

Investigating Parental Attitudes and Beliefs in Mathematics Education

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This study investigated views held about mathematics education by parents of a small inner-city primary school. Similarities in responses indicated consistency of ideas. Respondents demonstrated a broad understanding of mathematics and disagreed with a number of stereotypical statements about mathematics and mathematics education. They were keen to increase their knowledge and understanding of the mathematics curriculum and teaching practices. They showed high levels of interest in assisting their children with mathematics and provided a wealth of ideas for supporting learning.

The promotion of parental influence and involvement in education has been evident in educational literature and various learning initiatives in recent years. As well as providing a supportive home environment there is increasing recognition of the importance of the home-school link. Children's learning is claimed to be enhanced “by effective partnerships between school and home” (Ministry of Education, 1999a, p. 3) and emphasis has been placed upon parents as ‘active partners’ in the production of educated children (McNamara, Hustler, Stronach, Rodrigo, Beresford, & Botcherby, 2000).

However, parental approaches to involvement in mathematics learning are influenced by their attitudes, beliefs and understandings of mathematics and mathematics education. It is possible that parents hold alternative views of the nature and function of mathematics—views which may conflict with current mathematics education reforms. A hostile learning environment for a child may be created as a result of discrepancies between home and school perceptions of mathematics, or from parental anxiety over their child's performance in the subject, or persistent negative attitudes. This New Zealand study surveyed parents of a small, inner-city primary school about their beliefs and attitudes towards mathematics and mathematics education to provide insights into how parental input into children's mathematical thinking and learning could best be developed.

Research questions were:

1. Are there commonly-held beliefs, attitudes and understandings about the nature and function of mathematics in the parent population?
2. How well do parents feel informed about mathematical practices and curriculum content in primary schools and how do their ideas align with those implicit in curriculum statements and other supporting documents?
3. What role do parents see for themselves in their child's mathematics education?

Theoretical Perspectives

This brief theoretical framework draws from a variety of perspectives concerning parental involvement in mathematics education: the nature and value of education within the home environment; parental attitudes and perceptions of mathematics and links to children's learning attitudes and outcomes; and aspects of parental involvement in mathematics education and school activities.

Merttens (1999) sees a parent's role as crucial to learning, describing it as "the single biggest factor in children's educational success" (p.79). The home environment is seen as a crucial element in the early development of mathematical concepts and educational outcomes (Carr, Peters & Young-Loveridge, 1994; Peters & Jenks, 2000). Graue and Smith (1996), Horne (1998), and Peressini (1998) note the absence of attention paid by researchers to parents and family and their influence on the learner's mathematics education. The need to investigate the relationship between attitudes and "the effect of student, parent and teacher attitudes on mathematics in learning and teaching" was also expressed by the Ministry of Education (1999b, p. 4).

Beliefs such as (a) mathematics is a static body of knowledge (b) people either have mathematical ability or not and (c) people who are good at mathematics are 'really smart', interfere with the process of attaining equity in mathematics in education, according to Allexsaht-Snider and Hart (2001). A belief that mathematical ability is an inherited 'talent' with which you are born is popular among the adult population and it is generally deemed more acceptable to fail in this area than in other curriculum areas. Horne (1998) states "Community reaction to mathematics is that only very few students/adults have true 'mathematical ability', and often children have the impression that only a few are born with it" (p. 125). The perception of the existence of a limited pool of mathematical talent can create a demotivating 'fait accompli' approach to mathematics learning. Fraser and Honeyford (2000) discuss the social acceptability of being poor mathematically and the associated belief that "some people cannot be competent mathematically because of their gifts in other areas" (p. 3). They describe a variety of research studies which highlight widespread feelings of inadequacy and anxiety about mathematics in the British adult population. The tendency for American adults to "openly proclaim their ignorance of mathematics as if it were some sort of merit badge" was observed by USA's National Research Council (1999, cited in Peressini, 1998, p. 567) and in New Zealand the Ministry of Education (1999b) claimed "admitting to being no 'good at mathematics' is still socially acceptable" (p. 4). Other popular beliefs, such as gender stereotyping, can form barriers to learning or restrict access to mathematics opportunities for groups of children which leads to high performance expectations in mathematics for boys and low expectancies for girls (Tiedemann, 2000). It is also relevant to consider the effect of the interaction between such beliefs and a parent's personal experiences with mathematics throughout their own schooling and how "unexamined past schooling experience and fear of failure can drive parents' demands about schooling" (Morse & Wagner, 1998, p. 365). Parental assistance with mathematical activity can also be influenced by feelings towards their own ability to help their child (Bryan, Burstein, & Bryan, 2001).

Eccles (1993, cited in Hall & Davis, 1999) suggested that "parents form impressions of their child's interest and abilities in general on the basis of their own biases. Parents communicate their beliefs and attitudes about math and its utility through their individual practices" (p. 3). In their research, Hall and Davis (1999) claimed that parental attitudes seem extremely influential in the student's performance in mathematics. A link between parental attitudes and perceptions of mathematics in determining not only learning outcomes for students, but also their development of self-efficacy has been suggested by a number of researchers (Cain-Caston, 1993; Lehrer & Shumow, 1997; Tiedemann, 2000). Horne (1998) describes some of the factors which contribute to the formulation of attitudes towards mathematics, noting links with parental expectations, encouragement and attitudes and students' perceptions of these variables.

Parental beliefs about mathematics are regarded by Peressini (1998) as a 'regime of truth' (Foucault, 1980, cited in Peressini, 1998) which can stand in opposition to a school's 'regime' (p.572). Savell and Anthony (2000) describe the 'split' that is evident between home and school learning as a 'chasm' that develops when the home culture differs significantly from the school culture. Peressini (1998) posits alienation of parents from school as a result of a power struggle, claiming that "issues of power are central to parents' involvement in their children's mathematics education" (p. 560). Savell (1998) takes a similar position, "issues of power emerge as being central to any discussion of parental involvement" (p. 111). The apparent lack of knowledge felt and evidenced even by 'high-contact' parents (Savell and Anthony, 2000) concerning mathematics programmes in their schools noted in such studies as McNamara et al. (2000), and Savell and Anthony (2000), can affect attitudes and participation in mathematics.

Thus there appear to be links between parents' attitudes, perceptions and beliefs about mathematics and children's attitudes and performance in mathematics. The research describes ways in which prevalent societal beliefs and attitudes towards mathematics and mathematics education may affect a learner's self-efficacy and performance in mathematics. However there appears to be a lack of research which explores the nature of parental perceptions and attitudes to mathematics and mathematics education in depth to determine whether a mismatch with parental ideas and current directions in mathematics education does exist.

Methodology

A case study approach was taken to explore attitudes and beliefs of the parent population of a small, high socio-economic, largely mono-cultural, inner-city primary school. This holistic approach was used "in order to gain an in-depth understanding of the situation and its meaning for those involved" (Merriam, 1998, p. xii). The study investigated ways in which parents perceived the nature and function of mathematics, aspects of mathematics education, attitudes held about mathematics, and their role in supporting the mathematics education of their child. Although a single case study is not able to produce meaningful generalisations about issues or situations to the wider parent population because it is by definition - 'unique', it is possible to draw some types of 'naturalistic generalisations' (Stake, 1978) where there are similarities in settings or social contexts and problems. The approach served to underscore the complex and implicit nature of beliefs and attitudes, and the way in which they influence one's approach to an issue. It allowed for a variety of ideas to emerge concerning parental perceptions.

Information was gathered in two stages: a questionnaire, followed by a focus group of parents. The questionnaire was constructed in three main sections. The first section 'Mathematics in Your World', asked respondents to consider their own experiences and attitudes about mathematics. The second section 'What Matters in Mathematics', was designed to explore beliefs about the nature of mathematics, ideas about teaching and the curriculum, and attitudes towards educational outcomes for their children. The final section 'Mathematics for Your Children', explored parents' perceptions of their role in assisting their children's mathematics learning. Two copies of the three-page survey were sent home to each of the 54 families represented in the school. The focus group was to comprise eight to ten randomly selected adults who had indicated they wished to be involved with this stage. Focus groups combine well with questionnaires to flesh out issues raised, enrich the data gathered and generate hypotheses and "are particularly suited to the study of attitudes and experiences around specific topics" (Barbour & Kitzinger, 1999, p. 5). The purpose of

the group was to discuss issues raised in the questionnaire and to allow participants opportunities to examine and reflect on their assumptions and ideas about mathematics, allowing for an enrichment of the data gathered in the questionnaire and providing a 'full and thorough knowledge of the particular' (Stake, 1978). Findings from all aspects of the study were discussed with teachers at the school and made available to all school parents.

Results and Discussion

A total of 33 questionnaires were returned out of 108 distributed, some families completing two questionnaires whilst others returned one only. Respondents answered most of the questions in depth, and some added extra comments for various questions.

Although seven people indicated that they wished to attend the focus group (three women and four men) two of the women did not attend, reducing numbers to five. Several of the parents were parents who had a high level of contact with the school and one was a 'new' parent. None of the participants would be classed as 'hard-to-reach' parents (Toomey, 1996). Several days prior to the meeting focus group participants received edited summaries of a selection of questionnaire responses to enable some prior reflection on the issues raised. Ways in which they as parents affect their child's attitudes to mathematics and their main concerns regarding their child's mathematics education, were also discussed. The meeting was led by a facilitator, with the researcher present mainly as an observer and notetaker. Participants were reflective, articulate, animated, and positive about being involved in the study.

Commonly-Held Beliefs and Attitudes About Mathematics

Definitions of mathematics supplied by respondents in the questionnaire contained a variety of ideas, reflecting a breadth of perception of the nature of mathematics and showing an understanding of mathematics involving processes and affective issues as well as content topics. These definitions included such words as: *understand, think, solving, knowing, evaluate, study, relationships, application, systems, investigation, enjoyment, universe*. Words such as 'knowledge' or 'skills' were not present in their responses. Many of the ideas expressed matched well with the definition of mathematics as "a coherent, consistent, and growing body of concepts which makes use of specific language and skills to model, analyse, and interpret the world...mathematics involves creativity and imagination" as described in the New Zealand curriculum document (Ministry of Education, 1992, p. 7). The most common theme in their definitions was the primacy of number within the scope of mathematics. This aligned with the recent emphasis on number, as demonstrated by the implementation of the Literacy and Numeracy Strategy (Ministry of Education, 1999c) and commitment to initiatives such as Feed the Mind (Ministry of Education, 1999d) and the Numeracy Project (Ministry of Education, 2001). Another major group described mathematics as a science or art form.

When asked why parents felt it was important for their child to be proficient at mathematics, the responses fell within four general categories. The largest of these groups described the role mathematics plays in assisting learning and cognitive development. Several references were made to the way mathematics helps children with other aspects of the curriculum, and aids logical and critical thinking and understanding. One respondent wrote "[Mathematics] forms one of the basic educational building blocks of learning". Another group of responses focused on mathematics as being an essential requirement to participate effectively in society—views also expressed in the curriculum statement

(Ministry of Education, 1992, p. 7). Further categories contained ideas involving practical and everyday usage of mathematics, and responses which focused on the importance of mathematics for future career opportunities.

Although most parents in the questionnaire reported using mathematics regularly as part of their everyday home and work life, focus group participants claimed past school experiences with mathematics was a significant factor in forming attitudes. Many of the questionnaire respondents and focus group participants explained that their attitudes towards mathematics had become more positive as adults. Members of the focus group described awareness of the need to pass on positive attitudes towards mathematics, rather than negative ones, to their children. One participant stated, "Probably, the biggest risk for our children is us visiting our prejudices upon them. We must either remain neutral if we can't be positive, but deadly positive if we can be".

There was a general consensus regarding equity issues in mathematics in both the questionnaire and the focus group. One focus group participant made the comment, "In the right environment anyone can learn". Most questionnaire respondents stated that they did not agree with the stereotypical statements placing boys ahead of girls in mathematics ability, or with the view that mathematics ability is hereditary, or that creative people are not good at mathematics. This may have been partly due to the views appearing obvious as stereotypes on the questionnaire form. However it was encouraging to see a majority of the respondents disagreeing strongly with these 'popular' ideas which traditionally encourage inequitable environments for mathematics learning.

Knowledge of Curriculum Content and Current Practices

Many respondents (21 respondents out of 33) indicated that they felt uninformed about the mathematics curriculum and teaching methods in their child(ren)'s school. One questionnaire response was, "I don't know anything about how maths is taught in today's classroom, what level is being taught, what level is being set as a goal for end of a term or year, or what part of the syllabus is being studied". There were a variety of indications that this was a concern of parents and that they were keen to know more. One respondent wrote, "I would, as a parent, like more information on what my children are doing". The questionnaire statement, "I think that the way maths is taught in classrooms today is effective" produced nine abstentions, most of whom wrote comments explaining that they felt unqualified to comment. Focus group participants assumed many of the parents who had judged methods to be effective had based this on evidence provided in yearly school curriculum reporting sessions, results of summative tests, school reports, and teacher interviews. Participants were concerned that they could identify "reasonable expectations" in mathematics over a year for their children, and keen to explore avenues in which further evidence could be sourced to qualify or quantify their child's progress.

Both questionnaire and focus group participants supported use of teaching methods which are consistent with current practices for effective teaching. Parents were concerned that children 'understand' the mathematics, rather than merely going through procedures, and that mathematics had meaning for children through having opportunities to apply ideas to 'real-life' contexts. One focus group parent declared, "They need to translate the symbols into a real-world situation. They need to connect the two". Participants stated that if they "give them a reason for doing it [mathematics]", it increases their child's level of motivation and success. This reinforces current curriculum directions which encourages learning to occur in interesting and realistic contexts which are personally meaningful to learners (Ministry of Education, 1992, p. 11). Focus group participants discussed ways in

which heterogeneous groups can function, suggesting effective ways of structuring a lesson to provide for individual needs. Both questionnaire and focus group participants highlighted the need for enjoyment, positive self-belief, and competition which were seen as important factors in their child's motivation and learning environment.

Parental Roles

Parents were generally positive about helping their child in mathematics (27 respondents agreed or strongly agreed with the statement: "I enjoy helping my child with maths"), and provided many ideas about how they could assist them at home. Descriptions of various ways parents supported their children's learning included such activities as shopping, cooking, measuring, counting, and making comparisons. Another category focused on activities which provided strategies and expanded thinking in mathematics. These included: talking about strategies, reviewing mathematics problems, playing board games, and making connections with music. A major way in which parents felt they could help their child was by being encouraging and positive in their approach. A need to acquire further content knowledge was expressed by several respondents. Focus group participants provided ready examples of ways in which their intervention helped children in mathematics, which included providing practical examples for ideas such as fractions, finding patterns and relationships, rephrasing and rewriting questions, modelling, providing additional practice when necessary, reviewing ideas and reflecting on answers.

Conclusions and Implications

The total of 33 questionnaires returned, representing only a third of the population, meant that it was difficult to make meaningful generalisations concerning parental attitudes and beliefs about mathematics in the school population. The use of the survey and the focus groups perhaps initiated response from a certain 'type' of parent and may have discouraged participation from parents who already feel alienated from the school. These 'hard-to-reach' parents (Toomey, 1996) are often slow to respond to such initiatives and consequently are under-represented in research projects of this kind. Two members of the focus group described how in their household, the questionnaire had been handed on to the adult who was perceived to be 'good at maths'. There was also the possibility of duplication of ideas in the responses, as some families returned both of the questionnaires.

There are some difficulties in gaining accurate data through the use of a questionnaire procedure such as: respondents' failure to understand questions as intended, a lack of effort or interest on the part of respondents, unwillingness to admit to certain attitudes or behaviours, and the failure of respondents' memories or comprehension processes (Foddy, 1995). The impact of these variables was reduced somewhat by the use of the focus group although further limitations may have been incurred by inhibiting factors such as embarrassment or discomfort in expressing one's views openly, although there was little evidence of this in the discussion.

However there were several significant ideas communicated in this study. Throughout the questionnaire and focus group contributions mathematics was defined broadly by participants and seen as pervasive in society, involving practical, meaningful, investigative, and creative aspects. Many of their ideas about mathematics and mathematics education aligned clearly with current directions in mathematics, although most parents in this study expressed both their feeling of lack of knowledge about curriculum content and current teaching methods, and their desire to know more.

Participants indicated it was important for their child to succeed in mathematics, but also to enjoy it and understand what they were doing. Many of them seemed to disagree with popularly-held ideas and stereotypes which restrict their child's access to mathematics. A large group of participants indicated that they held positive attitudes towards mathematics as adults, although some of them had not been positive as children and there was a stated awareness of the impact of negative attitudes on children's learning. Questionnaire responses suggested that a large number of parents within the school are positive about helping their child with mathematics and have plenty of ways in which they support mathematics learning in 'out-of-school' environments. Willingness to ensure that their intervention progresses, rather than hinders, their child's learning was expressed in a number of responses.

This research raises awareness of the need for liaison between home and school on curriculum matters. Findings have the potential to feedback to influence school policy or initiate action which would result in greater quality of mathematical learning for children within the school. The questionnaire and focus group provided a forum for parents to express ideas and frustrations about mathematics and the opportunity to reflect not only on the nature and function of mathematics in society but also on the ways in which they influence their child's mathematical learning. The implementation of additional forums and school information projects could act to inform parents of curriculum content and provide ideas for parents to help their child learn at home.

Although the school in this study had not participated in any recent professional development involving initiatives in numeracy or teaching and learning approaches, many of the views expressed throughout reflect current approaches to learning and teaching mathematics. Responses demonstrated a level of sophistication which challenged preconceptions of the teachers from the school. It is possible that parents had gathered information about mathematics from other sources than the school, including broadcast media and internet websites. Current technology allows open access to websites such as Ministry of Education sites, providing a ready vehicle for communication with parents. It would be interesting to compare the results of this study with parents from schools which have been involved with numeracy projects and with schools from lower socio-economic or from more diverse cultural backgrounds. Knowledge of attitudes and beliefs of parents from a broad range of schools could inform educators as to how to take advantage of parental knowledge and interests, not only in mathematics, but also in other curriculum areas. This would promote further understanding of mathematical ideas, positive attitudes and increased constructive involvement by parents in their child's mathematics education which would ultimately improve their learning: "Practices that bring the school and family closer together are more likely to positively affect children's attitudes toward mathematics" (Ford, Follmer, & Litz, 1998, p. 312).

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