research Journal, 15*(2), 87-106.

Diezmann, C. M. & Watters J. J. (2000). Characteristics of young gifted children. *Educating Young Children, 6*(2), 41-42.

Eccles, J. S., & Harold, R. D. (1993). Parent-school involvement during the early adolescent years. *Teachers College Record, 94*(3), 568-587.

Epstein, J. L. & Dauber, S. L. (1991). School programs and teacher practices of parent involvement in inner-city elementary and middle schools. *The Elementary School Journal, 91*(3), 289-305.

Fehrmann, P. G., Keith, T. Z., & Reimers, T. M. (2001). Home influence on school learning: Direct and indirect effects of parental involvement on high school grades. *Journal of Educational Research, 8*(6), 330-337.

Hoover-Dempsey, K. V., Bassler, O. C., & Brissie, J. S. (1992). Explorations in parent-school relations. *Journal of Educational Research, 85*(5), 287-294.

Hoover-Dempsey, K. V., Bassler, O. C., & Burow, R. (1995). Parents' reported involvement in students' homework: Strategies and practices. *The Elementary School Journal, 95*(5), 435-450.

Hoover-Dempsey, K. V., & Sandler, H. M. (1995). Parental involvement in children's education: Why does it make a difference? *Teachers College Record, 97*, 310-331.

Kulieke, M. J., & Olszewski-Kubilius, P. (1989). The influence of family values and climate on the development of talent. In J. Van Tassel- Baska & P. Olszewski-Kubilius (Eds.), *Patterns of influence on gifted learners* (pp. 40-59). New York, NY: Teachers College Press.

Krutetski, V. A. (1976). *The psychology of mathematical abilities in schoolchildren*. Chicago: University of Chicago Press.

Matthews, D. J., & Foster, J. F. (2005). *Being smart about gifted children: A guidebook for parents and educators*. Scottsdale, AZ: Great Potential Press.

Ministry of Education. (2000). *Gifted and talented students: Meeting their needs in New Zealand schools*. Wellington, NZ: Learning Media.

Riley, T., Bevan-Brown, J., Bicknell, B., Carroll-Lind, J., & Kearney, A. (2004). *Gifted and talented education in New Zealand schools.* Wellington, NZ: Ministry of Education.

Riley, T. L., & Karnes, F. A. (1998/1999). Competitions: One solution for meeting the needs of New Zealand's gifted students. *APEX The New Zealand Journal of Gifted Education, 11/12*(1), 21-26.