Parents' Perceptions of Their Roles in Supporting Their Child with Down Syndrome Develop Mathematical Concepts

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STATEMENT OF AUTHORSHIP AND SOURCES

I, Theresa Shellshear, do declare:

This thesis contains no material published elsewhere or extracted in whole or in part from a thesis by which I have qualified for or have been awarded another degree or diploma.

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No other person's work has been used without due acknowledgement in the main text of the thesis.

All research procedures reported in this thesis received the approval of the ACU Human Research Ethics Committee.

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Theresa Shellshear

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The parents, who participated in this study and gave freely of the insights, are to be commended for their commitment to this research, and to their ongoing willingness to provide their responses to a wide range of topics. The researcher's understanding of the joys and challenges encountered by this group of parents has been broadened through engaging with the parents in this study. This opportunity to respond to the insights provided by the parents has added a new dimension to research understanding about the important work parents undertake in supporting the mathematics development of children with Down syndrome.

As a teacher in the past, parental involvement was one of the aspects of education that I always encouraged and supported. As the researcher in the present, the insights gained are rewarding and I express my thanks to all the parents who participated and willingly shared their experiences.

To those who read this thesis in the future, and to those who have read chapters in the past, I thank you for reflecting on this important topic of parental involvement and mathematics.

ABSTRACT

PARENTS' PERCEPTIONS OF THEIR ROLES IN SUPPORTING THEIR CHILD WITH DOWN SYNDROME DEVELOP MATHEMATICAL CONCEPTS

Many parents of children with Down syndrome are working with their child to help them learn. Little is known of the roles they play, however, in the development of mathematics concepts. This thesis reports on an investigation of the self-reported perceived roles of these parents and the way in which the perceptions of their roles changed during this study.

The study is situated within the Parent Involvement Process theoretical model first developed by Hoover-Dempsey and Sandler (1997) and revised by Walker, Wilkins, Dallaire, Sandler and Hoover-Dempsey (2005). All data were analysed according to the five parental roles as defined by Cai, Moyer, and Wang (1997). This research adopts a mixed methods methodology. Quantitative data were sourced from existing survey instruments. Twenty-four parents, comprising fifteen mothers and nine fathers, completed surveys before and after an intervention workshop. Rich qualitative data were also collected from the parents' Reflective Diaries, providing the opportunity to explore the parents' roles more deeply and to allow the Parent Voice to emerge and embellish the quantitative data. Of importance in this process was the emergence of the father's voice, often silent in research of this kind.

The findings from this research confirm the effectiveness of an intervention (a "Make and Take" workshop) to support parents in their roles by building new knowledge and strategies that increase their level of participation in their children's development of early mathematical concepts, while also strengthening their level of sense of achievement, confidence and self-efficacy. The outcomes of this research clearly indicate that providing support to parents in their roles can effectively enhance the opportunities for them to make a significant contribution to the learning of mathematical concepts for their child with Down syndrome. The researcher presents the Interconnected Model for data analysis and the Revised Parental Involvement Questionnaire for data collection.

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Chapter 1 INTRODUCTION TO THE STUDY

In recent times, Parental Involvement (PI) in education has become an expanding area for research. In many instances, researchers recognise that parental involvement is a major factor in predicting academic achievement for children (Sonnenschein et al., 2012; Wilder, 2013).

International, national, and state and territory education authorities have developed and implemented a variety of policies that specifically address parental involvement/engagement such as Progressing Parental Engagement, Australian Capital Territory, Department of Education and Training (2016). Schools are currently providing parental support programs as part of their overall policies for engaging with a wide range of families (Auerbach, 2009; Muller, 2012). Research identifying parents as advocates for their children range from those who are gifted and talented (Bicknell, 2014; Stoner & Angell, 2006), those with Asperger syndrome (Harrington, 2011), those with Autism Spectrum Disorder (Stoner & Angell, 2006) and children from low-income families (Durand, 2013; Jackson & Remillard, 2005). To this list, we add parents who have a child with Down syndrome (Buckley & Bird, 1998; Causton-Theoharis & Kasa, 2015; Fox, 2016).

Policies regarding the inclusion of children with intellectual disabilities/difficulties into mainstream classrooms have also been to the forefront in the 21st century. The combination of educational research reports (e.g. *Mapping the Territory*, 2000), reforms, and national and state/territory legislation (*The Inclusivity Challenge – Within Reach of us All*, (2002), Australian Capital Territory, Department of Education and Training (ACT DET); *Students with a Disability: Meeting their needs*, ACT DET (2008); *Disability Standards for Education*, (2006), Australia; *Student Centred Appraisal* ACT DET, (2008) have meant that all stakeholders are required to engage in partnerships with parents to enhance the outcomes for all students with disabilities, including children with Down syndrome. This has had an impact on all stakeholders in varying degrees, and in different ways.

Nichols (2000) reviewed the strategies for parental involvement employed by Australian schools considered exemplary in the provision of support to students with

learning difficulties in literacy and numeracy. She concludes that, “While all of these schools offer opportunities for parental involvement, very few include all the strategies associated with improved educational outcomes which can be drawn from the research literature” (p. 33) and that while all parents are involved to some extent, those who have a child with any learning difficulty may invest more time and energy (Nichols, 2000).

Current theories about how children learn mathematics have had a major impact on curriculum development and teachers’ education practices ((Sousa, 2014). Parental involvement is encouraged by policy, practice and the desires of the parents and yet, there is little educational research literature to provide guidance on how this should be achieved effectively.

Therefore, any research into parental involvement in the learning of mathematics by a child with a learning disability/difficulty will break new ground by highlighting practices that are worthy of consideration.

Problem Statement

This research sets out to investigate the nature of the roles parents undertake in supporting early mathematical conceptual development for their child with Down syndrome, parents’ current perception of their roles and the impact of a parent-focused intervention on their perception of the roles. The researcher has an ongoing interest in the development of early mathematical concepts and the opportunities provided by parental participation. To date, in-school participation has been the main opportunity to observe this contribution along with some opportunities for parent-focused and parent/child workshops in primary mathematics.

This research study was undertaken subsequent to involvement in a parent workshop for mathematics presented by the Australian Capital Territory Down Syndrome Association. The researcher, while preparing some activities for the workshop, realised that few research studies and limited resources were available in the area of mathematics for children with a disability (Geary, 2004; Nichols, 2000; Rousselle & Noe¨l, 2007).

Some studies investigated the role of parental involvement and a child’s mathematical achievement on school entry (Cai, 1999; Cai et al., 1997); others reported similarities and differences in parental roles across cultural groups (Anderson & Minke,

2007; Cai, 2003; Civil & Bernier, 2006). Nye, Fluck, and Buckley (2001) investigated the counting skills of typically developing children and those with Down syndrome.

It was evident, from early discussions with this particular group of parents, that they were very proactive on their children's behalf in all areas of language acquisition. However, very few parents had pursued a similar role for the development of mathematical concepts, although they would have liked to have done so.

Research into all aspects of literacy, including that of parental involvement, far outweighs that for mathematics/numeracy (Bauman & Wasserman, 2010; Clark, 2009; Morgan, Nutbrown, & Hannon, 2009; Nicholas & Fletcher, 2011; Nutbrown et al., 2016). In the majority of reported instances, mothers have been the focus group for both literacy and numeracy (Rose & Atkin, 2011; Silinskas, 2010). Recent research into the role of fathers in assisting the development of their child's literacy has involved specific programs: Cullen (2011) reported on the barriers to fathers' engagement; Potter, Walker, and Keen (2013) conducted a project that supported fathers to engage in their child's transition into formal school, and a literacy intervention program to enhance fathers' literacy skills and strategies for assisting their five-year-old child in the home setting was reported by Saracho (2008).

For typically developing children, language is the first form of formal communication, and parents and educators are aware of the progression of development. In the case of children with Down syndrome, parents are also aware of the importance of early language development for their child. There are motivational factors that influence parents becoming involved in ensuring that their children become literate (Cannon, 2008). Some of these factors could be influential in increasing parental involvement in mathematical activities. The researcher acknowledges the importance of language skills in developing mathematical concepts.

Studies of mathematical development for children with learning difficulties are also limited (Faragher, Brady, Clarke, Gervasoni, & Clarke, 2007; Geary, 2004; Nichols, 2000; Nye et al., 2001; Terrill, 2002). There are many factors that influence the nature of parents' roles at home and in the school environment in supporting the development of mathematical concepts for their children.

Involvement variables were identified by Berthelsen and Walker (2008) using Wave 2 data presented in the "Growing up in Australia" report (2000). Berthelsen and Walker (2008) identified the following variables: the nature of parental involvement, socio-demographic characteristics of families, and the social capital and cultural capital of parents. From their analysis, they noted that "the link between parental involvement and learning outcomes should not be regarded as causal" and that "increased parental involvement may also occur in response to learning difficulties" (p.40).

Down syndrome is a chromosomal disorder that presents prenatal or at birth and has some identifiable characteristic including: physical features (palmar crease on hands, low muscle tone), some health and development challenges (hearing, vision, and respiratory infections) and some level of intellectual disability (Faragher, R. & Clarke, B. 2014).

A publication by the Down Syndrome Association of Queensland, 'Where Do we Go From Here?' (2000, p. 7) translates these as characteristics that may possibly impact on classroom behaviours and learning opportunities – short attention span, short term memory, long term memory, generalisation skills, different developmental pathways and difficulties in thought processing. It is noted that as a consequence, a child may: have had fewer play experiences, be less confident about movement, have less knowledge of rules, have poor body awareness, poor hand-eye coordination, and poor dexterity. From the delay in language developments, a child may: have difficulty with instructions, have poor articulation, have a small vocabulary and have difficulty with leaning in general. These are factors that can impinge on the development of mathematical concepts for a child with Down syndrome.

Hence, parents of children with Down syndrome have been very involved with the development of their child since birth and this places them in an unparalleled position to influence the development of mathematical concepts. Through early intervention programs, parents learn the forms of interaction that effectively support the child's learning at home. The parents are aware of issues related to delays in language development and how these might impact on learning in general, such as short-term memory issues, marked differences between expressive and receptive language acquisition, and a high incidence of errors in recall (Geary, 2004). Couzens and Cuskelly

(as cited in Clarke & Faragher, 2014) explored the influences of working memory on expressive and receptive language facilities and the implications for teaching and learning. Clarke and Faragher (2014) discuss the advances in researchers' understandings of how children with Down syndrome develop understandings of number and argue for "the need to enhance educators' knowledge of the counting principles as tools to see the development of children with Down syndrome in relation to counting… For children with Down syndrome, it may be better if oral counting is not given primacy" (p. 160).

Nye et al. (2001) identified aspects of mathematics that are challenging for children with Down syndrome. In this study (Nye et al., 2001), tasks were administered to typically developing children of the same mental age range as the children with Down syndrome. Procedural counting ability and the conceptual understanding of cardinality were the basis of the tasks that were completed independently and secondly with parental/carer support. In the analysis of the responses Nye et al. (2001) found that:

> typically developing children produced significantly more number words altogether, longer standard number sequences and could count larger sets than the children with Down syndrome. Support from an adult improved performance on the count task significantly for both groups of children, and there was no significant difference between the groups in the degree of improvement, i.e. the zone of proximal development. No significant differences were found between the frequency of children (approximately one third) in each group who used counting to solve the give task, indicating an understanding of cardinality. (p. 68)

While not the focus of this study, the extent to which parents are aware of these research findings continues to be an interesting consideration. For parents of children with Down syndrome, there is a need to know which aspects of their roles have most impact on the development of their child's mathematical conceptual understanding. Of interest here is whether these perceived roles will mirror the roles identified by Cai et al. (1997).

Purpose of the Study

The literature review, which is presented in Chapter 2, indicates that there is an identified need for research I n the specific area of parental involvement in mathematics for children with learning difficulties and this study will add to what little is known about the role of parents with a child with Down syndrome, specifically in the area of mathematical conceptual development. The role of parents is examined from the parents' point of view, including both mothers and fathers, and whether fathers perceive their roles to be similar to that of mothers (Silinskas, 2010). This study also aims to identify factors that may impact on the variation of roles adopted by parents and for each individual parent over a period of time and as a result of intervention. This study was undertaken in two phases: Phase 1 – Pre-intervention and Phase 2 – Post-intervention. The Parent-focused Intervention implemented in this study was a "Make and Take" workshop where parents created resources to meet the needs of their child.

This research also aims to investigate the parent self-reported responses to their interaction in the home environment regarding the development of mathematical concepts. Although the identification of this role is challenging in the context of a parent of a typical child, in the case of parents who have a child with Down syndrome, it might be expected to be more challenging. Hoover-Dempsey and Sandler (1997, p. 14), in their examination of parental involvement, noted that:

> While parents' role constructs would appear to be created from the host of social values held by the significant groups to which they belong, parents' ideas about child development, child-rearing and child outcomes would appear to be among the most important components from the perspective of the parent involvement process. (p. 14)

The importance of Hoover-Dempsey and Sandler's (1997) research has been pivotal to the selection of the conceptual framework for this research study.

Methodology

In this study, a mixed mode research methodology was undertaken within two regionally-based groups of parents located in Sydney and in Canberra. There are various aspects to be considered in selecting mixed mode as a methodology (Merriam, 1998). In relation to this research, the challenges may include: the rigour of the procedures and protocols; the possibility of missed opportunities as there are no predetermined structures; the issues involved in collecting and analysing the spread of data; the amount of writing involved; creating survey/questionnaires; journaling by researchers and by parents; selecting the physical manner of data collection*;* the reading and analysis of the data; "lack of guidelines in constructing, defining and in how to go about analysing data … the success of which depends on the investigator's sensitivity and analytical powers" and "the 'unsaid issues' from the participants" (Merriam, 1998, p. 20).

Qualitative and quantitative data were collected through a variety of means: Surveys/questionnaires, Participant Group Sessions, and Participant Journaling. Discussions during the Participant Group Sessions, including an intervention "Make and Take" were digitally recorded and transcribed by the researcher.

The surveys, initial and final, and the questionnaires consist of a variety of statements rated on a scale based on published research into parental roles (Anderson & Gold, 2006; Blevins-Knabe & Musun-Miller, 1996; Cai, 2003; Cai et al., 1997; Hoover-Dempsey & Sandler, 1997; Walker et al., 2005). Open-ended questions are also included. These were completed by each parent individually. This provided an opportunity to document the possible emerging differences for mothers and for fathers in their perception of their roles.

The findings identify the parents' current roles and how this may be enhanced through proactive involvement in this research project, the parent-focused intervention of the participatory workshops and through ongoing discussion.

Research Questions

The researcher used the identified instruments to work with two groups of parents who have children with Down syndrome to investigate:

1. What is the nature of the roles parents engage in, to support their child with Down syndrome, develop mathematical concepts?

2. To what extent do mothers and fathers perceive their roles differently?

3. What is the impact of intervention on the parents' perception of their roles?

Conceptual Frameworks

The initial literature search emphasised the paucity of research in all facets of this research study. Therefore, the linking of the research problem to the wider body of relevant research was challenging.

However, research into parental roles in education has resulted in the development of frameworks such as "The Model of Parental Involvement Process", (Hoover-Dempsey & Sandler, 1997), and "Ecologies of Parental Engagement in Urban Education" (Barton, Drake, Perez, St Louis, & George, 2004). Other researchers investigated specific aspects: the concept of funds of knowledge within a socio-cultural framework Civil and Bernier (2006); research on parental involvement in mathematics education (Wilder, 2015), mothers as learners of mathematics (Civil, 2001), while yet others (Jackson & Remillard, 2005) investigated the challenges for Afro-American mothers in supporting their children with the learning of mathematics.

Other research which had an influence on this research project include: Cai (2003), who investigated in-home parental support in mathematics learning in a cross-national study, and Blevins-Knabe and Musun-Miller (1996) and Skwarchuk (2009) who investigated number use at home.

The conceptual framework provided by the revised model (Walker et al., 2005), was selected as the conceptual framework for this study. The constructs identified provided

an opportunity to collect data on aspects that were relevant to the parents. The parents' "voice" was to be the essence of this study.

<table>
<tr><th colspan="8">Revised Theoretical Model of the Parental Involvement Process - Walker et al. (2005)</th></tr>
<tr><td rowspan="2">LEVEL 2</td><td colspan="7">Forms of Parental Involvement</td></tr>
<tr><td colspan="3">Home Involvement</td><td colspan="4">School Involvement</td></tr>
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<tr><td>Parental Role Construction</td><td>Parental Self-Efficacy</td><td>General School Invitations</td><td>Specific Teacher Invitations</td><td>Specific Child Invitations</td><td>Skills and Knowledge</td><td>Time and Energy</td></tr>
</table>

Figure 1.1: Revised model - Walker et.al. (2005)

For the purposes of this study, the conceptual framework "Parental Involvement: Model Revision through Scale Development" revised by Walker et al. (2005) was implemented with complementary data collected through surveys from Cai (2003), Blevins-Knabe and Musun-Miller (1996), and Skwarchuk (2009). Questionnaires were developed by Walker et al. (2005) to provide data relating to the constructs involved in the parental involvement process. These were also used in this study.

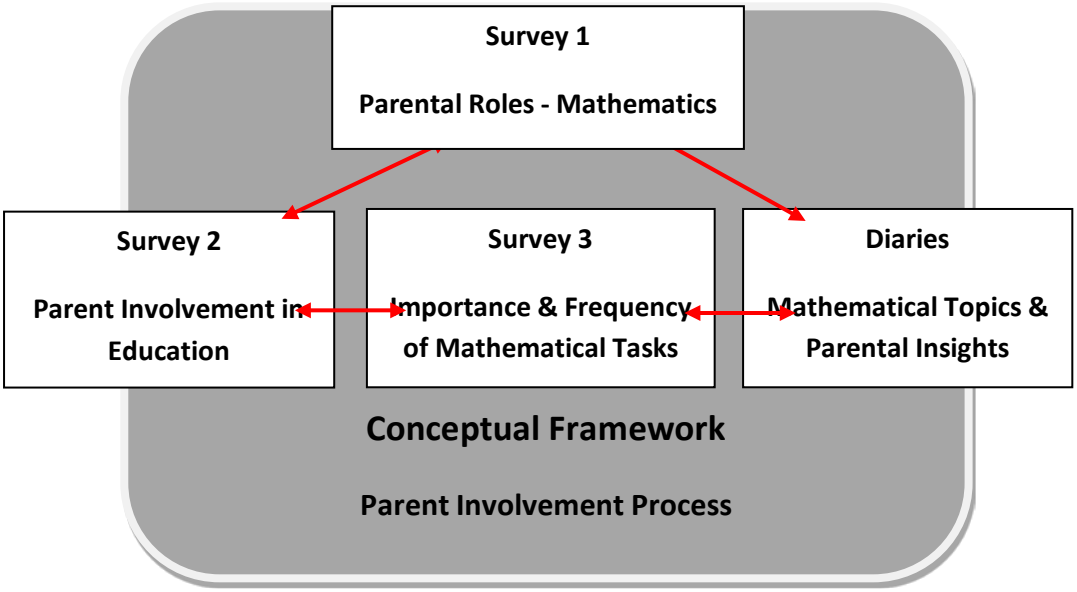


Figure 1.2: Interrelated Connections among Data Collection Instruments

Parental Involvement Questionnaire (PIQ)

The Parental Involvement Questionnaire (PIQ) was developed by Cai, Moyer, & Wang (1996) to identify roles parents may undertake in supporting their child develop mathematical concepts. This is discussed further in chapter 2.

Parent-child Interaction

Blevins-Knabe and Musun-Miller (1998, 2006) investigated the relationship between the frequency of a variety of number activities occurring at home for preschool and kindergarten children, tasks undertaken with their parent and their numeracy performance. Reporting on the initial study, Blevins-Knabe and Musun-Miller (1996, p. 35) stated that mothers reported on the level of engagement in certain activities over a period of one week. There was a positive correlation between the frequency of the number activities that parents reported for their children and parental participation in the same activities. In the second study, the frequency reported by parents correlated with the children's achievement in early number assessments.

Skwarchuk (1997, p. 189) used these same items to investigate relative importance and frequency of these parent-child interactions in an urban setting. In this study, the introduction of resource materials, a diary component and a videotape play session were also involved. The findings were discussed in terms of educating parents about incorporating numeracy concepts.

Definition of Terms

While there is a continuing discussion about how Parental Involvement should be defined as it differs if taken from the parents' perspective or from the educators' (Anderson & Minke, 2005) and the related constructs, the researcher has adopted the following definitions for role construction and self-efficacy from Hoover-Dempsey et al. (2005).

Parental Role Construction

Parental role construction is defined by Hoover-Dempsey et al. (2005) as:

> Parents' beliefs about what they are supposed to do in relation to their children's education and the patterns of parental behavior that follow those beliefs. … Role construction for involvement is influenced by parents' beliefs about how children develop, what parents should do to rear their children effectively, and what parents should do at home to help children succeed in school. Role construction is also shaped by the expectations of individuals and by groups important to the parent about the parent's responsibilities relevant to the child's schooling (p. 107).

This is the definition used in this study.

Parents' Sense of Efficacy for Helping the Child Succeed in School

Self-efficacy, like role construction, is socially constructed. Bandura (as cited in Hoover-Dempsey et al., 2005) suggests that it is grounded in personal experiences in four major domains:

> personal mastery experiences (success in achieving goals in the given area), vicarious experiences (observing similar others' success in achieving goals in the area), verbal persuasion (encouragement from important others that one is capable of successful performance), and physiological arousal (physical and affective states that individuals process as information about the importance of given goals and personal ability to achieve them) (p. 109).

The issue of parent aptitude and attitude towards mathematics was examined to explore the impact on self-efficacy.

Social Networks

Current research has raised awareness of the importance of social networks in parental involvement (Barton et al., 2004; Sheldon, 2002; Skwarchuk, 2009). Social networks are identified as contextual factors that impinge on the level of Parental Involvement (PI). In a study by Sheldon (2002), analyses showed that the size of parents' social network predicted the degree to which parents were involved at home and at school. Furthermore, different networks predicted different types of parent involvement.

In this current study, social networks are deemed to be “spaces where parents may interact with others about the concerns of schooling” (Barton et al., 2004).

Context of the Study

The literature review has influenced the scope and methodology of this research project.

Surveys such as those developed by Blevins-Knabe and Musun–Miller (1996), Anderson Downer and Gold (2006) and Hoover-Dempsey and Sandler (1997) have reported on findings from families and their involvement in their child’s education that directly relate to the parameters of this research study.

This research project involves two groups of parents. The parents, who were invited to participate in this research project who have children with Down syndrome attending a primary school and who live either in the Australian Capital Territory (or in the local environs of New South Wales) or those based in and around Sydney. They were initially contacted through correspondence with the local Down Syndrome Association of the ACT, and through the Down Syndrome Association of NSW. It was important, wherever possible, for both parents to participate, as the voice of both parents is one of the major foci of this research.

Intervention in this research project relates to a particular intervention for parents. Researchers, such as Jackson and Remillard (2005), Peressini (1998), Holmes and Tait-McClutcheon (2011), Fishel and Ramirez (2005) and Maher (2008), have conducted research into various aspects of intervention with parents and with students in the area of mathematics. These findings were considered by the researcher in undertaking the current research. Subsequent to this current study, further research has been undertaken in the area of parent-focused intervention.

Historical Context

Prior to the 1970s, children with Down syndrome were either institutionalised or were placed in segregated, special educational facilities. In these situations, there were very limited expectations in regard to educational outcomes for these children.

Buckley and Bird (1998, p. 6) state that although the US 1993 Education Act has been implemented, very few schools "embrace an inclusive philosophy and actively manage change". For those authorities where change was occurring, "it has received much of its impetus from effective lobbying by parents of children with disabilities and special educational needs".

Since the Salamanca Statement, issued at the UNESCO World Conference on Special Needs Education in 1994, there has been a major shift in the policies relating to the inclusion of children with disabilities into mainstream schooling.

In Australia, the Disability Standards (2006) intended to provide students with a disability the same access to education as other students. In the Australian Capital Territory (ACT), the policy statement, *Students with a Disability: Meeting Their Needs* (2008, p. 1), states:

> 1.1: ACT public schools are required to make reasonable adjustments for students with a disability at the time of enrolment and during the course of their education, ensuring they have the support they need to successfully access and participate in the school curriculum, programs and activities in the company of their same-aged peers (p. 1).

Parents have been the strong advocates of this change. In regard to parents involved in this research project, the affiliation through the Down syndrome associations has provided a strong voice for educational inclusion and better outcomes on behalf of their children.

Contemporary Context

Government, community, school and families are essential elements in creating partnerships that result in effective outcomes. There is already a small body of research in this realm. Berthelsen and Walker (2008) reported Reynolds and Clements' (2005) findings that: "school programs that provide support and resources for parent involvement in their children's schooling yield greater and longer lasting benefits than many efforts that consume a large share of public educational spending, such as smaller class sizes and after-school programs" (p. 40). They also reported that "researchers

cannot necessarily assume that parental involvement is always positively associated with children's learning. Increase d parental involvement may also occur in response to learning difficulties" (p. 40).

It is noted (Buckley & Bird, 1998, p. 5) that partnerships formed in early intervention programs and in preschool settings do not always translate when the child with Down syndrome moves into primary school.

The Participants

The participants were a specific group of parents; they have children with Down syndrome, they are members of their local Down Syndrome Association, and they have an expressed interest in exploring the development of mathematical concepts with their child. The findings represent the perceptions of these parents only.

The Researcher

The researcher has extensive experience working in primary school settings and was aware of the expected outcomes for typically developing children. Parent participation in her classrooms had always been encouraged and concomitant parent information workshops provided. The use of technology has enabled the researcher to employ relevant tools to support the recording and analysis of data, and present valid findings.

Limitations

There is likely a bias in this study due to the fact that the participating parents are already highly motivated and involved in their child's education. The "hard-to-reach" parents may perceive their roles in a different way.

Kervin et al. (2006, p. 72) identifies issues that could present as limitations. He states that "researchers need to maintain a strong chain of evidence and to employ other strategies to maximise the credibility of the research". The number of responses in the second phase of data collection was less than in the first phase and hence narrowed the scope for comparisons. In the analysis of the data, the researcher was the sole instrument for the collection, analysing and interpretation of data and may have been at risk of

allowing personal bias to interfere and may have overlooked relevant connections. The extent to which the findings may be generalised to others will not be determined.

Significance of the Study

This research focuses on the nature of the role of parents. Do they monitor, motivate, provide for or teach their child? Does the nature of the role change as a consequence of intervention?

Research in the area of mathematical conceptual development for children with learning disabilities is a growing field. Parents who have a child with Down syndrome and who are proactive in supporting their child have little research evidence to draw upon for mathematics. Research into literacy for typical and atypical children is readily available with many programs being developed and accessible to these parents.

While implementing a structure, such as Hoover-Dempsey and Sandler's (1997) conceptual framework to shape the collection and analysis of data, this research seeks to contribute findings that are relevant to the community of learners in mathematics with intellectual disabilities and to the roles their parents play.

Currently in Australia, many children with Down syndrome are enrolled in regular primary schools. This has come about, in part, through the strong lobbying of parents. It is expected that these children will be supported in their learning and that this support will meet their needs. The majority of primary schools already have literacy intervention programs in place. Is the same true the mathematics? There is little or no evidence of this being so.

Each time research is undertaken in the field of mathematical conceptual development, parents and teachers are able to focus their efforts more effectively. If this research can demonstrate that certain parental involvement roles within the home setting have a positive impact on the educational outcomes for their child, then a greater emphasis can be placed on the importance of the home/school relationships in promoting those roles.

Chapter 1 Summary

This chapter presents the focus of the study and the range of aspects to be considered. The purpose for this research study was to investigate current findings regarding parental roles as demonstrated through their involvement in mathematics education, to provide an opportunity for the parents' voice to be heard, to identify any changes in perceived roles as a consequence of parents being involved in an intervention process and to expand the researcher's knowledge about the challenges parents face in supporting the mathematical conceptual development for their child with Down syndrome. Of further interest is the extent to which these parents are aware of the current research findings in the area of mathematical conceptual development.

Parents of children with Down syndrome are strong advocates in the educational process. These parents are well-versed in the development of literacy skills. They have invested a great amount of time and energy into providing resources that support speech development, as well as reading and writing skills. To have the same dedicated support directed at the development of mathematical concepts would be highly beneficial. For many children with Down syndrome, the development of numerical concepts is a great challenge. Parents have recognised this challenge and have been willing to commit themselves to supporting this project.

The desired outcome was that parents would be better informed of the possible strategies and approaches, the available resources and how these can be implemented in an enjoyable and supportive environment within the home.

The methodology for this project has been identified as mixed mode and, while alluded to here, will be expanded upon in chapter 3.

Pre-existing structures and surveys/questionnaires that were used to collect the quantitative data concerning parents' perceptions of their role in supporting the development of mathematical concepts for their child who has Down syndrome have been identified and the relevant definitions presented.

Organisation of the Thesis

The first chapter of the study has included an introduction to the problem, statement of the problem, methodology, purpose of the study, theoretical frameworks, definition of terms, context of the study, limitations, significance of the study and a chapter summary.

The next chapter is the Literature Review which covers research relevant to the roles parents undertake in supporting the education of their children, The Model of Parental Involvement Process, identification of research questions, the range of data collecting instruments, the role of fathers and interventions for parents in the area of mathematics.

In chapter 3, Methodology, the research design and methodology are presented. The reasoning behind selecting mixed mode methodology is explored in depth. The processes undertaken for the study are presented in a comprehensive manner, as are the instruments used to collect and analyse data.

Chapter 4, Analysis of Phase 1 Data, addresses the data analysis of the pre-intervention data from each of the instruments – PIQ survey, Cai et al. (1997); The Parental Involvement Process, Walker et al. (2005); the frequency/importance of mathematics activities in the home, Blevins-Knabe (1996); and the Parent Journals, Skwarchuk (2009) for all the parent participants.

Chapter 5, Analysis of Phase 1 and Phase 2 Group Data, addresses the data from the three surveys and the diaries but from the perspective of a small group of parents, mothers and fathers of two children, considering both pre- and post-intervention phases.

Chapter 6, Analysis of Individual Parent's Phase 1 and Phase 2 Data, analyses the data from the four parents identified in Chapter 5 but from an individual perspective with respect to pre- and post-intervention responses.

The final chapter, Findings, Conclusions and Recommendations, presents the collated findings from these instruments to answer the research questions and relates those findings to the overall conceptual framework as presented by Walker et al. (2005).

This chapter also presents a synopsis of the study including a summary, conclusion and future recommendations.

Chapter 2 LITERATURE REVIEW

The Literature Review influenced many aspects of this study including elements of the methodology and the data collecting instruments as well as the scope of this research project. The initial literature search emphasised the paucity of research in many facets of this research proposal.

The purpose of this study was to investigate the perceived parental role in supporting the development of mathematical concepts for children with Down syndrome. This chapter provides a review of research literature pertaining to the various aspects of this study.

The researcher identified keywords to support the literature search. These included: parental involvement, support, engagement in their children's education; parents' decision making, parental role construction, parents' self-efficacy, intervention for parents, learning difficulties in mathematics, early intervention, and inclusion policy -- historical, contemporary.

Parental Involvement in Education

Research into parental involvement in education often investigates specific groups or compares cultural groups; for example: African American, (Huang & Mason, 2008); Pakistani and Anglo, (Abreu & Cline, 2005); Latino, (Civil & Bernier, 2006); High SES in NZ, (Maher, 2007); American and Chinese, (Cai, 2003); Low SES, (Smith & Brown, 2005); ASD, (Stoner et al., 2005); DS new entrants, (Rietveld, 2005); Dyslexia, (Henderson, 2001); Autism, (Birkin, Anderson, Moore, & Seymour, 2004); Mathematically gifted, (Bicknell, 2006; Bicknell, 2014); Preschool families, (Clarke & Robbins, 2004); Greek and Canadian parents, (LeFevre, Polyzoi, Skwarchuk, Fast, & Sowinski, 2010).

Each of these investigations provides an added value to the knowledge base. In some instances, aspects of the methodology, including data gathering instruments, methods of recording and analysing data did influence some aspects of this research

project that investigates the perceived role parents undertake in developing mathematical concepts for their child who has Down syndrome.

Parental Involvement Defined

Defining Parental Involvement (PI) broadly, Gage and Workman (1994) stated: "Our understanding of parental involvement needs to be on a continuum that allows for parents' participation in a variety of levels and through a wide variety of activities" (p. 77). Researchers in the area of Parental Involvement present a range of perspectives to be considered in this study.

Parents' Voices and Parents' Presence

Findings from research into parental involvement are usually reported by persons other than parents. Parents' voices are rarely heard, even when the title of the article is "Parental Involvement in Mathematics: A focus on Parents' Voices", Civil et al., (2003). They are heard within the structures of the teachers' voices.

McKenna and Millen (2013) present a hypothetical model for parental engagement. From their perspective "Parent engagement must include two central components: parent voice and parent presence" (p. 11). Their definition of parent voice varies from encompassing parents expressing their thinking to also including parents' concerns or frustrations. They identify that "the goal of parent presence is to build the social and cultural capital of children, both inside and outside of formal educational environments" (p. 13).

One of the few instances identified where the focus was on the parents' voice, was reported by Huang and Mason (2008). In their study, "Motivations of Parental Involvement in Children's Learning: Voices from Urban African American Families of Preschoolers", they conclude that: "Parents' motivations to be involved in their children's learning evolved in three themes: (a) parents need to develop relationships; (b) parents need to influence their children's learning; and (c) education is the key for children to achieve success" (p.24). They also identified three types of motivational needs as identified by McClelland (1987): "(a) the need for affiliation (nAff), (b) the need for power (nPower), and (c) the need for achievement (nAch). According to McClelland (1987),

people have either one of these needs or a combination of these three needs, which motivate them toward a certain pattern of behavior" (p. 22).

Civil et al. (2003) reported in "Parental Involvement in Mathematics: A Focus on Parents' Voices" that while parents were engaged in the large scale Math and Parent Partnerships in the South-West (MAPPS) project, they expressed anxiety in relation to the changes in the approaches to teaching and learning mathematics. As part of this bigger project, a variety of roles was presented including parents as learners, as teachers, and as parents. In this 2003 project, both parents' and teachers' responses were sought. The authors noted: "Teachers' perceptions towards parental involvement may have changed as an outcome of this project from one where parental involvement was largely seen as deficit, to view parents as a resource" (p. 23).

The current research will privilege the voice of this particular group of parents who have children with Down syndrome attending a primary school. Of particular interest is the role of fathers in supporting the mathematical development for the child with Down syndrome. The findings may indicate the extent to which fathers perceive their role as being any way different to mothers. The incidences where there is any mention of fathers' involvement in supporting their child's learning are very limited (Bauman & Wasserman, 2010; Cullen, 2011; Fletcher & Silberberg, 2006).

Models of Parental Involvement

This literature review has identified a range of structures and frameworks of parental involvement that are worthy of consideration as each contributes to the selection of the chosen model. Some models were discarded as the elements were outside the field of the study.

The models will be presented briefly here and the selected model will be discussed fully in chapter 3.

Epstein Model

Epstein's (1995) Framework of six types of involvement including parenting, communicating, volunteering, learning at home, decision making and collaborating –

forms the underlying structure for some research. Sheldon (2002) investigated the extent to which parents' social networks and beliefs are predictors of parents' involvement in their child's education. In this study, Epstein's (1998) six types of school, family and community partnerships are separated into two categories: "1. Parental involvement at home and 2. Parent involvement in school" (p. 302). Social networks were a focus of this study and acknowledged that "Parents are social actors and maintain social networks that may affect the role they play in their children's education" and also that "different networks predicted different types of parent involvement" (p. 301). Sheldon (2002) also noted the contribution of parent involvement to student success from other studies and suggests that, previously, researchers studying the motivation for involvement have argued "that people are more likely to engage in activities in which they believe they can be successful" (p. 303).

In a later study, Sheldon and Epstein (2010) presented their findings from a longitudinal study where they examined connections between parental involvement and students' achievement in mathematics. They noted that "the changes to mathematics education have positioned parents on the sidelines" (p. 196).

Jackson and Remillard (2005) presented initial findings for a specific parent group, African American mothers, with regards to their role in engaging with mathematics with their children. Data were collected from in-home interviews that were subsequent to activity focus groups, family math evening observations, and the parent mathematics course. These data were viewed through the lens of Epstein's six types of involvement (Epstein, 1998). Jackson and Remillard (2005) recognise that their perceptions of parent involvement may be different from other researchers. Both school and home were to be examined. What parents do to support their children, the contexts within which they make such choices, and their perceptions of the actions they choose to take on behalf of their children, were the basis of their study. Involvement in children's learning, involvement in children's schooling and active presence in the school were all considered in this study. They take a broad parent-centric view of parent involvement rather than one that is school-centric. The role of advocate for their child's learning, and to this end seeking opportunities in learning outside of school, was evidenced throughout the study.

Assisting with homework, specifically for mathematics, was one way of monitoring their child's progress. The purchase of educational materials, including games, as well as initiating informal activities with a mathematical basis were all reported by these mothers as a way of supporting the learning of mathematics.

From a different perspective, Jackson and Remillard (2005) see parents as intellectual resources for their children's learning rather than deficits that are resistant to change. They examined how African American mothers construct their roles in their child's mathematics education. In summary, Jackson and Remillard (2005) noted that to reconceptualise parent involvement, consideration must be given to "the importance of examining what parents do to support their children, the contexts in which they make such choices, and their perceptions of their actions they choose to take on behalf of their children" (p. 67).

Ecologies of Parental Engagement Framework

Barton et al. (2004) proposed the Ecologies of Parental Engagement (EPE) framework where they considered not only "what parents do to engage in schooling but also how parents understand the *hows* and *whys* of their engagement" (p. 3). They use the term "ecologies" because: "it focuses on parents in relation to their environment. Another focus is on the word "engagement" rather than "involvement" because involvement has been used to describe things parents do. We use the word "engagement" to expand our understanding of involvement to also include parents' orientation to the world and how these orientations frame the things they do" (p. 4). The focus for this particular study was science. They examined school-based academic spaces and community spaces that are shaped by rules and expectations and that, in engaging in these spaces, parents' beliefs expressed and actions undertaken are "framed by the capital they bring to any given space" (p. 5). From their stance, parent involvement may have been from a deficit viewpoint, where little or no account is taken of networks or resources available to parents.

Engagement was defined by Barton et al., (2004) as "a set of relationships and actions that cut across individuals, circumstances, and events that are produced and bounded by the context in which that engagement takes place" (p. 6).

Learning Facilitation Mode

Eloff, Maree, and Miller (2006) investigated how parents of Grade 1 South African children help them acquire mathematical skills and knowledge. The focus was on "the method of primary learning facilitation mode that parents utilised in order to introduce their children to mathematical concepts" (p. 318). The facilitation methods explored were: "dialogue, example, instruction and play (Snyman & Kuhn, 1993, p. 38)". The primary method and frequency as used by the parents were investigated with a small group of parents. Semi-structured interviews were conducted according to a questionnaire, and qualitative and quantitative data were analysed for frequency and for significant themes. Dialogue (49%) was identified as the primary method, with use of example (32.7%). Frequency of play (6.1%) and instruction (12.2%) were determined to indicate an under-utilisation of these particular methods.

Parental Involvement: Parental Roles

Cai (2003) undertook a search for studies related to parental roles. She cited Eccles and Harold's (1993, p. 88) five variables that assess the level of involvement of parents with both schools and their children's teachers. These are monitor, volunteer, involvement, progress, and extra help (p.88). Cai also cited Haynes and Ben-Avie's (1996) three tiered model: "(1) participating on the school's planning and management team, (2) helping in classrooms or sponsoring and supporting school programs, and (3) generally participating in school programs (p. 88). While researching parental roles, Cai (2003) found that very limited research had been undertaken into parent roles with mathematics in the home situation. The earlier studies undertaken by Cai et al. (1997, 1999) identified the five roles of parental involvement in relation to mathematics in the home setting. These are Motivator, Resource Provider, Monitor, Mathematics Content Advisor and Mathematics Learning Counsellor. Reporting on the 1999 study, Cai (2003) identified that the indirect roles of "motivators, resource providers, and monitors seemed to be the most important predictors of students' mathematics proficiency and performance" (p. 89).

Table 2.1: The Five Roles - Cai et al. (1997)

	Parental Role	Description
Emotional & Resource Support	Motivator	Parents provide emotional support for students learning.
	Resource provider	Parents play the role of resource provider by providing an appropriate place to study, relevant reference books, and/or access to resources.
	Monitor	Parents monitor their children's learning and progress at home.
Direct Educational Support	Mathematics content advisor	Parents provide advice to their children on mathematics content.
	Mathematics learning counsellor	Parents understand their children's current situation, learning difficulties, potential, needs and demands, and provide appropriate support to help their children overcome their learning difficulties.

These roles are the focus for this study and will be explored further in Chapter 3.

Each of these models was considered as a framework for the current study but was deemed to be wider in scope than required in this instance or less relevant to this group of parents. The findings from other researchers into aspects of parental involvement (Anderson & Minke, 2007; Bartel, 2010) were taken into account when determining the methodology and the approaches to analysing data.

The Conceptual Framework

Hoover-Dempsey and Sandler (1995, 1997) presented a comprehensive model that examined parental involvement from parents' perspectives. The model delineates five levels that link parents' initial decisions to become involved in their children's education with student outcomes.

The first two levels of the model address parents' decision-making processes and the upper levels of the model (Levels 3–5) outline the ways in which parental involvement may positively affect student achievement. According to this 1997 model, parents make an initial decision to be involved in their children's education according to their beliefs

(i.e. role construction, sense of efficacy) and the general opportunities and demands for involvement from the school and their children (Level 1).

MODEL OF THE PARENTAL INVOLVEMENT PROCESS		
Level 5:	**Child/student outcomes**	
Skills and knowledge	Personal sense of efficacy for doing well at school	
Level 4:	**Tempering /mediating variables**	
Parent's use of developmentally appropriate involvement strategies	Fit between parent's involvement actions and school expectations	
Level 3:	**Mechanism through which parental involvement influences child outcomes**	
Modelling	Reinforcement	Instruction
Level 2:	**Parents' choice of involvement forms influenced by:**	
Specific domains of parent's skill and knowledge	Mix of demands on total parental time and energy [family, employment]	Specific invitations and demands for involvement from child and school
Level 1:	**Parent's basic involvement decision, influenced by:**	
Parent's construction of the parental role	Parent's sense of efficacy for helping children succeed in school	General invitations and demand for involvement from child and school

Figure 2.1: Model of the Parental Involvement Process Hoover Dempsey and Sandler (1997)

The three crucial factors identified by Hoover-Dempsey and Sandler (1997) were: "role construction – having beliefs about what is important for their children's success, self-efficacy – the extent to which parents believe they can have a positive effect on their children's education, and invitations and opportunities – the parents' perceptions that the school and their children want them to be involved" (p. 3). General opportunities and demands are characterised as generic invitations from the child and the school, which indicate that parents' involvement is desirable and valued. Those general invitations (Level 1) were differentiated from specific invitations from the child and teacher, which appear in Level 2 of this model. Hoover-Dempsey and Sandler (1997) also note that "the involvement process finds its end in this model in its influence on the child's educational outcomes, most notably the child's knowledge, skills and personal sense of efficacy for succeeding in school" (p. 32). *Role construction* in this model means parents' ideas about what they should do in relation to their children's schooling (i.e. their job as a parent). They found that parents with high role construction support a high level of involvement in

their children's education. *Parents' sense of efficacy* is based on Bandura's (1996) theory of self-efficacy and refers to parents' beliefs that their involvement in their children's schooling will positively affect their children's learning and school success. Furthermore, parents with a high sense of efficacy for parental involvement believe that they can enact the behaviours that will result in these positive outcomes.

This framework has been tested by researchers such as Anderson and Minke (2007) in regard to its usefulness as a tool for examining home-based and school-based involvement. It lends itself readily to hypothesis testing. Also, the model captures several important processes that have been at least partially supported in the qualitative and quantitative literature.

Anderson and Minke (2007) conducted a study into parent decision-making using the Hoover-Dempsey and Sandler (1995, 1997) model. In their 2007 study, they noted that there were differences in defining involvement as either "community-centric" or "school-centric" depending on whether the parents' or teachers' viewpoint was being considered. They noted that their study sample included "a high percentage of minority parents, who were traditionally underrepresented in research" (p. 317). The first two levels of the original model were used by Anderson and Minke (2007) in their study to solely determine the parents' perceptions of their involvement. This included role construction, self-efficacy, resources, specific teacher invitations and parent involvement practices. They also implemented Sheldon's (2002) 18-item scale to measure role construction as it only explored parents' beliefs about their role in their child's education. A five-point Likert-type scale was used: 1: strongly disagree to 5: strongly agree. Data were collected on the other constructs within levels one and two using a range of surveys including those from Hoover-Dempsey et al. (1992), The Family Resources Scale from Dunst and Leet (1987), and the Family Involvement Questionnaire from Fantuzzo, Tighe and Childs (2000). Anderson and Minke (2007) noted that while "Walker et al. (2005) reported that specific invitations from the child were the strongest predictor of parents' home-based involvement" (p. 320), the results of their current study identified the importance of teacher-parent relationships as the most important contributing element

for parental involvement. They also noted that their findings indicated that parents' resources did not influence their involvement decisions.

In an international context, Lavenda (2011) used the original Hoover-Dempsey and Sandler (1995, 1997) model to compare this model's fit for a large study of the high school students of the two major populations in Israel. As highlighted by Lavenda, "Since both populations have their own school systems, with differences in language and traditions practice, this study includes natural controls for cultural differences between minority parents and the majority-run educational system. This has an advantage over previous studies, many of which did not control for direct minority-majority relationships" (p. 929). In this instance, a self-reporting questionnaire was based on the one developed by Walker et al. (2005) with minor adjustments for the age group and included all elements of this revised model as well as demographic information. In analysing the data, parental involvement was the dependent variable. It refers to the schools/home involvement, as passive or active involvement and influences child or entire school. The independent variables were parental role construction and self-efficacy, invitations, and life contexts. For both samples, teacher and child invitations had the strongest direct effect on parental involvement. All other factors in the model had a less significant effect. In conclusion, Lavenda (2011) stated:

> the findings imply that programs and interventions aimed at promoting parental involvement could be implemented in diverse settings, particularly in light of ethnic affiliation and SES level. Programs that have shown success in one culture would like to show good results with other populations from different cultures or in socio–economic backgrounds (p. 934).

The Revised Model

In a parallel study, Walker et al. (2005, p. 87) reported on an examination of the first two levels of Hoover-Dempsey & Sandler's (1997) model. To this end, role model construction and self-efficacy were presented as an overarching idea: parents' motivational beliefs and a second construct focusing on parents' perceptions of invitations for involvement from others. In their study, parents' perceived life context encapsulated parents' perceptions of their available time and energy, and specific skills

and knowledge for involvement. Thus, this framework has evolved from a psychological perspective to an analytical one.

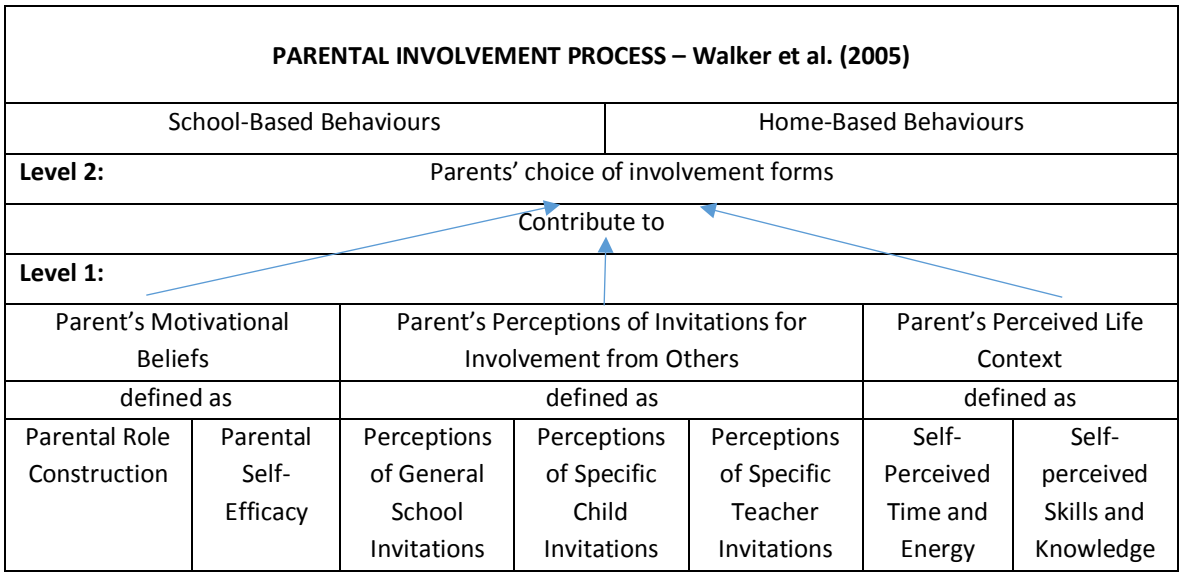


Figure 2.2: Revised Model of Parental Involvement Process - Walker et al. (2005)

Green, Walker, Hoover Dempsey, and Sandler (2007) used the revised model by Walker et al., (2005) to predict types and levels of parental involvement from a large group of ethnically diverse parents and to examine the relative contributions of the various constructs to parents home-based and school-based activities. They state: "in general, parents who hold an active role construction were more involved in their children's education than parents who hold less active beliefs" (p. 533).

Walker, Ice, Hoover-Dempsey, and Sandier (2011) used the revised model to explain the involvement behaviours in education of Latino parents. Home-based involvement was found to be related to "partnership-related role construction (a personal psychological belief) and by specific invitations from the student (a contextual motivator)" (p. 409).

The theoretical framework presented by Hoover-Dempsey and Sandler (1997) and revised by Walker et al., (2005) has been selected as the conceptual framework for this study and will be detailed further in Chapter 3. (Appendix 2)

Parental Roles in Education

Recent research into parental roles in education has also been influenced by the Hoover-Dempsey and Sandler (1997) model which was revised by Walker et al. (2005). How parental involvement is defined by researchers will determine the dimensions of their research. Jeynes (2011) expressed the need for a sincere questioning of current theories to engage with the more subtle aspects of parental involvement and the effect this might have on something as basic as the definition of parental involvement. There are implications for school policies and practices. Jeynes (2011) encourages schools to heed researcher findings "to maximize the efficacy of these initiatives" (p. 16).

Green et al. (2007), in their study into the ability of the model to predict parental involvement, quote multiple researchers and state that parents' beliefs about child rearing and child development, about appropriate home support roles, personal experiences with regards to schooling and social influence are all constructs that influence and shape parental involvement. The definitions of these constructs of the revised model were clearly defined.

Parental Role Construction

In the current study, Walker et al.'s (2005) definition of parental role construction will be used: "parents' beliefs about what they are supposed to do in relation to their children's education" (p. 89), including the patterns of parental behaviour that follow those beliefs. Therefore, role construction is influenced by parents' understandings of how children develop and what they believe they should do at home to help children succeed in school. Role construction is also shaped by the expectations of individuals and groups important to the parents and who have input about the parent's responsibilities relevant to the child's schooling.

Parents' Sense of Efficacy for Helping the Child Succeed in School

Citing Bandura (1997), Green et al. (2007) note: "Self-efficacy is defined as a person's belief that he or she can act in ways that will produce desired outcomes: it is a significant factor in shaping the goals an individual chooses to pursue and his or her level of persistence in working toward those goals" (p. 533) . "Like role construction, self-

efficacy is socially constructed. It is influenced by personal experiences of success in parental involvement, precarious experience of similar others' success for involvement experiences, and verbal persuasion by others" (p. 535).

Social Contexts

In addition to parental beliefs, research by Astone & McLanahan (1991), Lee, 1993; Bronfenbrenner (1994) shows that the social contexts in which families live can predict parent involvement. Traditional family structures tend to be more involved in their children's education than non-traditional structures. Sheldon (2002) cites Wasserman and Faust's (1994) definition of social contexts as "the set of social relationships and linkages one person has with other individuals" (p. 303).

This context may be an important factor related to the role parents take in their children's education. Furthermore, parents' social networks have been viewed as social capital, a resource that enhances children's education. Sheldon (2002) notes that social relationships encourage the exchange of information, the sharing of beliefs, and the enforce norms of behaviour. Studies conducted prior to Sheldon's (2002) study extended existing research on parent involvement but data collection in the form of surveys focused only on mothers.

Parental Involvement at Home

Sheldon (2002) defines parental involvement at home as "parent-child interactions on school-related or other learning activities and represents the direct investment of a parent's resources in her or his child's education" (p. 302).

Parental Involvement with Mathematics Education

The original model (Hoover-Dempsey & Sandler, 1997) and the revised model (Walker et al., (2005) provide an opportunity to collect parents' perspectives of their involvement in their child's general education in a structured manner. The extent to which the revised model can be applied to parental involvement in the specific area of mathematics will be examined.

While this is a narrow field of research, there are some notable findings. The large scale, multifaceted MAPPS project, involving mothers, provided the context for an ongoing study by Civil et al. (2003). They used a socio-cultural framework and, in particular, the concept of funds of knowledge when investigating parental involvement in mathematics education. They also drew on research on parental involvement in education, particularly that which critically examines issues of power and perceptions of parents. "They present a model for parental involvement in mathematics in which parents engage as (a) parents, (b) learners, (c) facilitators, and (d) leaders" (p. 309). In this 2003 project, both parents' and teachers' responses were sought. Civil et al. (2004) note that "Teachers' perceptions towards parental involvement may have changed as an outcome of this project from one where parental involvement was largely seen as deficit, to view parents as a resource" (p. 23). In further research undertaken by Civil, Diez-Palomar, Menendez, and Acosta-Iriqui (2008), the initial question was "What kind of practices do parents use to help their children with their mathematics?" Parents reported that their own experiences shaped their approaches to helping their child. Parents' perceptions of their own ability in mathematics were a factor in their decision to be participants in the project. Parents reported that they used everyday situations in helping their children learn mathematics. Civil et al. (2003; 2008) Civil & Quintos, 2002) reported directly on the voices of mothers as they engaged in this large project.

The Role of Fathers

Research in many areas of education has focused on the participation and perceptions of mothers. The extent to which fathers' participation has an impact on a child's learning and the specific involvement of fathers in programs and projects have been addressed in a limited way.

In reviewing research into fathers' involvement in their child's early learning, Downer, Campos, McWayne, and Gartner (2008, p. 70), note that "a father's socialising role might involve introducing children to the world and realities outside the home." and that "By taxing children's language capacity and self-regulatory skills in new and unforeseen ways, theorists have suggested that fathers may uniquely prepare children to enter classrooms in which interactions with unfamiliar peers and teachers can be both novel and demanding" (p. 71).

Palm and Fagan (2008) also conducted a review. Quality and quantity of involvement were identified as relevant constructs to be considered. Their review identified factors that support increased father involvement in Early Childhood Programs as well as barriers to father involvement. Fathers' characteristics and family factors were seen to be related to fathers' level of involvement.

The differences in fathers' involvement with sons and daughters were the focus of a study by Leavell (2012). Their findings suggest "that fathers channel their children toward gender-typed activities well before their children have a clear understanding of gender roles. Ethnic differences were also found in fathers' activities with children, and child gender moderated ethnic patterns of behavior" (p. 53).

A longitudinal study by McBride, Dyer, and Laxman (2012) focused on the impact of fathers' involvement and student achievement. Characteristics of the child – ethnicity, gender, and the family income were identified as relevant factors. They also suggest "that father involvement throughout the childhood years may have a unique impact on student achievement in later childhood, even after controlling for the influence of early mother involvement on both later father involvement and student achievement". (p. 821)

Studies of fathers who have a child with learning difficulties are rare. One such study into fathers who have a child with a hearing loss was reported by Ingber and Most (2012). This comparative study investigated fathers whose children had normal hearing and those with hearing loss.

> Fathers completed self-reports regarding their parental involvement and parenting self-efficacy and reported on their family cohesion and adaptability. Mothers also reported on their husbands' involvement. Similarly high levels of involvement on the part of both groups of fathers were found. . Involvement correlated positively with fathers' self-reported parenting self-efficacy, family cohesion, and adaptability, and mother-reported paternal involvement. (p. 226)

Hawkins et al. (2002) (as cited in Ingber & Most, 2012, p. 227) formulated nine characteristics of the father's unique roles in children's development. These include: basic needs; supporting the mother; discipline and teaching; encouraging school success; affirming; spending time together; helping the child with homework and encouraging the child to develop talents.

In the same study, Lamb et al. (as cited in Parke, 2003) proposed that there are three components of paternal involvement: interaction, availability, and responsibility.

Specific programs comprising of four workshops aimed at involving fathers in a more active role in supporting their child's literacy development (Bauman & Wasserman, 2010) have resulted in

> The fathers became increasingly committed to the literacy development of their children; participants learned about and regularly engaged in a variety of emergent literacy activities with their children; and participants developed confidence in their roles as agents for change in their children's lives. (p.363)

Other programs have reported a lower level of father participation and were primarily involved in stereotypical activities such as outdoor, sport and security aspects (Cullen, 2011).

Literacy development and the fathers' involvement or lack thereof has been a focus of studies by some researchers. An investigation into gender roles in the context of family literacy programs in different countries was undertaken by Rose and Atkin (2011). When interviewed for this study, fathers reported the pressure of time, teaching not being their responsibility and that they considered the programs to be female-dominated. Nicholas and Fletcher (2011) reporting on their study indicated that the level of paternal involvement in literacy depended on the child's reading ability.

Other researchers reported on specific father-inclusion project with positive outcomes for the fathers and the children (Potter et al., 2013; Saracho, 2008). Saracho (2013) reported that in their study, each father had a unique approach to practicing the literacy strategies presented in the program and how the fathers usually used home and community situations. In this study, fathers reported on their choice of approach depending on their own self-efficacy and their child's level of interest.

In undertaking a longitudinal study into the predictors of the level of involvement of parents in the teaching of literacy and mathematics Silinskas (2010) identified that for their parent group, the family's lower SES and the lower the child's ability, the higher the parent involvement. Their results showed that

> … mothers taught significantly more reading during kindergarten and Grade 1 and more mathematics during Grade 1 than fathers. Also, mothers taught significantly more reading during kindergarten and Grade 1 than mathematics, whereas fathers taught more mathematics than reading during Grade 1. Comparison of the amount of parental teaching of reading and mathematics during kindergarten and Grade 1 showed that only mothers' teaching of mathematics increased in Grade 1 (p. 70).

There are insights gained from these various aspects of research into paternal involvement that will be considered in the current study.

Parent-focused Interventions

Lopez and Donovan (2009) reviewed Latino family-school partnerships in the area of mathematics through Family Math Nights with the view to empowering parents, promoting student achievement and encouraging mathematics in the home environment. The focus was Epstein's (2001) Type 4 and Type 5 roles – learning at home and decision making. In many instances, the parents' mathematics knowledge was not at a level where they could effectively teach their children so two family workshops were offered. Take-home booklets, videos and teacher-created explanations were made available. Ford, Follmer, and Litz (1998) (cited in Lopez & Donovan, (2009) proposed that,

> The more parents engage in meaningful mathematics with their children, the more these experiences will become positive experiences and a family pastime rather than a chore. Trained parents learn that wrong answers can be their lens into their child's understanding (Ford et al., 1998). They learn to be observant of their child's mathematical thinking, to ask probing questions about how a problem was solved, and to be open to multiple solutions. Families who engage in probing interactions at home are sensitive to their child's needs and attitudes and are more likely to share their concerns with the teacher (De La Cruz, 1999; Ford et al., 1998) (p. 226).

In an exploratory study that investigated the effectiveness of an intervention focusing on parents, rather than the child, to improve school readiness Noble et al. (2012) reported that structured scaffolded experiences were necessary for literacy and mathematics. This program for socioeconomically disadvantaged Latino families involved

nine sessions of ten activities that addressed both literacy and numeracy using everyday resources and situations such as “math activities include using familiar objects (e.g., buttons, laundry, cookware) to solve math problems, learning how math connects with real life (e.g., while cooking, during community walks or trips to the store), estimating numbers and sizes, and exploring shapes” (p. 3). From parental feedback they noted that “parents talked about learning about how their children learn and acquiring skills and tools to facilitate children’s learning”. (p.10)

A recent study into the impact of a parent-child numeracy intervention in two urban Catholic schools has been reported by Lore, Wang, and Buckley (2016). A fifteen week program using training and materials was implemented for parents who were randomly selected. By asking parents to provide regular feedback, the researchers were able to identify the issues encountered by the parents and to subsequently provide further support. The outcomes for their children were compared with the control group. The researchers identified the intervention as a cost-effective measure that has long-term implications for success in mathematics.

Involvement with Mathematics at Home

Identifying researchers whose focus had been home-based mathematics activities provided a narrow focus that proved relevant to this study. Researchers such as Blevins-Knabe and Musun-Miller (1996), Cai (1999), Cai et al. (2003), Sheldon and Epstein (2010), Skwarchuk (2009) and LeFevre et al. (2009) all reported on the importance of home-based mathematics activities on student outcomes.

Blevins-Knabe and Musun-Miller (1996) investigated “the type and frequency of number activities that children engage in, in general and their interaction with their parents” (p. 36). Preschool children were the focus, with their mothers self-reporting the frequency and type of mathematical interactions. The aim of their study was to identify factors that contribute to the child’s number competence. Blevins-Knabe and Musun-Miller’s (1996) questionnaire included 33 topics relevant to preschool age children and included “counting, basic number facts, demonstration of concepts such as seriation, number words, and using words related to number concepts” (p. 37). They investigated

tasks undertaken by the child alone and also tasks that involved both parent and child. For frequency, the parent identified how many times a task was undertaken in the previous week with a four-point scale. To establish reliability and parental responses, mothers were called two or three times during the study with half of the mothers receiving two calls, one week apart, and the other half receiving three call during the same time period.

Blevins-Knabe and Musun-Miller (1996) analysed the data to identify specific items that were reported as occurring less than twice a week by the child. These were: "mentioning number facts and using the word less" (p. 39). Reporting on the mother-child joint activity, parents reported tasks occurring less than twice a week as: "encouraging the child to group objects and asking the child to order objects" (p. 39). Some items were found to be age-related; "write numbers" or "recite the numbers in order" were more evident depending on the age of the child. Blevins-Knabe and Musun-Miller (1996) also analysed the data with respect to gender differences: "mothers of daughters reported that their children engaged in more counting, singing of number songs and matching than did mothers of sons" (p. 39). Items from the mother-child aspect of Blevins-Knabe and Musun-Miller's (1996) questionnaire were used in the current study.

Skwarchuk (2009) adapted items from Blevins-Knabe and Musun-Miller (1996) in her study. The same items were ranked for relative importance and for frequency using five- and four-point scales respectively. The addition of a diary component, a bag of resources, and a videotaped laboratory session expanded on the previous work undertaken by Blevins-Knabe and Musun-Miller (1996). This study by Skwarchuk (2009) reinforced findings from other studies, (Blevins-Knabe & Musun–Miller, 1996; LeFevre et al., 2006) that involvement in mathematical activities at home is important. However, when considering basic and complex numeracy activities as predictors of numeracy scores, Skwarchuk (2009) found that:

> After controlling for age, parents who focused on complex outcomes had children with higher math scores; those who focused on basic outcomes had children with lower math scores. … Thus, early exposure to activities with a direct, complex mathematical focus (going beyond counting) may be the key to enhancing

> numeracy. … Parents need to know about the activities that promote numeracy knowledge (current participants believe everything is important) and how to incorporate them (p.197).

LeFevre et al. (2009) noted that many previous studies, including Blevins-Knabe et al. (2000), found no significant correlation between the numeracy activities as reported by parents and the children's numeracy skills. In their study (LeFevre et al., 2009), they distinguish between direct activities that involve numbers that are used for the development of quantitative skills, and indirect activities embedded in real-world tasks where acquisition is incidental. In an earlier study Huntsinger et al. (2002) (cited in LeFevre et al. (2009, p. 56) found "that parents' deliberate efforts to teach mathematics in early childhood correlated with later maths achievement". LeFevre et al. (2009) proposed that their study would "explore not only activities related to specific number skills but also to assess the frequency of a variety of situations that might involve children in quantitative activities, where the focus is not necessarily on direct learning of number skills" (p. 56). The items for their questionnaire were sourced from other researchers. These included: "demographic questions, questions about the frequency of involvement in home activities, and questions assessing parents' academic expectations and maths attitudes" (p. 57). LeFevre et al. (2009) used a five-point scale of 0 to 4. In reporting their findings, they reported that "frequency of participation in games correlated with performance" (p. 60). From the findings of the study, these researchers suggest that different mathematical outcomes need to be considered in order to understand the role of home experiences and "that both types of activities are likely to be important in children's early numeracy experiences, in the same way that direct teaching of reading skills versus shared storybook activities both related to children's literacy development" (p. 63).

Sheldon and Epstein (2010) addressed parental involvement in the light of mathematics achievement when considering the 6 types of parent involvement: Parenting, Communicating, Volunteering, Learning at Home, Decision-making, and Collaborating with the community. Reporting on Mathematics Partnership Practices, the Type 4 role, Learning at Home, consistently related to improvements in students'

performance on mathematics achievement tests when homework consisted of tasks that required parent-child interactions. Sheldon and Epstein (2010) noted that "the relationships between implementation of these activities and mathematics achievement were strong and positive" (p.204). This was even after the researchers "accounted for the influential variables of schools' prior levels of mathematical achievement or level of schooling" (p. 204).

Cai (2003) stated that "There is a general consensus that parental involvement, as an enhancing variable, contributes to students' higher academic achievement, positive behavior, and emotional development (Booth & Dunn, 1996; Hoover-Dempsey & Sandler, 1995; Wang, Haertel, & Walberg, 1993)" (p. 101).

Parental involvement in mathematics was the focus of a study undertaken by Cai et al. (1999). Parental roles were investigated from a wide range of reported research and the roles of Motivators, Resource Providers, Monitors, Mathematics Content Advisors, and Mathematics Learning Counsellors were identified as those relevant for the learning of mathematics. A Parental Involvement Questionnaire (PIQ) was developed to identify the degree to which parents identified with each role. (Appendix 1)

Cai (2003) reported that "among the studies examining parental roles supporting students' learning in home settings, only a few of them have been done to examine parental support in home settings involving mathematics with early childhood and elementary school children" (p. 88). In more recent studies, researchers (Anderson & Gold, 2006; Clarke & Robbins, 2004; Downer Anderson & Gold, 2006; Goos et al., 2004; Maher, 2007; Sheldon & Epstein, 2010; Vukovic, Roberts, & Green Wright, 2013) have continued to investigate aspects of the importance of parental involvement in mathematics learning.

While the role of parents in their children's education continues to be recognised, Cai (2003) queries the kind of support that is most effective for the development of mathematics. While consideration was given by the researcher to the structure and the findings of these researchers in the area of home-based mathematics, for the purposes of this study, the five roles as identified by Cai et al. (1997) were those selected.

Data Collection Instruments

Parental Involvement Questionnaire (PIQ) – Cai et al. (1999)

Subsequent to the 1999 study, Cai (2003) undertook a cross-cultural study for parents in the US and in China. In this study, students were also assessed on mathematical ability. Cai (2003) concluded that parental involvement was a statistically significant predictor of children's mathematics achievement. The five roles of Motivator, Resource Provider, Monitor, Mathematics Content Advisor and Mathematics Learning Counsellor were deemed to be relevant in this context of parents of children with Down syndrome.

In the current research study, all the items from Cai's PIQ were viewed to be relevant. (Appendix 1) They were randomised to reduce the incidence of parents identifying their roles according to the original format. During analysis of the Phase 1 and Phase 2 data, the levels of involvement for these parents in these five roles were identified. All other data were analysed with reference to these five roles.

Findings from Cai's research (2003, p. 101) also identified that in that study:

> Mathematics content adviser and mathematics learning counsellor are roles that parents play in directly assisting students' learning of mathematics in the home setting. Parents as motivator, monitor, and resource provider are roles that parents play in providing emotional and resource support in students' learning.

From this current research study, it will become evident whether these descriptors can be identified in a similar manner. This is fully described in Chapter 3.

Parental Involvement Process – Walker et al. (2005)

While revising the original framework developed by Hoover-Dempsey and Sandler (1997), Walker et al. (2005) developed a questionnaire to determine the level of parents' perceptions of the defined aspects of their role construction. These questionnaires were used as one of the data collection instruments (Appendix 2). The details of this questionnaire are explained fully in Chapter 3.

Frequency of Mathematical Tasks at Home - Blevins-Knabe and Musun-Miller (1996)

Blevins-Knabe and Musun-Miller (1996; 2006) investigated the relationship between the frequency of a variety of number activities occurring at home for preschool and kindergarten children and their numeracy performance. (Appendix 3) Reporting on the initial study, Blevins-Knabe and Musun-Miller (1996, p. 35) stated that mothers reported on the level of engagement in certain activities over a period of one week. There was a positive correlation between the frequency of the number activities that parents reported for their children and parental participation in the same activities. This is fully described in Chapter 3.

Parental Diary

Skwarchuk (2009, p. 189) used these same items (Blevins-Knabe and Musun-Miller. 1996) to investigate the frequency of these number activities in an urban setting as well as the relative importance for developing numeracy. The introduction of resource materials, a diary component and a videotaped play session were also involved. In this study (Skwarchuk, 2009), the findings were discussed in terms of educating parents about incorporating numeracy concepts. Yet another interesting finding was that preschool numeracy scores were predicted by parental reports of their own positive personal experience in mathematics.

In this current study, the Blevins-Knabe and Musun-Miller (1996) list was adapted with the items being rated for both relative importance as identified by parents, and for frequency of occurrence. It was also intended to adopt the provision of resource and the diary components (Skwarchuk, 2009) into this study.

Chapter 2 Summary

This chapter has presented the current research findings and structures that have had a direct influence on the present study. These included a variety of frameworks that identified parental involvement roles in education. Role construction and self-efficacy were defined. The importance of home-based mathematics activities were noted and relevant findings identified. Parent-teacher relationships, child invitations, parental school

experiences, parental expectations and parental self-efficacy are all identified as contributing to positive outcomes for children.

From this wide range of options, the following have been selected: Walker et al.'s (2005) revised model has been selected as the conceptual framework. It will also be one of the data collection instruments. Cai et al.'s (1997) five roles of parent involvement will be one of the data collection instruments and will also provide the structure for the analysis of the data. Blevins-Knabe and Musun-Miller's (1996) parent-child activities will be used to identify current tasks undertaken at home. The diary and kit components from Skwarchuk's (2009) study will be implemented.

The next chapter presents the methodology selected for this study, the participants, the context, the data collection strategies, the surveys and diary format, the intervention, and the procedure for the analysis of both the quantitative and the qualitative data.

Chapter 3 METHODOLOGY

This study set out to investigate the role parents play in supporting the development of early mathematical concepts for their child with Down syndrome. At a one-day workshop for parents who have a child with Down syndrome, held in Canberra and presented by the ACT Down Syndrome Association, the researcher was approached by several parents after presenting a session on tasks that support the early development of mathematical concepts. The parents expressed self-confidence in addressing aspects of language development, both in speech and literacy. Their ability to support their child develop mathematical concepts was proving to be a challenge. The problem faced by these parents was the stimulus for this research, which emerged from the review of the literature.

Research Questions

The researcher worked with two groups of parents, both mothers and fathers, who have children with Down syndrome to investigate their perception of their roles, as defined by Cai et al. (1997). The intervention was a parent –focused workshop.

1. What is the nature of the roles parents engage in, to support their child with Down syndrome, develop mathematical concepts?

2. To what extent do mothers and fathers perceive their roles differently?

3. What is the impact of intervention on the parents' perception of their roles?

In preparation for presenting the parent session, the researcher had become aware of the paucity of relevant current research in the field of parental involvement in mathematics. In undertaking this research, from the outset, the intention was that the parents' voices were to be heard. All data, both quantitative and qualitative, were collected through self-reporting by the parents, both mothers and fathers.

This chapter outlines the theoretical underpinning of this study and includes the research focus, the conceptual framework, the research questions, the selection of the methodology, the methods, the participants, the context, the selection of the data collecting instruments, the data collection procedures, and the approach taken to the analysis of both the quantitative and qualitative data.

The purpose of this study was to investigate the nature of the roles parents undertake in supporting the development of early mathematical concepts for their child with Down syndrome. Parental perceptions of their roles were investigated using a variety of data collecting instruments, pre- and post- an intervention. Data were analysed to investigate the structure of the roles parents undertake in supporting early mathematical concept development for their child with Down syndrome, their current perception of their roles and the possible impact of intervention on their perception of their roles.

Parents of children with Down syndrome are in a position to support the mathematical development of their children in the early childhood years. As noted in the previous chapter, the Literature Review, highlighted there is little research evidence into understanding the nature of the roles parents undertake in the field of mathematics. This research, with this particular group of parents, aimed to establish the significance of the parents' perceived roles in promoting the development of mathematical concepts.

It was intended that the reporting of the outcomes, conclusions, and findings from this research study would be of benefit to participating parents and to all educators.

Conceptual Framework

Wisker (2005), quoted in Berman and Smyth (2015), writing about conceptual frameworks in the research process, notes that the role of the conceptual framework is to create "a scaffold for the work, that will run throughout the student's work and throughout the thesis since it identifies the key concepts and theories that inform and drive the research questions".

For Smyth (2004), the criteria underpinning such a framework are that it:

- provided a common language from which to describe the situation under scrutiny and to report the findings about it;
- developed a set of guiding principles against which judgements and predictions might be made;
- acted as a series of reference points from which to locate the research questions within contemporary theorising;
- provided a structure within which to organise the content of the research and to frame conclusions within the context (p. 127).

The conceptual basis of this study was influenced by the original framework presented by Hoover-Dempsey and Sandler (1997) and then by the revised model of this framework by Walker et al. (2005).

Hoover-Dempsey and Sandler Model

Hoover -Dempsey and Sandler (1997) proposed that parental involvement decisions were based on three constructs:

> 1. Parents' Role Construction defines parents beliefs about what they are supposed to do in their children's education and appears to establish the basic range of activities that parents construe as important, necessary, and permissible for their own actions with and on behalf of their children;
>
> 2. Parents' Sense of Efficacy for helping their children succeed in school focuses on the extent which parents believe that through their involvement they can exert positive influence on their children's educational outcomes;
>
> 3. General Invitations, Demands and Opportunities for Involvement refer to parents' perceptions that the child and school want them to be involved (p. 3).

In selecting this conceptual framework for the current study, Smyth's (2004) criteria were a sound basis against which this framework could be judged. It was intended that by selecting this Parental Involvement Process Model, the researcher would utilise the common language, the guiding principles, and essential key ideas and concepts of the model. This would enable the researcher to explore this contemporary theory within a

specific setting and to use the embedded structure to frame the content of the research and the conclusions.

The decision to include a conceptual framework in this study came about as the researcher struggled to find an overarching structure that supported the conceptualisation and analysis of both the quantitative and the qualitative data. Prior to this, the self-created framework for data analysis proved to be fragmented.

Hoover-Dempsey and Sandler (1995) suggested "that specific variables create patterns of influence at critical points in the Parental Involvement Process" (p. 3). The background to this model involved extensive research by the authors into the literature about parent involvement and possible variables. The variables selected by the authors were identified as "'process' variables (i.e. What parents think and do, across status groupings) that have been associated with parental decisions about involvement in their children's education" (p. 8), rather than static variables such as social status or economic circumstances. Their intention was to understand why parents make their involvement choices.

MODEL OF THE PARENTAL INVOLVEMENT PROCESS – Hoover-Dempsey & Sandler (1997)		
Level 5: Child/student outcomes		
Skills and knowledge	Personal sense of efficacy for doing well at school	
Level 4: Tempering /mediating variables		
Parent's use of developmentally appropriate involvement strategies	Fit between parent's involvement actions and school expectations	
Level 3: Mechanism through which parental involvement influences child outcomes		
Modelling	Reinforcement	Instruction
Level 2: Parent's choice of involvement forms influenced by:		
Specific domains of parent's skill and knowledge	Mix of demands on total parental time and energy [family, employment]	Specific invitations and demands for involvement from child and school
Level 1: Parent's basic involvement decision, influenced by:		
Parent's construction of the parental role	Parent's sense of efficacy for helping children succeed in school	General invitations and demand for involvement from child and school

Figure 3.1: "Parental involvement in children's education: Why does it make a difference?" Hoover-Dempsey & Sandler (1995, 1997)

At Level 1, this model identifies the individual parent's decision to be involved. This is taken from the perspective of the parent – the parent's voice.

Quoting Bronfenbrenner (1994) and others, Hoover-Dempsey and Sandler (1997) noted that their findings were only relevant when considered within the context of the broader social ecology of parents' lives, "human development cannot be adequately understood without significant reference to the proximal and distal social systems that work to limit or enhance both developmental processes and outcomes" (p. 5). They acknowledge the psychological basis and its underpinning perspectives in defining this model.

> The outcomes of psychological inquiry (and any policy suggestions that may be derived) are thus limited to the individual and to selected elements of the individual's environments; they offer one window on the full range of issues influencing parental involvement in child and adolescent education (p. 5).

In referring to parents' *choice* of involvement, they note "parents are sometimes explicitly reflective, aware, and active in relation to their decisions about being involved in their children's education; in other circumstances, they appear to respond to external events or unevaluated demands from significant aspects of the environment" (p. 6). While their initial findings identified that the involvement of mothers was generally the focus, their intention was to be inclusive of both mothers and fathers. They also noted that these variables are dynamic and are "amenable to growth and change over the period of appearance on adult development" (p. 7).

Parent's Role Construction

Of particular relevance to this study, Hoover-Dempsey and Sandler (1997) identify the parents' construction of their role to be important because:

> it appears to establish a basic range of activities that parents will construe as important, necessary, and permissible for their own actions with and on behalf of their children. Parental role construction and functioning clearly begin before and extend beyond the child's years in school and, during those years, influence and are influenced by other domains of the child's life as well (p. 9).

In discussing role construction, Hoover-Dempsey and Sandler (1997) identified two aspects of this construct. These are: "(a) the expectations (explicit and implicit) that parents and those in their significant groups hold for their behaviours in relation to their children's schooling and (b) the behaviours they enact in relation to their children's schooling" (p. 9).

Further to this, Hoover-Dempsey and Sandler (1997) note that the basic tenet of role definition process, according to role theory:

> is characterised by interaction between individuals and their groups over time; it is also characterised by varying degrees of stability and change over time. Three aspects of the role process have been implicated in role stability and change: (a) structurally given demands, groups expectations and norms for an individual member's behaviour; (b) personal role conceptions, or an individual member's ideas about what he or she is supposed to do as a group member; and (c) role behaviour, or the actual behaviours of individual group members, which usually conform to, but may at times violate, the expectations of the group (Harrison and Minor, 1978, drawing on Levinson, 1959) (p. 9).

Parents' role behaviours will be influenced by the expectations held by the groups to which they belong. The extent to which the parents perceive their role in home-support beliefs will ultimately impact on role construction. In regard to home-support, Hoover-Dempsey and Sandler (1997) noted that:

> Parents' ideas about child development, child-rearing, and appropriate roles in supporting children's education at home appear to constitute important specific components of the parental role construct as influential particularly in parents' decisions about involvement in their children's education (p. 17).

Parent's Sense of Self-efficacy

Self-efficacy for assisting their child at school is the second construct identified by Hoover-Dempsey and Sandler (1997). Do parents believe that their involvement has a positive impact on their child's educational outcomes? In this model of Parental Involvement Process with reference to Bandura (1986), they state that:

> Individuals' self-efficacy beliefs undergird in part the challenges they decide to undertake, how much effort they are willing to put into the situation, and the extent of their persistence and perseverance in working to overcome difficulties in the situation (p. 18).

By committing to this study, the participating parents have demonstrated a willingness to be challenged in the area of supporting early mathematical concepts for their child. They viewed this as an opportunity to extend their understanding and to explore avenues for success. Time and effort had been a commitment. Hoover-Dempsey and Sandler (1997) conclude that "parental self-efficacy for helping the child succeed in school appears pertinent, because of its grounding in parents' beliefs about their personal capabilities and likely effectiveness within the area, to their fundamental decisions about the wisdom and likely pay-off of involvement" (p. 26).

General Invitations, Demands and Opportunities for Involvement

The relationship between parents and schools has been a focus of ongoing research (Warren & Young, 2002). The extent to which the participating parents perceive this relationship as a positive one is to be explored in the light of invitations from the child, the teacher and the school. Referring to Eccles and Harold's (1994) work regarding teachers' efforts to create a climate that supported parental involvement, Hoover-Dempsey and Sandler (1997) note that "Parents who held more positive views of the school's concern, accountability, and desire for parents' involvement were more involved in the school" (p. 30).

The influence generated by a school where multiple invitations are extended to parents for involvement, is seen as important in parents' decision-making. Hoover-Dempsey and Sandler (1997) note:

> This influence may be particularly important if a parent's role construction sense of efficacy for helping children succeed in school does not encourage involvement. The considerable evidence on teacher practices intended to support parental involvement, and parents sensitivity to teacher attitudes about their involvement,

> underscores the importance of school-generated invitations and opportunities for positive parental decisions about involvement (p. 31).

In conclusion, Hoover-Dempsey and Sandler (1997) note that:

> Parents become involved in their children's education *because* they have developed a parental role construction that includes involvement, *because* they have a positive sense of efficacy for helping children succeed in school, and *because* they perceive general opportunities and invitations for involvement from their children and their children's schools (p. 31).

This model suggests that parents, having made the basic decision to become involved, then choose specific involvement activities. These specific choices are shaped by three major constructs operating at the second level of the process: "(a) parents perceptions of their own skills, interests, and abilities; (b) parents experience of other demands on time and energy; and (c) parents experience of specific invitations to involvement from children, teachers, and schools" (p. 32).

The parent's role construction was identified as the most important construct in this model. Hoover-Dempsey and Sandler's (1997) model of Parental Involvement Process, revised by Walker et al. (2005) has provided a conceptual framework under which research can be structured in this particular situation.

Walker et al. Revised Model (2005)

The Hoover- Dempsey and Sandler (1997) model was revised by Walker et al. (2005). The revised structure of the model dealt with the first two levels of the original model. While the Hoover- Dempsey and Sandler (1997) approach had been from a psychological perspective, Walker et al. (2005) noted that "our primary purpose is to introduce our revised representation of psychological factors underlying parents' involvement behaviours and describe the conceptual and methodological processes underlying the development" (p.87). Parent Role Construction and Self-Efficacy were now subsumed under the category "Parents' Motivational Beliefs". Parents' Perceptions of Invitations from the School, Teacher and Child are now presented under the heading

"Perceptions of Invitations for Involvement from Others" and "Parents' Perceived Life Contexts " now include available Time and Energy, and Specific Knowledge and Skills for Involvement.

<table>
<tr><td colspan="8">Revised Theoretical Model of the Parental Involvement Process Walker et al. (2005)</td></tr>
<tr><td rowspan="3">LEVEL 2</td><td colspan="7">Parents' Involvement Forms</td></tr>
<tr><td colspan="4">Home-based Involvement</td><td colspan="3">School-based Involvement</td></tr>
<tr><td colspan="7">Parents' Involvement Decisions</td></tr>
<tr><td rowspan="2">LEVEL 1</td><td colspan="2">Parents' Motivational Beliefs</td><td colspan="3">Parents' Perceptions of Invitations for Involvement from Others</td><td colspan="2">Parents' Perceived Life Context</td></tr>
<tr><td>Parental Role Construction</td><td>Parental Self-Efficacy</td><td>General School Invitations</td><td>Specific Teacher Invitations</td><td>Specific Child Invitations</td><td>Skills and Knowledge</td><td>Time and Energy</td></tr>
</table>

Figure 3.2: Revised Theoretical Model - Walker et al. (2005)

During the process of revision, Walker at al. (2005) initially created questionnaires assessing the elements of Parental Role Construction with regard to Role Activity Beliefs. Statements were provided that would reflect both active and passive beliefs. A Likert scale of 4 to 1 was used for rating the responses from "I strongly agree" and "I agree" to "I disagree" and "I strongly disagree" to the statements presented. Valence toward school was also identified as a contributing factor to understanding Parent Role Construction. Subsequently, questionnaire items were constructed for Valence toward School, for Invitations – general, teacher and child, and for the aspects of Parents' Perceived Life Contexts, including Skills and Knowledge, and Time and Energy.

At level 2, Walker et al. (2005) also developed questionnaire items for "Parents' Involvement in Home-Based and School-Based Activities" statements. These were rated for frequency from 1 – never, to 6 – daily.

These quantitative questionnaires developed by Walker et al. (2005), with the exception of the one relating to the child invitations, were the basis for Survey 2 for this research study. (Appendix 2)

Participants

The population for this study included parents who have a child with Down syndrome and who is attending a primary school. A convenient sample was taken from parents who were initially contacted through their local Down Syndrome Association, either in the Australian Capital Territory (ACT) or in New South Wales (NSW). The majority of parents who completed an Expression of Interest Form became active participants. Participant Information Letters were sent to each participant outlining the purpose and schedule for the study. Consent forms were attached to the letter. Minimal demographic information was collected concurrently with the completion of Survey 1.

Table 3.1: Demographic Information of Participating Parents

Age				Father	Mother	Location		
20-30	31-40	41-50	>51			Canberra	Regional	Sydney
0	3	12	9	9	15	10	4	10

Twenty-four parents (fifteen mothers and nine fathers) engaged with this project. The majority of parents were over forty, with nine being over fifty. The distribution of parents between the two locations, Canberra and Sydney, was ten in each, with an additional four parents from regional centres also participating. In the Sydney group, eight of the participants were partners (e.g. MO1 was the partner of FA1) and in the Canberra group ten of the participants were partners. This provided opportunities to explore the responses from both parents of the same child. Six participants indicated that they were sole parents; four participants were involved in formal education – one in a high school, one as a teacher librarian and another two in primary schools. All parents worked, either part-time or full-time. Parents were allocated a pseudonym (Mother MO __; Father FO __) to ensure confidentiality in recording and analysing data. (Appendix 8).

Ethics approval for this study was granted by the Australian Catholic Universitiy's Human Research Ethics Committee.

Minimal demographic data were collected on the children.

Table 3.2: Demographic Information of Children

Child's Age				Sibling/s			
5-6	7-8	9-10	11-12	Male only	Female only	Male & female	Only child
5	5	4	1	4	4	3	5

The children in these families ranged in schooling from Early Childhood through to Upper Primary. The majority of the children attended regular primary schools, with two children attending schools that catered for children with specific needs and one child being home-schooled. Five of the children have no siblings, five have one sibling; three have two siblings and three have three siblings. The children were not identified in this study. The findings represent the perceptions of the parents only.

Context

For the parent participants, the setting for the self-reporting of this study was within their home or environs. While the researcher is based in Canberra, accommodations were made for parents in New South Wales. Scheduled meetings and the "Make and Take" Workshops were arranged on Saturdays in both centres, Canberra and Sydney, using facilities based on the two campuses of the Australian Catholic University. Regional parents had the choice of attending at either centre.

Research Methodology

Case study was the methodology originally considered, because it offers several relevant dimensions that suit this study. These are identified by Denscombe (2003) and include: the situation which already exists prior to the research project, and will continue to exist once the research is finished, and where the researcher has little control over events, because the approach is concerned with investigating, so there is no pressure on the researcher to impose controls, or to change circumstances. It has distinct boundaries and is of intrinsic interest.

Also, as Merriam (1998) states: “The case as a thing, a single entity, a unit, around which there are boundaries. I can “fence in” what I am going to study” (p. 27). These aspects provided justification for the earlier consideration of possibly undertaking this research as a multiple case study. Family groups might have represented individual cases.

Mixed Methods Methodology

However, in light of further reading, and in accordance with the conceptual framework, this research study was undertaken through a mixed methods methodology.

Creswell (2008, p. 552) defines “a mixed methods research design as a procedure for collecting, analysing, and mixing both quantitative and qualitative research methods in a single study to understand a research problem” (p. 552). The basic assumption is that the use of both quantitative and qualitative methods, in combination, provides a better understanding of the research problem and questions than either method by itself.

The literature review of recent studies of parent involvement in education, demonstrated that in some instances both qualitative and quantitative data collecting instruments were used effectively as neither qualitative nor qualitative gave sufficient information. Several studies in the field of parental roles have used mixed methods approaches (Bartel, 2010; Civil, Bratton, & Quintos, 2005; Eloff et al., 2006; Jackson & Remillard, 2005).

Johnson and Onwuegbuzie (2004) present an argument for the acceptance of mixed methods/models as “the third research paradigm in educational research” (p. 14), and that “the bottom line is that research approaches should be mixed in ways that offer the best opportunity for answering important research questions” (p. 16). They present two major types of research: “mixed model (mixing quantitative and qualitative approaches within or across the stages of the research process) and mixed-method (the inclusion of a quantitative phase and a qualitative phase in an overall research study” (p.20). They offer a model for consideration (Figure 1: Monomethod and mixed-model designs) (p. 21) where the weight of each of the qualitative and quantitative processes are presented on a continuum.

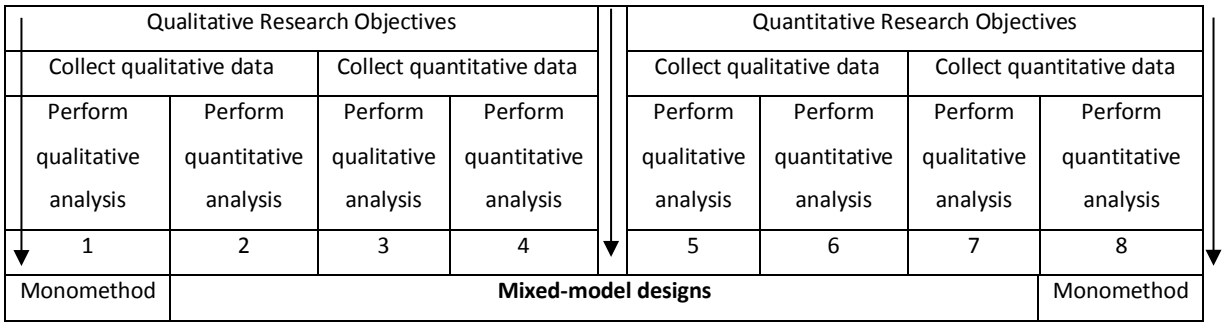


Figure 3.3: Monomethod and Mixed-model - Johnson & Onwuegbuzie (2004)

A mixed method design matrix was also presented by Johnson and Onwuegbuzie (2004) to assist the researcher in decisions about: "(a) whether one wants to operate largely within one dominant paradigm or not, and (b) whether one wants to conduct the phases concurrently or sequentially" (p. 20). They define a mixed-methods design as combining/mixing the findings from both qualitative and quantitative data when the researcher interprets the data.

		Time Order Decision	
		Concurrent	**Sequential**
Paradigm Emphasis Decision	**Equal status**	QUAL + QUAN	QUAL → QUAN QUAN → QUAL
	Dominant status	QUAL + quan QUAN + qual	QUAL → quan qual → QUAN QUAN → qual quan → QUAL

Figure 3.4: Mixed-method Design Matrix Johnson & Onwuegbuzie (2004)

The mixed methods design implemented for this research study, and the quantitative and qualitative data collected iteratively, were accessed from the self-reporting responses of the participants and given equal status.

A variety of data collection instruments were selected. The research questions in this research study indicate that the researcher intended to collect both quantitative and qualitative data during the study, in both phases of the study, and that the two forms of data would be mixed during data collection, during analysis and during the interpretation of the results.

As presented by Johnson and Onwuegbuzie (2004, p. 21), the development of a mixed research process model that entails eight steps assists the decisions-making throughout the study, starting with the research questions and followed by "(2) determine whether a mixed design is appropriate; (3) select the mixed-method or mixed-model research design; (4) collect the data; (5) analyze the data; (6) interpret the data; (7) legitimate the data; and (8) draw conclusions (if warranted) and write the final report".

Further to this, this study could be described as one of an Explanatory Mixed Methods Design – Creswell (2008, p. 560), as the qualitative data will be used to refine the results from the quantitative data. There are clearly defined qualitative and qualitative parts to this study. The parent responses to the surveys were scaled and provided the quantitative data. The parents completed these in Phase 1 and Phase 2 (pre- and post-intervention). Qualitative data was collected in the first and second phases through parent reflective journaling and refined through an in-depth qualitative exploration.

Current researchers in the field of family engagement in education detail the benefits of using mixed methods. McWayne, Melzi, Schick, and Kennedy (2013) reported on their research into how parents construct involvement roles and support their children's educational experiences from the point of view of Latino families. They used a mixed methods approach to identify and validate culturally specific constructs. While data were collected from teachers re parental participation, they cited Jahoda, (1990) and noted that "'emic' approaches recognise that social actors with any given culture group are experts in their own experiences and, as such, their voices and experiences must be given a pre-eminent place in social scientific investigations about their lives" (p. 594).

Underwood (2010, p. 30), in her study regarding inclusion for children with Individualised Education Programs (IEP), describes the situation in four Canadian schools from the parents' point of view. Underwood (2010) presented the purpose of that study as an investigation into the parents' perceptions of their involvement and their descriptions of the challenges they faced. In that study, data were collected through in-depth interviews and a parent questionnaire about their participation and satisfaction in regard to the programming for their children. Demographic information and questions

using a six Likert scale rating were the source of the quantitative data. Coding strategies were used in the thematic analysis of the data. The questionnaire data were used to inform the interpretation of the themes. Underwood (2010), as the author of that study, noted that in some instances the questionnaire data would not have fully supported the parent's voice.

Other researchers such as Dunning, Williams, Abonyi, and Crooks (2008) and Klassen, Creswell, Plano Clark, Clegg Smith, and Meissner (2012) identify benefits from implementing mixed methods. These include the strength of the combination of the two forms of data to provide a more comprehensive analysis of the situation.

Advantages from the researcher's perspective for selecting a mixed mode in this instance include:

- The researcher recognised the richness of obtaining data from both quantitative and qualitative sources.
- The researcher acknowledged that to answer the research questions, embedded in the Parent Involvement Process Model, selecting either quantitative or qualitative designs would provide too narrow a response.
- As the researcher encountered reported research through the Literature Review, it became evident that mixed mode was a common methodology and means of confirming and/or challenging results.

The researcher understood that while the interpretation of data filtered through her personal sensitivity may have been interpreted as a bias, it was also a positive as the researcher was outside the social setting.

Methods

In keeping with the mixed mode methodology, decisions had to be made in regard to how and when the quantitative and qualitative data would be collected. The concepts, embedded in Hoover-Dempsey and Sandler's (1997) and Walker et al.'s (2005) models, were to be considered throughout all aspects of this study.

Research into the nature of the perceived roles parents undertake in supporting early mathematical concept development for their child with Down syndrome was the focus of this study. While exploring the perceived needs and wishes of individual parents, it was important at all times that the focus was to be voice of the parents. To this end, data were collected through self-reporting. Quantitative data were gained through the implementation of pre-existing questionnaires/surveys. Qualitative data were collected through open-ended questions and parents journaling.

The Literature Review, Chapter 2, provided insights into processes and procedures used by other researchers in the field of Parental Involvement in Education that were relevant to this study.

Selection of Data Collection Instruments

Recent research into parental involvement in their child's schooling often has two phases. First, to identify the role that parents engage in and secondly, to establish the impact this may have on student achievement. In the current study, it is the parents' perceived role in supporting their child that is the focus.

Through a search for relevant keywords for the Literature Review (Chapter 2), it became evident that there were researchers whose work would directly support the current study by providing exemplary surveys, parental journaling and relevant home-based resources. Cai et al. (1997), Cai (1999), Hoover-Dempsey and Sandler (1997), Hoover-Dempsey et al. (2005), Walker et al. (2005), Blevins-Knabe and Musun–Miller (1996) and Skwarchuk (2009) all addressed aspects that would support the current study. The structure and statements of each survey from these researchers were examined to ensure that the parents' responses would provide data that, when analysed, would result in answering the research questions.

Survey 1, sourced from Cai (2003) Parent Involvement Questionnaire (PIQ) which focused on parental roles in the acquisition of mathematics, and Survey 2, sourced from Walker et al. (2005) which focused on parental roles in education in general, both provided multiple relevant statements to collect quantitative data for each aspect of this study. The researcher selected the "Child-Parent Activities" section of the Blevins-Knabe

and Musun-Miller (1996) survey that measures the frequency and relative importance of early number activities at home, as the basis for Survey 3. Skwarchuk (2009) investigated parental support at home with numeracy used the survey from Blevins-Knabe and Musun-Miller (1996), and also incorporated parental self-reporting diaries and a kit of resources.

Table 3.3: Data Collection Instruments, Sources and Types of Data Obtained

Data collecting instrument	**Source**	**Key aspects of data obtained**
Survey 1 (Appendix 1)	Cai (2003)	Likert scales, parent roles, open ended statement.
Survey 2 (Appendix 2)	Walker et al. (2005)	Parents' perceptions of their involvement in the child's education as identified in various aspects.
Survey 3 (Appendix 3)	Blevins-Knabe & Musun-Miller (1998)	Relative importance and frequency of tasks undertaken by the parent and the child together.
Parent Diary (Appendix 4)	Skwarchuk (2009)	Type of activity undertaken, parental responses to interactions with child during the activity, insights gained by the parent into the mathematics involved.

As the research progressed, it became evident to the researcher that the roles defined by Cai et al. (1997) would be a central focus in answering the first question, with the data from other sources supporting or challenging these findings. This proved to be similar for questions two and three.

Table 3.4: Sources of Data for Answering the Research Questions

Research questions	**Data Collecting Instruments**
What is the nature of the roles parents engage in, to support their child with Down syndrome, develop mathematical concepts?	Survey 1: Parental Involvement Questionnaire Survey 2: Parental Involvement Process Survey 3: Home-Based Child-Parent Mathematical Tasks Diary: Topics and Insights
To what extent do mothers and fathers perceive their roles differently?	Survey 1: Parental Involvement Questionnaire Survey 2: Parental Involvement Process Survey 3: Home-Based Child-Parent Mathematical Tasks Diary: Topics and Insights
What is the impact of intervention on the parents' perception of their roles?	Survey 1: Parental Involvement Questionnaire Survey 2: Parental Involvement Process Survey 3: Home-Based Child-Parent Mathematical Tasks Diary: Topics and Insights

Using roles identified in Cai et al. (1997) as the focus in the proposed model, the extent to which the data from the other surveys support the defined roles of Motivator, Resource Provider, Monitor, Mathematics Content Advisor and Mathematics Learning Counsellor was explored.

By using pre-existing surveys and questionnaires about parental involvement Cai (2003), Hoover-Dempsey & Sandler (1997) and Blevins-Knabe & Musun-Miller (1996), the researcher identified the quantitative data collecting instruments. Each provided a different insight into the parents' perceptions of their roles.

Qualitative data were collected in the current study through parents undertaking to journal the outcomes of mathematical tasks undertaken by them with their child.

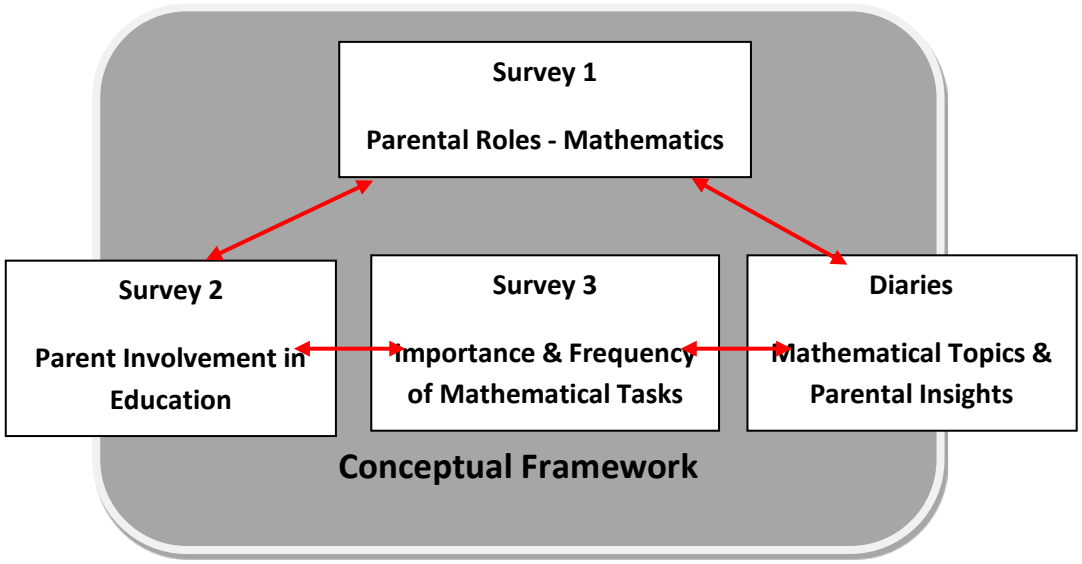


Figure 3.5: Interrelated Connections among Data

Both quantitative and qualitative data were collected in two phases. Phase 1 was the initial collection from surveys and diaries. Phase 2 involved a repeat of surveys and diaries subsequent to an intervention – the "Make and Take" Workshop.

The decision to implement an intervention workshop meant that this became an Intervention Study presented within an Explanatory Mixed Methods Design.

Creswell (2008, p. 306), in discussing intervention studies, states that the researcher physically intervenes in one or more conditions so that the individuals experience

something different. In this study, the second parent participation session, which is identified as the "Make and Take" workshop, introduced opportunities to make and trial new resources and to gain new understandings of conceptual development. This subsequently influenced the data collected through the second phase of surveys and of parental journaling. It also provided the opportunity to follow up any unexplained, unpredicted variation in responses from the surveys or journals.

Data Collection Strategies

In this research study, quantitative data were collected through parents' self-reporting on three separate surveys. Qualitative data were collected through parent journaling, and the provision of Parent Group sessions. Parents were asked to journal twice during the period of the study.

Table 3.5: Data Collection Instruments and Phases of Data Collection

Date 2010	Task	Details
April	Survey 1 sent by email on receipt of consent forms	Dates and venues arranged for initial group meeting in Sydney
May	Phase 1 group meeting – Sydney	Agenda: Background to the project Discussion on personal situation Reporting back on Survey 1 early findings Completion of Survey 2, Survey 3 Format of diary negotiated
June	Phase 1 Diaries submitted by mail or email from Sydney group	Dates and venues arranged for workshop Content for workshop finalised Resources for parents created/bought
June	Phase 2 group meeting – Sydney	Agenda: General discussion about resources Workshop for parents – input on tasks and the mathematics involved. Instructions provided. "Make and Take" session – parents select and create own resources – Maths Kit provided.
July	Phase 2 Surveys 1, 2 and 3 completed; Diaries submitted by mail or email from Sydney group	Dates and venues arranged for initial group meeting in Canberra
July	Phase 1 group meeting – Canberra	Agenda – same as for Sydney
August	Phase 1 Diaries submitted by mail or email from Canberra group	Dates and venues arranged for workshop Same workshop input and resources as for Sydney
September	Phase 2 group meeting – Canberra	Agenda and workshop – same as for Sydney
September / October	Phase 2 Surveys 1, 2 and 3 completed; Diaries submitted by mail or email from Canberra group	Data collection completed

Initial sessions with parents provided baseline data as to their current involvement practices. This included discussion, questioning and self-reporting on Survey 1 that was e-mailed to each participant prior to the first meeting. As families vary in structure and in background, with some involved in home schooling, while others have their child in a mainstream classroom or special unit, the researcher endeavoured to identify the diverse methods parents have for supporting their own child, as well as identifying the common elements.

The researcher was the primary instrument for gathering and analysing data, and needed to maximise opportunities for collecting, recording and analysing to ensure that the contributing factors were able to be identified. Technology was used to assist in these processes – Digital recorder for recording Focus Group dialogue sessions, Dragon Naturally Speaking 12 to transcribe the data, and Excel spreadsheet for coding and analysing data.

Data Collection Instruments

In this study both qualitative and quantitative data were collected. The decision to select the mixed mode methodology stems from the fact that this design provided the means for the collection and interpretation of the qualitative and quantitative data required to answer the stated questions.

In the case of quantitative data, the initial survey, Survey 1, was adapted from Cai (2003) (Appendix 1). Subsequently, Survey 2 was taken directly from the questionnaires created in response to the Revised Theoretical Model by Walker et al. (2005) based on the "Model of Parental Involvement Process" as presented by Hoover-Dempsey and Sandler (1997) (Appendix 2). Survey 3 was adapted from Blevins-Knabe and Musun-Miller (1996) and focused on the Parent-Child Interactions. (Appendix 3)

The structure for the parent diaries was a collaborative decision undertaken during the Phase 1 meeting with the parent participants. A minimum of five diary entries was agreed upon by the parents in the first meetings. (Appendix 4)

Quantitative Data

Survey 1

Cai et al. (1997) investigated the roles parents play in their child's learning of mathematics at home and to examine this in relation to the students' learning of and achievement in mathematics. To this end, a PIQ was developed to assess the parents' level of support for the five identified roles.

For the purposes of this current study the PIQ developed by Cai (2003) is identified as **Survey 1.** Cai et al. (1997) designed this instrument to assess parental roles: Motivator, Resource Provider, Monitor, Mathematics Content Advisor and Mathematics Learning Counsellor. Descriptions of these roles are identified below.

Table 3.6: The Five Roles as Defined By Cai et al. (1997)

Parental Role	Description
Motivator	Parents provide emotional support for student's learning.
Resource Provider	Parents play the role of resource provider by providing an appropriate place to study, relevant reference books, and/or access to resources.
Monitor	Parents monitor their children's learning and progress at home.
Mathematics Content Advisor	Parents provide advice to their children on mathematics content.
Mathematics Learning Counsellor	Parents understand their children's current situation, learning difficulties, potential, needs and demands, and provide appropriate support to help their children overcome their learning difficulties.

These roles fell into two broader categories – direct educational assistance or emotional support. Parents as Mathematics Content Advisers and Mathematics Learning Counsellors are roles that parents play in directly assisting the learning of mathematics in the home setting. Parents who engage as Motivator, Resource Provider and Monitor are roles parents play in providing emotional and resource support in students' learning.

Survey 1 consists of 20 items sourced from Cai et al. (1997) (Appendix 1). The items are presented as closed statements ranked against the Likert scale: 1. “I strongly disagree”, 2. “I disagree”, 3. “I agree” and 4. “I strongly agree”. An opportunity for open-ended comment was also provided. A neutral choice was not provided. Statements with positive valences were scored from 4 to 1; for statements with negative valence scores were reversed. The authors, Cai et al. (1997), identified the PIQ as a reliable and valid instrument. Items were presented in a random manner when administering to parents, both in the 1997 study by Cai et al. and in the current study.

In analysing Survey 1, the PIQ items provided an opportunity to present the results as summed scores for the group and for individual parents as well as summed scores for each item and for each role. The results were also presented as a fraction of the possible scores and as a percentage of possible scores. This was the initial survey presented to parents by e-mail. The administration of this questionnaire was repeated in Phase 2 to ascertain any changes from the baseline data.

Survey 2

While the theoretical framework for this study was sourced from Walker et al. (2005), the questionnaires created by Walker et al. (2005) to address each construct were presented to the parents as a second data collecting instrument. For the purposes of this study, these questionnaires were identified as **Survey 2.**

Hoover-Dempsey and Sandler (1997) presented a framework to investigate why parents choose to become involved in their child’s education. They suggested that there are “specific variables which create patterns of influence at critical points in the parental involvement process” (p. 3). A detailed description of the framework, outlined in Chapter 2, identifies three major constructs believed to be central to parents’ basic involvement decisions. These are: Hoover-Dempsey and Sandler provided a detailed description of the framework.

> First, parents’ role construction defines parents’ beliefs about what they are supposed to do in their children’s education and appears to establish the basic **range of activities** that parents construe as important, necessary, and permissible

for their own actions with and on behalf of children. Second, parents' **sense of efficacy** for helping their children succeed in school focuses on the extent to which parents believe that through their involvement they can exert positive influence on their children's educational outcomes. Third, general **invitations, demands, and opportunities** for involvement refer to parents' perceptions that the child and school want them to be involved (Hoover-Dempsey and Sandler, 1997, p. 3).

The original model delineates five levels that link parents' initial decision to become involved in their children's education, with student outcomes.

In the original model, variables at Level 1 were deemed to be the most important with respect to parents' general decision to be involved. Specific ways in which parents became involved were identified as Level 2 variables – Parents' Specific Knowledge and Skills, Competing Demands on their Time and the Specific Invitations Received from their Children and their Children's Teachers.

Using the "Parental Involvement: Revised Model through Scale Development" Walker et al. (2005) redefined Levels 1 and Level 2 into one level of three overarching ideas – Parents' Motivational Beliefs, Parents' Perceptions of Invitations for Involvement from Others and Parents' Perceived Life Contexts. A study by Green and Walker (2003) examined the ability of the revised model to predict the types and levels of parental involvement.

Table 3.7: Revised Model Constructs – Walker et al. (2005)

Construct	Defining the Construct
Parental Role Construction	Parents' beliefs about what they should do in the context of their children's education; functions as motivator of parental involvement.
Parent-Focused Role Construction – ACTIVE	Parental beliefs and behaviours that the parent is ultimately responsible for the child's education.
School-Focused Role Construction – PASSIVE	Parental beliefs and behaviours that this school is ultimately responsible for the child's education.
Partnership-Focused Role Construction – ACTIVE	Parental beliefs and behaviours that parents and schools together are responsible for the child's education.
Valence toward School	Personal history with and feelings about school.
Parental Self-efficacy	The beliefs in one's capability to act in ways that will produce desired outcomes; identified as a significant influence on people's goal selection, effort, persistence, and ultimate goal accomplishment (Bandura, 1986, 1997).
Parents' Perceptions of Invitations for Involvement from Others	Parental perceptions that their involvement is sought, welcomed and valued by the child, the child's teacher and child's school.
Parents' Perceived Life Context	Parents' time and energy, knowledge and skills for being involved.
Parents' Involvement Forms	Parents' home-based and school-based behaviours.

This data supported the collection of the initial quantitative data from Survey 1.

Survey 3

The third source of quantitative data was gained through presenting a list of preschool activities sourced from Blevins-Knabe and Musun–Miller (1996) (Appendix 3). Skwarchuk (2009) implemented an expanded version of the Blevins-Knabe and Musun-Miller (1996) number activities survey to investigate parents' responses to the relative importance and frequency of mathematics activities at home. The results from this study, with regards to frequency of activities identified, included: "number sense themes (e.g. counting objects, adding objects, read numerals, print numbers, sing number songs, subtract objects)" (p. 193).

Furthermore, in Skwarchuk's (2009) study, activities were classified either as basic or complex in content. As with Blevins-Knabe and Musun-Miller (1996, 2005), Skwarchuk (2009) examined the opportunities for developing numeracy concepts at home and how significant this is in predicting mathematical achievement. Parental attitudes, experience and mathematical knowledge were investigated using a five-point rating scale – strongly disagree, disagree, neutral, agree, strongly agree. Skwarchuk (2009) extended this study to include the use of diaries to record mathematical interactions. Parents also received a bag of materials to support them.

In the current study, data were gained from parents self-reporting on frequency and relative importance of mathematical activities, using the "Child-Parent Mathematical Activities" section from Blevins-Knabe and Musun-Miller (1996, p. 38). Frequency responses were rated on the following scale: 1 = not at all; 2 = one or two times per week; 3 = three to five times per week; 4 = six more times per week. Relative importance responses were rated on a scale: 0 = Do not know; 1 = Not important; 2 = Slightly important; 3 = Important; 4 = Very important; 5 = Essential.

These provided summed scores for individual parents as well as summed scores for each statement and mathematical aspect. In some situations, these results are reported as fractions or percentages of possible scores. For the purposes of this study, Blevins-Knabe and Musun-Miller's (1996) "Child-Parent Mathematical Activities" survey was identified as **Survey 3**.

The inclusion of Survey 3, comprising 20 mathematical activities, provided parents with some unintended guidance when journaling the mathematical tasks they were engaged in with their child.

The quantitative data from Survey 3 supported the data already gained from Survey 1 and Survey 2 in Phase 1.

Quantitative Data Summary

In this section of the chapter, the selection and the structures of the quantitative data collecting instruments have been detailed with reference to the original developers. The baseline data was obtained by parents reporting on their "current" practices during

Phase 1 of the project by completing the surveys. Survey 1 was completed prior to the Phase 1 Parent Group Session and emerging findings presented to the parents during this session. Midway through this study, after the Phase 2 Parent Group Session, the second phase of self-reporting using the surveys, was completed and returned to the researcher. The interconnectedness of these quantitative data has been identified.

Qualitative Data

Parent Group Sessions

There were two Parent Group Sessions in both locations each with a specific agenda. These meetings were held at ACU campuses in Sydney and in Canberra. The sessions were digitally recorded by the researcher with the permission of the participants. Listening to these recordings of the sessions augmented the developing picture of each of the participants' real life situations as they discussed the challenges and coping strategies. The sessions provided an opportunity for further discussion on related aspects and for ongoing feedback of the findings to the parents. During the Phase 1 Parent Group Session, the time frame for the project was presented, parents discussed their personal situations, and Survey 2 and Survey 3 were completed. The structure of the journal was negotiated between the researcher and the parents. Discussions were held to determine an understanding of informal early mathematical activities.

The "Make and Take" workshop was held during the second Parent Group Session where parents participated in tasks, and were presented with a Maths Kit of resources and a range of possible activities to be developed. Parents were requested to use these resources as the basis for activities for Phase 2 of their diary journaling.

Diaries/Journals

The other main source of qualitative data was the fieldnotes/journaling undertaken by the parents. Parents were asked to journal 5 to 10 minute sessions with their child, for a minimum of five sessions pre- and post- the intervention workshop. The format was collaboratively designed during the first Parent Group Session. The researcher provided a small notebook for this purpose.

Table 3.8: Diary Format

Time	Duration	Topic	What we did together	What did I think about it

Skwarchuk (2009) introduced a diary component and a selection of mathematical resources in her study for parents to use. These resources included: mazes, connect the dots, number stickers, tape measure, play money, and five shaped craft flowers. In her study, parents were requested to journal for 14 days and note the mathematical components of the tasks undertaken by the child. It was not necessary to utilise the resources provided.

Both the parent diary and the resource pack have been implemented in the current research study.

Topics in the diaries were to be analysed to identify corresponding topics in Survey 3. Insights gained by the parents through undertaking mathematical tasks with their child were to be analysed to identify connections to the five roles as presented by Cai et al. (1997).

Qualitative Data Summary

In this section of the chapter, the selection and the structures of the qualitative data collecting instruments have been detailed with reference to the original developers. The interconnectedness of this data to the quantitative data has been identified.

Data Collection Summary

This section of chapter 3 has presented the instruments used in both the quantitative and the qualitative data collection. Using resources (questionnaires, diaries) adapted from researchers in the field of parental involvement in education enabled the researcher the opportunity to effectively use mixed methods. The decision to implement an intervention enabled the researcher to further investigate the parents' perceived role in supporting the development of mathematical concepts.

Intervention

Intervention in the field of mathematics is often related to the child. In this study, the intervention was planned for the participating parents with the view of enhancing their understanding of the development of mathematical concepts.

From the beginning of this study, it was of prime importance to the researcher and to the participants that some type of intervention took place. To assess the initial perceived parental roles could have been valid in its own right. One of the reasons the parents chose to participate in this study, was to engage in furthering their understanding of mathematical concepts. However, to what extent would that have supported the opportunity to investigate how parent perceptions could change as an outcome of an intervention?

To provide a meaningful intervention that met the needs of the participants and provided further research data, the intervention was undertaken as a natural outcome.

"Make and Take" Workshop

The researcher has had previous experience in presenting workshops to parents on a variety of mathematical topics, often within the context of Literacy and Numeracy Week activities. As an outcome of these workshops, resources were always made available for parents to take home. Subsequent to the first series of diary entries in this study, each group of parents then participated in a "Make and Take" workshop. A Saturday workshop was organised for both the Sydney and Canberra participants. The majority of attendees were mothers, with one occasion of the whole family attending.

In Phase 1, the parent responses to Survey 3 and the topics addressed in the parent diaries had provided an insight into the aspects of early mathematics that were familiar to the parents. Counting, Numerals and Time were the most frequently recorded. Of lesser frequency were topics such as Comparing, Ordering, Matching, Sorting and Grouping. These topics became the focus for the input section of the workshop. The parents participated in a range of possible hands-on activities that supported the conceptual development of early mathematical concepts – "Matching and Comparing: Objects,

Pictures and Symbols". Parental input to these tasks was important as they discussed the relevance of the resources for their child.

Some parents were familiar with current resources including: the series "Practical teaching strategies in numeracy for children with learning difficulties" by Munro (2000), Nye, Fluck & Buckley's (2001) "Counting and Cardinal understanding in children with Down syndrome and typically developing children", Nye's (2006) publication "Teaching number skills to children with Down syndrome using the Numicon Foundation Kit", Wing & Tacon's (2007) "Teaching number skills and concepts with Numicon materials." or Buckley's (2007) "Teaching Numeracy". Some other parents were familiar with recent research undertaken by Faragher, Brady, and Gervasoni (2008) into the mathematical development of children with Down syndrome by an interview process.

Parents then had an opportunity to create resources for their own child. Items, such as numeral cards, base boards, card, stickers, bottle tops, and scourers, were provided for parents to create the resources that would be relevant to their child's interests and abilities.

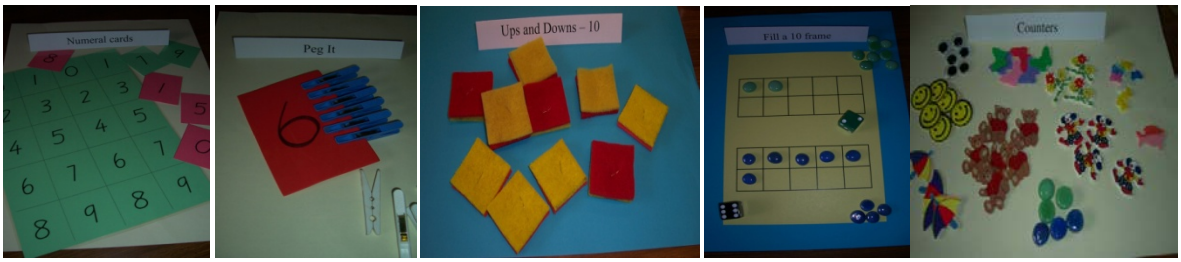


Figure 3.6: Selection of Resources - "Make and Take" Workshop

The focus for these tasks was on matching, comparison, patterns, and combinations for 10. The parents' choice of tasks was left to the individual parent. In one instance, the parent created ten-frame cards as a replica of the Numicon system as her child was familiar with this structure. Another parent selected resources that had a specific appeal to his child: e.g. dinosaur stickers, racing cars. The impetus to encourage these types of tasks was that there was minimal evidence of these activities in Phase 1 of parent diary entries. A Maths Kit, a small backpack, was provided to each family and included

resources such as: playing cards, dominoes, dice, counters, bottle tops, washing line with pegs and the resources that were created by the parents during the workshop.

The researcher provided support throughout the selection and resource-making process.

As part of Phase 2, following this workshop, parents were encouraged to provide a minimum of another five diary entries using some of the resources provided or created.

This section of chapter 3 provided a detailed overview of the intervention implemented in this study. The resources provided were deliberately inexpensive items, thus enabling parents to create similar resources in the future.

Figure 3.7: Parents Creating Resources at "Make and Take" Workshop

Data Analysis

The analysis of data, in all its forms, necessitated that it was progressively constructed and systematically recorded to enable the researcher to capture the spirit and direction of the research focus. To this end, the researcher has ensured that all response items were duly identified, using the given pseudonym, and categorised in preparation for analysis.

Onwuegbuzie and Teddlie (as cited in Johnson and Onwuegbuzie, 2004) present a structure for the conceptualisation of a mixed methods data analysis processes. According to these authors, “the seven step data analysis stages are as follows: (a) Data

reduction, (b) data display, (c) data transformation, (d) data correlation, (e) data consolidation, (f) data comparison, and (g) data integration" (p. 22). In the data transformation stage, they also note the term *qualitize* to describe the process of converting quantitative data into narrative, and *quantitize* to describe the process where qualitative data are converted into numerical codes.

In a later article, Onwuegbuzie and Combs (2011) refer to the possibility of decisions being made during the course of the study that impact on when and how the mixed analysis takes place. In this study, Survey 1 data was to be collected either as hard copy or as an email attachment and analysed prior to the first Parent Session. Basic level feedback was to be presented to the parents at this time. During this Parent Session 1, Survey 2 and Survey 3 were completed. The format for the diary/journal was agreed upon collaboratively.

Table 3.9: Data Analysis Timing

	Phase 1	**Phase 2**
Survey 1	Survey 1 emailed to participants; Returned by email or as hard copy Analysed before Parent Session 1 Feedback during Parent Session 1	Survey 1 emailed to participants; Returned by email or as hard copy Analysed after Parent Session 2 – 'Make and Take' workshop
Survey 2	Completed during Parent Session 1 Analysed prior to Parent Session 2 - 'Make and Take' workshop	Completed during Parent Session 2 – 'Make and Take' or emailed Analysed after Parent Session 2 – 'Make and Take' workshop
Survey 3	Completed during Parent Session 1 Analysed prior to Parent Session 2 'Make and Take' workshop	Completed during Parent Session 2 – 'Make and Take' or emailed Analysed after Parent Session 2 – 'Make and Take' workshop
Diary	Format agreed upon during Parent Session 1 Completed after Parent Session 1 Analysed prior to 'Make and Take' workshop	Completed after Parent Session 2 Analysed on receipt of email or hardcopy

Quantitative Data

Quantitative data were collected using three surveys. Survey 1, sourced from Cai et al. (1997), identified the parents' perceived role in supporting their child in mathematics. Survey 2, sourced from Walker et al. (2005), identified the parents' perceived constructs with regard to their involvement in education. Survey 3, sourced from Blevins-Knabe &

Musun-Miller (1998), identified the frequency, and the parent's perception of, the relative importance of mathematical activities undertaken in the home.

As all the surveys used a Likert scale, the initial results were tabled using a spreadsheet and then were identified as summed scores for individual parents and for separate aspects of the surveys. These were presented as tables for all participants. Correlations between items in Survey 1 and in Survey 2 were identified. (Appendix 5)

Subsequent to the intervention, the comparative analysis of the survey data was conducted to ascertain differences in perceived roles of selected parents as evidenced in responses to the Phase 1 and Phase 2 data collections. These were also presented as tables. The data from the open-ended questions as part of the surveys were presented under emerging themes. The analysis of the initial survey responses also assisted in the formation of the intervention.

Qualitative Data

Qualitative data were collected from the parent group discussions and the parent journals by digitally recording and then transcribing using Dragon Speaking 12. The data from the open-ended questions, as part of the surveys, were presented under emerging themes.

Research into options for the coding of qualitative data identified Perry and Docket's (2002) 'powerful mathematical ideas' as one option. Their categories (mathematisation, connections, argumentation, number sense and mental computation, algebraic reasoning, spacial and geometric reasoning, and data and probability sense) did not have a 'fit' with the mainly number tasks the parents had undertaken. Similarly, Bishop's (1988) universal activities (counting, locating, measuring, designing, playing and explaining) although a closer 'fit', were limited in the application of this study as part of the future audience will be parents. Schools will also report the child's knowledge and skills against the curriculum documents.

Attride-Stirling (2001) proposes that “analyses can be usefully aided by and presented as thematic networks: web- like illustrations (networks) that summarise the main themes constituting a piece of text” (p. 386). Further, it is stated:

> The technique provides practical and effective procedures for conducting an analysis; it enables a methodical systematisation of textual data, facilitates the disclosure of each step in the analytical process, aids the organisation of the analysis and its presentation, and allows a sensitive, insightful and rich exploration of the text’s overt structure and underlying patterns (p. 386).

To this end, Attride-Stirling (2001) presents a structure where several Basic Themes relate to Organising Themes, which in turn can be presented as Global Themes. Underwood (2010) used a similar structure in her study. In the current study, Basic Themes were identified by reading and annotating the data. These Basic Themes were then refined as specific topics (Organising Themes) and finally as encompassing themes (Global Themes). These themes were used to support or challenge the findings from the quantitative data.

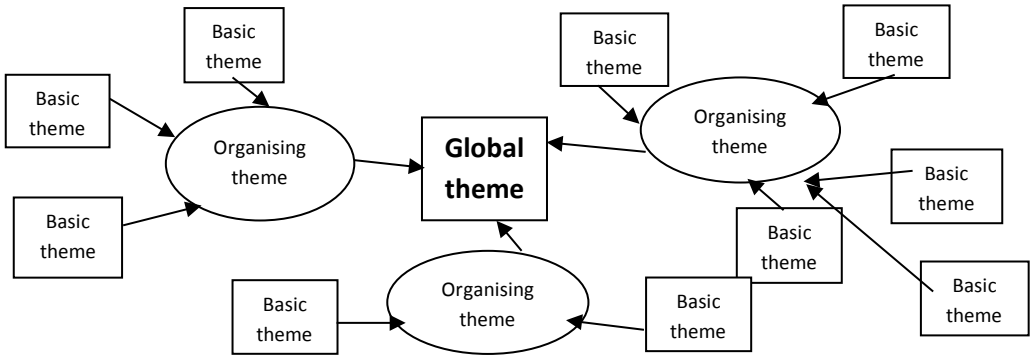


Figure 3.8: Thematic Networks - Attride-Stirling (2001)

The collection of the quantitative and qualitative data was analysed to enable the researcher to gain a deeper understanding of any changes that might have occurred in relation to the elements of the theoretical framework and to respond to the specific research questions.

Presentation of Analysis

The analysis of the data is presented in three separate chapters. Chapter 4 presents the Phase 1 data, both quantitative and qualitative. The results in this chapter are structured according to each specific data collecting instrument. Key findings are identified for each survey and for the diary entries. For Survey 1, results are reported for the fifteen mothers and nine fathers who participated. These are presented in table format as fractions and as percentages of possible total summed scores. Detailed discussions are presented for each of the five roles as identified by Cai et al. (1997). While overall statements were made for each role, results of parental responses to specific items within each role were also noted.

Parental responses, to the items identified in each of the constructs which were the basis of Survey 2, were reported on separately and connections made across the constructs. The results were presented in table format, in graph format and as text. Discussion is presented on specific items from various constructs.

Links between data collected from Survey 1 and Survey 2, and the correlations, were identified for 16 of the items from Survey 1 (Appendix 5).

The results from parental responses to Survey 3 are reported in both text and table format. From the parents' reported incidences of the "Parent-Child Activities", with regard to frequency of undertaking activities and the relative importance of those activities to their child's life, the results identified similarities for some aspects but wide differences for others. The topics of the activities undertaken frequently were also noted when preparing for the "Make and Take" workshop.

The Phase 1 data provided through the diaries, although collected from only four fathers and thirteen mothers, proved to be challenging to collate and analyse. Initially these entries were transcribed in a table format. Subsequently, the entries were analysed using a spreadsheet to enable the researcher to identify the mathematical topics involved. Results were presented in text, spreadsheet and graph format. In the first analysis, many topics were identified as being directly linked to the activities in Survey 3.

The identified topics were then considered against the Content Descriptors of Foundation level of the Australian Curriculum: Mathematics (2014).

The next stage of analysis for the parent diaries involved identifying themes within the parents' insights. Attride-Stirling's (2011) analytical tool – Thematic Networks – was used to identify basic themes, organising themes and global themes. Discussion on each theme was presented with examples from the spreadsheet and of the themes. The frequency of parental insights (a global theme), was presented in a graphic format. Links between the organising themes and the five roles were identified.

In Chapter 5, the analysis of the data for a group of four parents, two mothers and two fathers, was conducted by identifying changes for these parents from Phase 1 to Phase 2 of the study. Data is presented in table and graph formats for each of the surveys and diaries (topics and the insights). Discussion will be presented identifying changes in the roles, the constructs, selected activities, and the topics and insights from the diaries. Where relevant, responses to specific items from the surveys will be identified and discussed. Key results will be identified.

Chapter 6 will report on the results from Phase 1 and Phase 2 for the four individuals – the two mothers and two fathers who were members of the group in Chapter 5. This will provide the individual parent's voice to be heard. In this chapter, data from each parent's responses will be analysed using the five roles as identified by Cai et al. (1997). Parent's responses to specific items within the surveys will be utilised to identify changes. Where relevant, the responses relating to quantitative data will be presented in graph format with accompanying discussion; direct quotes from parental diaries will be used to enrich these results. Key results will be identified.

Chapter 3 Summary

This chapter has provided a detailed overview of the conceptual framework as presented by Walker et al. (2005), the methodology, the methods, the data collection instruments, data collection time line and methods of data analysis that were implemented in this study. The next chapter, chapter 4, presents the analysis of the data

gained from both qualitative and quantitative sources in Phase 1 - prior to the intervention for the participants.

Chapter 4 ANALYSIS OF PHASE 1 DATA

The purpose of this study was to investigate the nature of the roles parents undertake in supporting early mathematical concept development for their child with Down syndrome, their current perception of their role and the possible impact of an intervention on their perception of their role.

In the previous chapters, the conceptual framework, the setting for the research, the participants and the methodology have been explored. Using mixed mode methods, both quantitative and qualitative data were collected.

Parents of children with Down syndrome are in a position to support the mathematical development of their children in the early childhood years. However, as noted in Chapter 2, the Literature Review, there is little research evidence into understanding the nature of the role parents undertake in the field of mathematics. This research, with this particular group of parents, studies the significance of the parents' perceived roles in promoting the development of mathematical concepts. The findings represent the perceptions of these parents only. This research study involved 24 parents – 15 mothers and nine fathers.

Surveys and diaries were the chosen data collecting instruments. The intervention undertaken in this study was a "Make and Take" workshop.

Research into parental involvement in their child's schooling often has two aspects. One, to identify the role that parents engage in and, the other, the impact this may have on student achievement. In this study it is the nature of the parents' role that is the focus.

In this chapter, data gained in Phase 1 from Survey 1, Survey 2, Survey 3 and the Parent Diaries/Journals are analysed to investigate the findings that will be presented in Chapter 7.

This chapter sets out to present the Phase 1 data findings to address the research questions. The identification of perceived parental roles and the differences between mothers' and fathers' perceptions have been noted.

Data from the three surveys and diaries will be presented and analysed.

Phase 1 Data Collection

The baseline quantitative data were collected from the three existing surveys and the baseline qualitative data were collected from comments from Survey 1 and from the parent diaries.

Table 4.1: Sequence of Data Collection

DATA COLLECTION PHASE 1: PRE-INTERVENTION – May/June 2010			
QUANTITATIVE DATA		**QUALITATIVE DATA**	
Survey 1-1	**Survey 2-1**	**Survey 3-1**	**Survey 1 Comments & Diary – 1**

Survey 1 was sent to all participating parents by e-mail. The initial data from this survey were recorded and initial analysis completed prior to the Phase 1 group meetings. These initial findings were presented to the parents as part of the agenda for the first group meeting.

Table 4.2: Survey 1 Phase 1

ANALYSIS OF DATA FROM COLLECTION 1 OF SURVEY 1				
Pre-Intervention Parental Perceptions of Roles: May-June				
Motivator	Resource Provider	Monitor	Mathematics Content Advisor	Mathematics Learning Counsellor

Survey 2 and Survey 3 were completed by the parents during the first group meetings. The format of the parental diaries was also decided upon at this meeting. These three surveys and the initial diary entries were completed by parents prior to the "Make and Take" workshop.

Survey 1: Phase 1 Data

The Parental Involvement Questionnaire (PIQ) was used when studies were undertaken initially in America, and then again when investigating Cross-National Differences in perceived parental roles. (Cai, 1999, 2003; Cai et al., 1997)

In this current study, parents who have a child with Down syndrome undertook the same survey using the 23 items used by Cai (2003) in the Cross-National Differences study. (Appendix 1) Within the analysis of the data from this survey, the responses were examined: a) to understand which of the five parental roles would emerge as the most prominent, and b) to identify any perceived differences between mothers and fathers. Do fathers and mothers perceive their roles differently in supporting their child develop early mathematical concepts?

Fifteen mothers and nine fathers responded to this survey in two locations – Canberra and Sydney.

Table 4.3: Results of Survey 1 (PIQ) Phase 1

	Motivator	Resource provider	Monitor	Content adviser	Learning counsellor
Maximum Scores	**20**	**16**	**20**	**16**	**20**
Parents	13.1	10.3	13.3	11.5	13.1
	65.6%	**64.8%**	**66.7%**	**71.6%**	**65.6%**
Mothers	13.2	11.1	13.7	11.1	13.3
	66%	**69.1%**	**68.3%**	**69.1%**	**66.7%**
Fathers	13.0	9.2	13.0	12.1	12.8
	65%	**57.6%**	**63.8%**	**75.7%**	**63.9%**

In Survey 1, several statements were presented for each role. Parents responded using the ratings: 4 = I strongly agree, 3 = I agree, 2 = I disagree, 1= I strongly disagree. The maximum scores are the possible totals for the combined statements. The summed scores were calculated by adding the scores for each statement within each role. These scores are also presented as a percentage of the maximum score.

Parents, in general, had the highest scores in Content Advisor (71.6%). Motivator (65.6%), Monitor (66.7%), Learning Counsellor (65.6%) and Resource Provider (64.8) rated lower scores. In the overall scoring, both mothers' and fathers' responses to the roles of Motivator, Monitor and Mathematics Learning Counsellor, were very similar. However, when addressing specific questions, the responses of the parents did vary.

In the role of Resource Provider, mothers' responses (69.1%) were higher than the fathers' (57.6%) and in the role of Mathematics Content Advisor fathers' responses (75.7%) were higher than those of mothers' (69.1%).

The summary of the results of the initial responses to the PIQ used in this study (Survey 1) are presented in the following sections according to each role. Responses to specific items within the roles are included when deemed important.

Motivator

The majority (65.6%) of parents recognised the importance of mathematics in their child's future, and were able to provide encouragement and to motivate their child to do well in mathematics. Within the role of Motivator, mothers' responses indicated a higher level (62%) of agreement for the item "At home, I encourage my child to work hard on mathematics problems, even though the problems are difficult." Within the same role, fathers' responses (77%) to "I don't know how to motivate my child to do a good job on his/her mathematics assignments" indicated that fathers perceive themselves as parents who can motivate their child as they responded with either "I disagree" or "I strongly disagree" to this negative statement.

Resource Provider

In providing a good learning environment at home, parents indicated that books, games and puzzles are a means of encouraging mathematical conceptual development. This data was provided by the parents through responding to the specific item "I try hard to have a nice learning environment at home for my child to do mathematics" and via the open comments at the end of Survey 1. In the role of Resource Provider, the overall scoring for mothers (69.1%) was considerably higher than that of fathers (57.6%). To the

specific item “I often buy mathematics related books for my child”, the responses scored were mothers 66% and fathers 33%.

Monitor

While parents identified that they readily check homework, several commented that homework is not set for mathematics or that, as their child is in kindergarten, homework is not yet on the agenda. Awareness of the child’s mathematical requirements varied among parents. Within the role of Monitor, with particular reference to homework, mothers responded to “I check my child’s homework regularly”, with a high degree of agreement (86%).

Mathematics Content Advisor

The majority of parents (71.6%) indicated that they have the ability to help their child solve mathematical problems. They also indicated that they recognise the importance of discussing the relevance of mathematical concepts to everyday life. Parents were willing to increase their understanding of the mathematical concepts their child is currently learning. It was proposed that parents’ needs in this area would be the focus of the workshop where the “Maths Kit” was presented. In the role of Mathematics Content Advisor, the overall scoring for fathers was higher than that of mothers. To the item “I think I know enough about maths to help my child”, the responses scored were fathers 88% and mothers 56%.

Mathematics Learning Counsellor

While some parents have identified that they have some strategies to assist their child in overcoming challenges in mathematics, and that these strategies are effective, others identified this as an area for further investigation. Not all parents were aware of the approaches used in classroom situations. Overall, only 50% of parents understood their child’s strengths and weaknesses in learning mathematics. The majority of parents (87%) indicated that they do try to match their expectations with their knowledge of their child’s potential. Within this role, mothers’ responses (93%) indicated a significant level of agreement to the statement “I try to match my expectations to my child’s potential” while fathers’ rated this item at 66%.

Analysis of Survey 1 Phase 1 data influenced the underlying structure of the workshop by addressing aspects of early mathematical concepts at Foundation Level of the Australian Curriculum and Reporting Authority, Mathematics, 2014.

Key Findings from Survey 1

For responses to the item "I am usually able to motivate my child to learn maths well", two-thirds (71%) of parents responded in the affirmative, with mothers scoring (72%) slightly higher than fathers (66%). As Resource Providers, when responding to "I often buy mathematics-related books for my child", mothers were twice as likely (66%) to respond in the affirmative as fathers (33%). In the role of Monitor, mothers' responses (86%) indicated that the monitoring of homework was a constant task, while fathers responded less positively (66%).

In the role of Mathematics Content Advisor, the majority of fathers responded positively to "I think I know enough about maths to help my child" (88%), but fewer (66%) indicated a positive response to "I often discuss with my child how mathematics is used in our everyday life". For the same items, mothers' responses were 53% and 60%.

For the overall responses to the role of Mathematics Learning Counsellor, there is a mismatch between "I understand my child's strengths and weaknesses in learning mathematics" (50%) and "I try to match my expectations with my child's potential" (87%). In this second item, mothers' responses rated 93% compared to fathers' at 66%.

Parents did add general comments to the end of the PIQ. These comments were qualitative data that provided further insights beyond the rated statements. The themes that emerge from these general comments include: child being in the early years of schooling and not receiving homework that specifically addresses mathematics; parents being more confident and immersed in language development; lack of communication from the school/teacher with regard to child's mathematical progress/challenges; greater emphasis on literacy; parent realisation that games and other real life activities already support mathematical understandings; parent expectations that involvement in this research project will further their understanding of the development of early mathematical concepts with the view of assisting their child.

From the open-ended question in Survey 1, some parents identified their willingness to engage in tasks specifically relating to mathematics and indicated that their willingness to participate in this study would provide an opportunity to do so. Comments included:

> *We are hoping to gain input from this experience that will motivate us to help them in maths skills. We are really focusing on literacy at the moment, so we need as much motivation to continue with maths as possible. Thanks.*
>
> *I am a high school maths teacher and I encourage my son to think mathematically. However, I have just realised how little I know … about my son's development, especially how to teach at the year two level. I am looking forward to an interactive injection into my son's development.*
>
> *Talking to the teacher and through the Individual Learning Plan (ILP), is how I find out about the maths. She is not given any homework except the reader. I have concentrated more on reading and writing than maths. I think maths is a vital aspect that she needs to be able to incorporate into life so any input would be invaluable. Some of the questions above were not relevant for example my child does not receive homework. The last question does not address the option of discussing his progress in work with the teacher and school, an official ILP process.*

Survey 1 Summary

This section, has reported on the data collected from Survey 1 during Phase 1. Both quantitative and qualitative data were analysed. Evidence has emerged that there were some differences in perceived roles in this study between fathers and mothers.

Survey 2: Phase 1 Data

The second survey presented to the parents was Survey 2: the Revised Model from Walker et al. (2005) originating in the work of Hoover-Dempsey and Sandler (1995). (Appendix 2)

Level 1 and Level 2 of this model were implemented in this study. Specific questions were developed for each aspect of these levels by Walker et al. (2005). The description of the aspects of this model is to be found in Chapter 3.

<table>
<tr><td colspan="8">Revised Theoretical Model of the Parental Involvement Process Walker et al. (2005)</td></tr>
<tr><td rowspan="3">LEVEL 2</td><td colspan="7">Parents' Involvement Forms</td></tr>
<tr><td colspan="4">Home-based involvement</td><td colspan="3">School-based involvement</td></tr>
<tr><td colspan="7">Parents' Involvement Decisions</td></tr>
<tr><td rowspan="2">LEVEL 1</td><td colspan="2">Parents Motivational Beliefs</td><td colspan="3">Parents Perceptions of Invitations for Involvement from Others</td><td colspan="2">Parents Perceived Life Context</td></tr>
<tr><td>Parental Role Construction</td><td>Parental Self-Efficacy</td><td>General School Invitations</td><td>Specific Teacher Invitations</td><td>Specific Child Invitations</td><td>Skills and Knowledge</td><td>Time and Energy</td></tr>
</table>

Figure 4.1: Revised Theoretical Model - Walker et al. (2005)

Survey 2 investigates the involvement of parents in their child's education and does not specifically address mathematics. However, the impact of the parent's role construction, self-efficacy, perceptions of invitations, life contexts and home- and school-based involvement have a direct impact on their perceived roles with respect to mathematics.

Parent responses to the statements in Survey 2 during Phase 1 are presented in this section. Three fathers and thirteen mothers responded during the first meetings. As the number of fathers responding was low, the responses of parents in general were analysed. The percentages for each aspect were calculated by summing the scores for all

the items for all the parents and dividing by the maximum possible scores. Where significant, the summed scores for relevant items have been noted.

Figure 4.2: Results from Survey 2 Phase 1 - Parental Involvement Levels 1 & 2

LEVEL 1:	
A. Parental Role Construction for Involvement in the Child's Education	
Role active beliefs: responsibility	77%
Valence toward school	69%
B. Parental Self-Efficacy for Helping the Child Succeed in School	
Overall	32%
4. Other children have more influence on my child's grades than I do	3%
C. Parents' Perceptions of General Invitations for Involvement from the School	
Overall	70%
4. This school lets me know about meetings and special school events	20%
E. Parents' Perceptions of Specific Invitations for Involvement from the Teacher	
Overall	26%
3. Asked me to talk with my child about the school day	10%
4. Asked me to attend a special event at school	10%
5. Asked me to help out at the school	6%
F. Parents' Perceived Life Context	
Time and energy:	60%
2. Help out at my child's school	27%
Knowledge and skills	72%
4. How to communicate effectively with my child about the school day	32%
LEVEL 2:	
G. Parents' Involvement In Home-Based and School Based Activities	
Home-based:	72%
3. Helps this child study for tests	15%
School–based:	17%
1. Helps out at this child's school	8%
2. Attends special events at school	15%
3. Volunteers to go on class field trips	12%
4. Attends PTA meetings	6%
5. Goes to the school's open house	14%

When addressing Phase 1 of Survey 2, the majority of parents indicated that they believed to a greater extent that schooling was their responsibility (77%). In rating their feelings about their school experiences, more than two-thirds (69%) of the parents indicated that they had had a positive experience.

When self-reporting on aspects of their self-efficacy for helping their child to succeed in school, there was a mixed response; parents know if they are getting through to their child (22%), but 20% agreed that they don't know how to help their child learn. This negative statement may have caused confusion in the parents' responses. Although few in number, fathers did report lower on the scales than any of the mothers.

Responses to the parents' perceptions of general invitations for involvement from the school were positive to five of the items (70%), including the school contacting them about any problem involving their child (76%). These items rated higher than those concerned with the school letting them know about meetings and special school events (20%). Responding to the regularity of teacher contact, parents responded that this occurred infrequently (26%), with this aspect being one that scored lower overall, and considerably lower for three items. Some contact was made through notes, phone calls and e-mails (37%), and some parents were asked to help with homework.

Parents reported that they had enough time and energy to attend special school events (10%), help their child with homework (76%) and supervise homework (69%). Helping out at school (27%) and communicating effectively with the child about the school day (32%) rated a considerably lower response. Also, half of the parents indicated that they had the knowledge and skills to communicate effectively with the school (58%), and only one third of parents indicated that they knew "How to communicate effectively with my child about the school day" (32%).

Level 2 addressed parents self-reporting of at-home and in-school activities. These are not specific to mathematics.

Three-quarters of the parents responded positively with respect to their involvement in home-based activities (72%). Parents indicated that the children do not participate in tests. Responses to "Reads with the child", scored relatively highly at 66%

whereas “Practices spelling, maths or other skills with this child” scored 54%. Supervising homework rated less than 50%.

With regard to school-based involvement, parent responses indicated that this happens much less frequently (17%). Attending school events, attending open days and volunteering to go on class field trips all ranked at 15% or less. Parents ranked “Helping out at the school” and “Attending meetings” even lower at 8%.

Survey 2 Summary

Overall, in completing Survey 2, participants self-reported that they perceive they are highly influential in supporting their child to succeed in school. These parents are confident with literacy, but claim to be challenged with helping the child learn maths. They rated invitations from the school, at a low level.

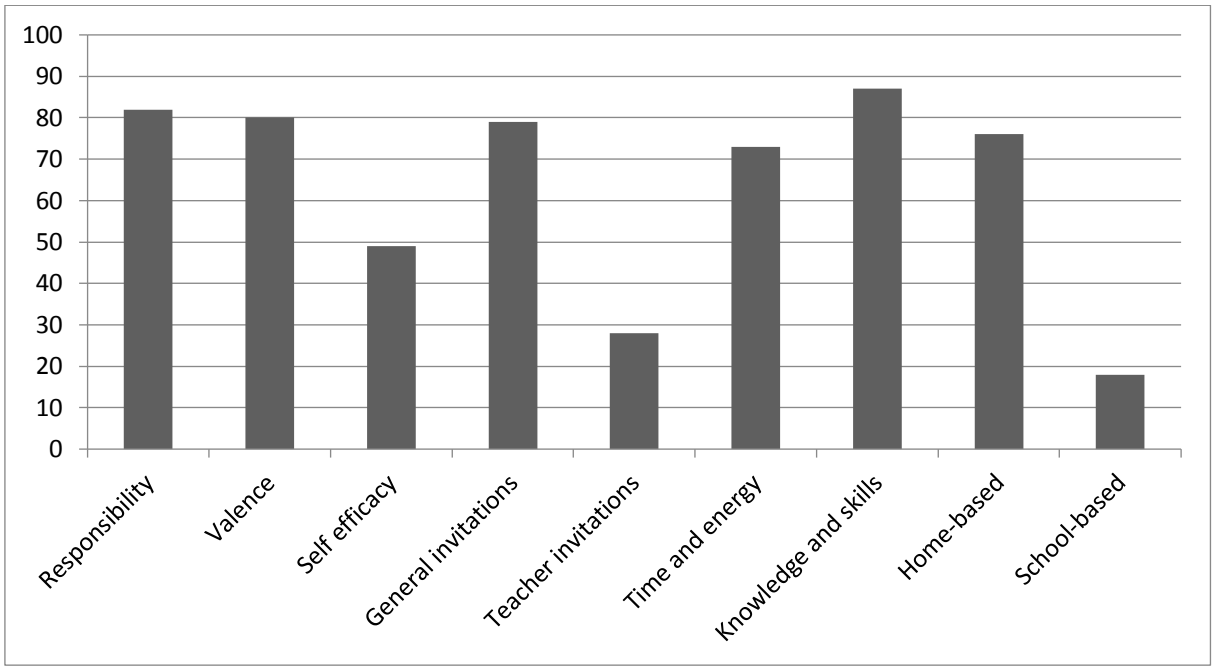


Figure 4.3: Results from Survey 2 Phase 1

The graphed representation of parent responses to Survey 2 indicates that while parents feel they have the knowledge and skills, as well as the responsibility, to be involved in their child’s education, their perceptions of teacher invitations and school-based involvement were significantly lower than other aspects. Parents’ self-efficacy ranked midway.

This section has presented the analysis of the data obtained from Survey 2 from all the parents.

Links between Data Collected from Survey 1 and Survey 2 in Phase 1

There was evidence at this point in the analysis that parent responses to Survey 2, in some instances, supported the responses to Survey 1. "Agree" was determined by adding the total scores for "I strongly agree" and "I agree".

Table 4.4: Selected Items from Survey 1 and Survey 2 – Phase 1

Survey 1		Survey 2	
MOTIVATOR	Agree		Agree
2. At home, I encourage my child to work hard on mathematics problems, even though the problems are difficult	**44%**	**Parents' Perceived Life Context – time and energy** F7 Explain tough assignments to my child	**50%**
5. I don't know how to motivate my child to do a good job on his/her mathematics assignments	**20%**	**Parental self-efficacy for helping the child succeed in school** B 6 I don't know how to help my child learn	**20%**
RESOURCE PROVIDER			
7. I often take my child to the public library	**33%**	**Parents' involvement in home-based activities** G 5 Reads with this child	**95%**
MONITOR			
10. I check my child's homework regularly	**70%**	**Parents' involvement in home-based activities** G 2 Supervises this child's homework	**69%**
11. I seldom spend time talking with my child about his/her progress in mathematics	**32%**	**Role activity beliefs** A 10 Talk with a child about the school day	**86%**
MATHEMATICS CONTENT ADVISOR			
15. I feel I can help my child solve problems from mathematics class	**68%**	**Parental self-efficacy for helping the child succeed in school** B 2 I know if I am getting through to my child B 3 I know how to help my child get good grades in school	**22%** **34%**
16. I think I know enough about maths to help my child	**58%**	**Parental self-efficacy for helping the child succeed in school** B 7 I make a significant difference in my child's school performance **Parents involvement in home-based activities** F 13 I know enough about the subjects of my child's homework to help him/her	**55%** **87%**
MATHEMATICS LEARNING COUNSELLOR			

19. I don't know strategies for helping my child overcome weaknesses in mathematics	**34%**	**Parental self-efficacy for helping the child succeed in school** B 6 I don't know how to help my child learn	**20%**

The correlation between items from Survey 1 and Survey 2 were identified for 16 items from Survey 1. Specific items were selected on the basis that the data from Survey 2 supported the findings from Survey 1. The full correlation table can be found in Appendix 5.

In the role of Motivator, 50% of parents reported that they have time and energy when supporting their child to do mathematics. Responses on both surveys, 53% and 48%, indicate that they had identified that there was a specific concern in their ability to support their child develop mathematical concepts. While literacy, in the form of reading with their child, rated highly (95%), visiting the public library was seldom undertaken (33%).

With regard to homework, parents' responses in the role of Monitor were the same at 70% and 69% respectively. In this role, parents reported that they talked with their child regularly about school (94%). The statement 'I seldom spend time talking to my child about his/her progress in mathematics' responses were 32% in agreement; therefore it can be assumed that 68% do talk about mathematics.

As Mathematics Content Advisor, there are mixed results from the two surveys. Parents' self-efficacy for assisting successful outcomes for their child is low (34%) as reported in Survey 2 yet more than two-thirds feel they can assist (68%). Also within this role, just over half of the parents (58%) indicated that they have the mathematical knowledge and that they do make a difference to their child's performance at school (55%); however, the overwhelming majority of parents rated that they do have the knowledge and skills to assist with homework (87%).

It is to be noted that in the role of Motivator in Survey 1, item 5 is presented as a negative statement "I don't know how to motivate my child to do a good job on his/her mathematics assignments" and the corresponding statement in Survey 2 is also presented

as a negative statement “I don’t know how to help my child learn”. Results for these two items were the same.

In the role of Mathematics Learning Counsellor negative statements were also presented to the parents – “I don’t know strategies for helping my child overcome weaknesses in mathematics” from Survey 1 and “I don’t know how to help my child learn” again from Survey 2. In this instance, there were low levels but different results.

By cross-referencing parental responses from Survey 1 and Survey 2, relevant consistencies and inconsistencies have been identified.

Survey 3: Phase 1 Data

Survey 3 addressed 20 specific mathematical tasks that could be undertaken by parents with their child. In Phase 1, the parents were asked to note the frequency they had undertaken these tasks with their child and how important these tasks were for their child. Details of this survey can be found in Chapter 3; the detailed parents’ responses are in Appendix 3.

Items were selected from Survey 3, and presented here, on the basis of highlighting the incidences where the frequency of undertaking the tasks and the relative importance given to those tasks were identified.

Table 4.5: Selected Items form Survey 3 Phase 1

Selected Items	FREQ		IMPORT
CHILD AND PARENT ACTIVITIES	**%**		**%**
1. Use the words “one”, “two” or “three” with your child.	**98%**		**94%**
3. Encourage your child to group objects. For example “Put all the red ones here.”	**58%**		**91%**
7. Use the concept of “more” with your child. For example, “Billy has more marbles than you.”	**75%**		**80%**
9. Use the concept “same number” with your child. For example, “You have the same number of dolls as Becky.”	**68%**		**71%**
14. Discuss number values with your child. For example, “Seven is more than three.”	**47%**		**87%**
19. Worked with your child on recognising written numbers.	**47%**		**90%**

In Survey 3, the following items from the categories were identified as those that parents perceive to be important, in that they frequently undertake these tasks with their child: using words 1 to 10, using the concepts of more and same as, showing how to recite the numbers in order, and, showing how to count objects.

The other items indicated that, in responding to the initial Survey 3, parents' perceptions of what was important and what they frequently undertook, involved tasks addressing certain aspects that resulted in a wider difference in responses. These items fall into the following categories: classifying, ordering, comparing and hearing, and reading and writing number words. For example:

> Item 3: Encourage your child to group objects. For example "Put all the red ones here." Rated 91% for importance but only 58% for frequency.
>
> Item 14: Discuss number values with your child. For example, "Seven is more than three." Rated 87% for importance and 47% for frequency.
>
> Item 19: Worked with your child on recognising written numbers; e.g. Rated 47% for frequency but 90% for importance.

Survey 3 Summary

In ranking importance of mathematical tasks as presented in survey 3, tasks were ranked by the parents from 71% to 99%. In ranking importance, item 9: "Use the concept "same number" with your child; e.g., "You have the same number of dolls as Becky" ranked lowest (71%). Eight items ranked close to or less than 50% for frequency of involvement. These involved comparisons, ordering, using numbers greater than 10, and the recognition and writing of numerals. Money and number songs were also included. Counting to 10 was reported as the most frequent activity (91%).

These findings influenced the preparation for the "Make and Take" workshop.

Parent Diaries: Phase 1 Data

The decision to include parent diaries as a data collecting instrument was influenced by Skwarchuk (2009). In Phase 1 of this current study, the actual mathematical content topics to be included in the diaries were left to the discretion of the parents. Aspects of the format for the diaries were agreed upon during the first scheduled meetings. The aspects were: date, time, duration, topic, what we did together, and what did I (the parent) think about.

This section reports the findings from the Phase 1 diaries. Four fathers and thirteen mothers submitted their diaries in the pre-arranged format. In the initial recordings of activities in Diary 1, the majority of parents undertook more than the requested five entries. In total, 153 diary entries were presented in Diary 1.

For most of the sessions, the diary entries described the parent-child activities which were between 5 and 15 minutes in duration, with many of the activities occurring in the mornings. On a few occasions, siblings were involved in the task.

Table 4.6: Phase 1 Diary Sample (MO)

Date	Time	Duration	Topic	What we did together	What did I think about it
21/5	1:30 pm	10 mins.	Counting up to 10 and backwards from 10 to 1	Counting up to 10 and backwards 10 to one. Showing 2+2 fingers, 2+ 1 finger, 2+3 fingers; Parent prompting with counting backwards – what comes before five? Demonstrating with fingers and asking how many there are.	Surprised that the child could just see the total of fingers without having to count them separately.

Parents were presented with a small spiral-bound notebook for recording purposes. The majority of parents scribed by hand, with four presenting their diaries as computerised text. All diary entries were transcribed by the researcher into a table format. The transposing of this data gave great insights to the researcher.

Research-based options for the coding of qualitative data as identified Perry and Docket's (2002) powerful mathematical ideas and Bishop's (1988) universal activities

were deemed by the researcher to be too broad to be a relevant application for this study.

As an Early Childhood and Primary School teacher of many years and as a lecturer in the field of Pre-service Teacher Education in mathematics, the researcher is familiar with the mathematical topics relevant to this study. This expertise was drawn on to code the extracts for the mathematical content using the Foundation stage in the Australian Curriculum: Mathematics.

She won **Washing everywhere**

Figure 4.4: Families Enjoying Mathematics Activities

Diary 1 Topics

For the researcher, consideration of where these topics originated was an interesting exercise. On reflection, it became evident that the activities itemised in Survey 3 were a basis for the selection of topics for some parents. On further analysis, it became evident that many of these topics correlated clearly to the Foundation Year of the Number and Algebra Strand and Sub-strands of the Australian Curriculum – Mathematics.

The data, accessed through the parent diaries, gave a greater insight into the parents' interaction with the child. In the reflections documented by the parents subsequent to undertaking tasks, they identified the mathematical basis of the task. All topics were recorded using a spreadsheet. In some instances, more than one topic was identified in the one diary entry.

Table 4.7: Sample Spreadsheet of Diary Topics Phase 1

Diary 1 Topic	Diary entry	Diary 1 Topic	Diary entry
Adding up	Drawing, counting, writing	Ordering Numbers	Order – Rainforest Maths
Combinations for 10	Scourer Squares	Ordering numbers	Washing line – game
Comparison	Size of jeans	Pairs	Pegs for washing
Comparison	Spot the difference	Pattern	Shape and number
Cooking	Turn taking	Patterns	Choose and create with 3s
Counting	Around the table	Quantity	Money
Counting	Subitising on dice	Quantity	Spreading jam
Counting	Shopping aisles	Sorting	Colours
Counting	Total – *Rainforest Maths*	Sorting	Washing
Game	What's the time Mr. Wolf	Time	Beat the clock
Grouping	Matching dolls and items	Time	Age – oldest
Matching	Objects to the numbers	Time	Calendar – crossing off days
Measurement	In the garden	Time	Timetable for the day
Money	School canteen	Time	Counting how many days
Money	PIN	Time	Book just a Minute
Numbers	Speed signs	Time	Sequence for the day using markers
Numbers	Washing line game		

The diary entries that were of a real life context, indicated that the parents recognised mathematics in everyday life. Examples of these were: a basic understanding of time, both telling the time and understanding duration; one-to-one counting involved in real life tasks; and money, both value and shopping. Games were recognised by the parents as having a mathematical basis and having underlying benefits such as taking turns and following rules.

Of those that were mathematical in origin, such as numeral recognition, addition and rote counting, they may have been influenced by completing Survey 3. This was an unintended outcome of presenting this survey prior to Diary 1 being undertaken by the parents.

When Diary 1 items are compared to Survey 3 items, it is noted that the following topics were all included in the survey: adding, comparison, counting, grouping, matching, money and written numbers. Item 17, “Sang a number song with your child”, was the

only item not correlated to the topics selected by the parents in the entries for Diary 1. These topics are presented below as the number of instances within the total number of diary entries.

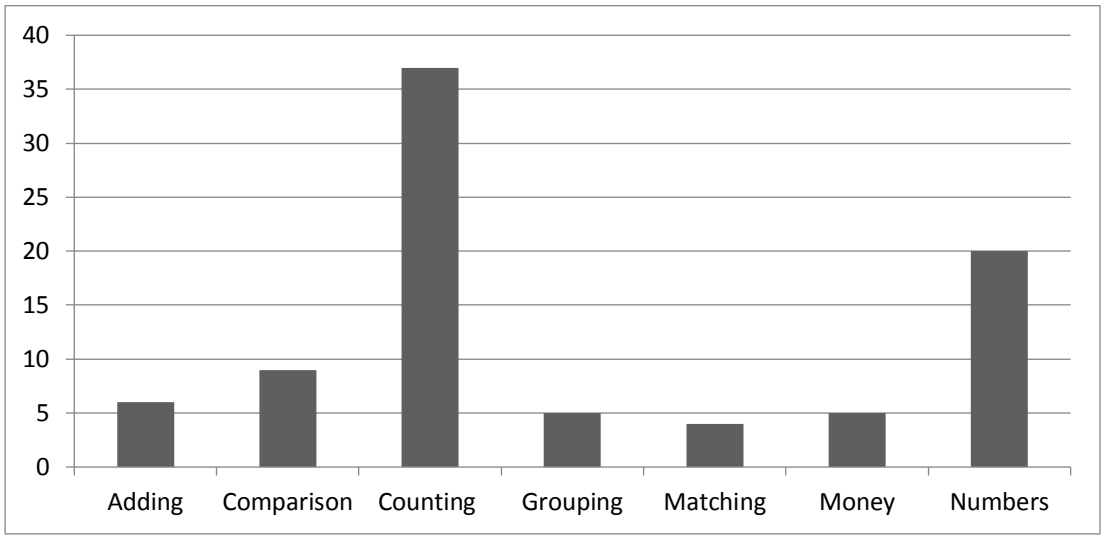


Figure 4.5: Frequency of Topics from Survey 3 as identified in Diary 1

Taking a wider view, diary entries contained many other topics beyond those of Survey 3 and these are identified in Figure 4.4. In some instances, parents focused on a narrow range of topics, while other parents explored a wider range. There were no specific directions given by the researcher regarding the range of topics to be chosen.

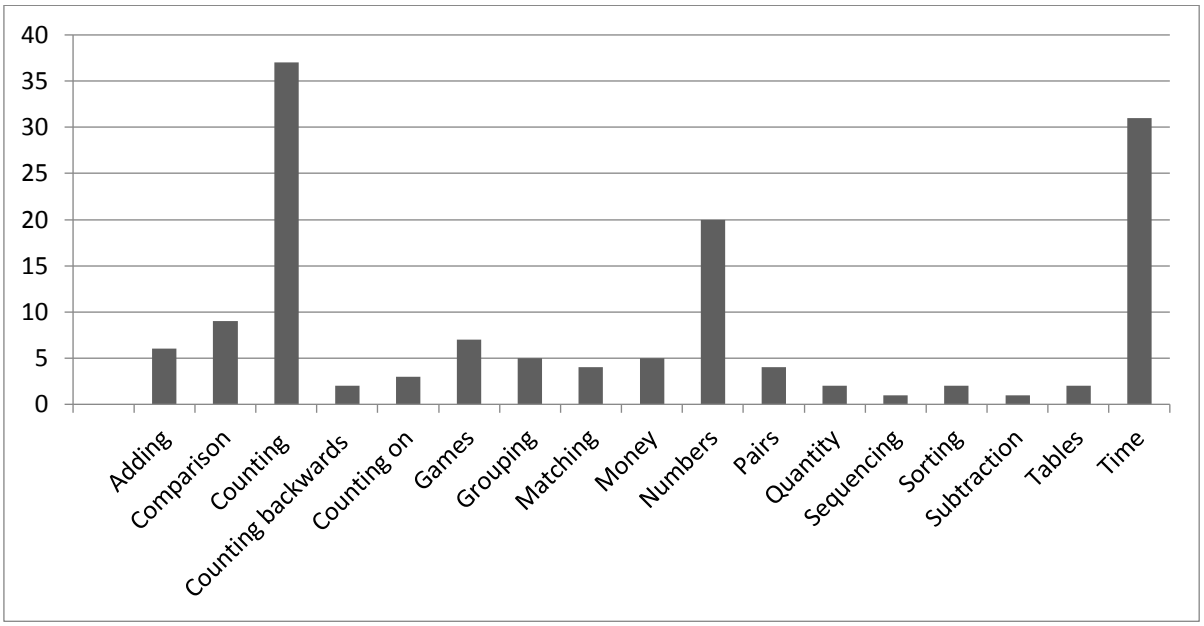


Figure 4.6: Frequency of Topics Identified from Diary 1

Overall, parents canvassed a wide range of topics in their journal entries. Very few parents focused purely on the mathematics; i.e. identifying numerals or counting without a context. It is evident that parents do value counting and numeral identification. As can be seen in Figure 4.3, in Diary 1 there was a heavy emphasis on counting (24%), number recognition (13%) and aspects of time, both telling the time and understanding duration (20%). These percentages have been calculated by using the number of instances compared to the total number of diary entries.

In many instances, activities undertaken in the context of everyday life were viewed through the lens of mathematics. Using half cup measures to explore that the two halves make a whole, identifying speed zones while travelling and correlating with the scale on the speedometer, hanging out the washing, matching socks as pairs, and more, were all detailed in parent diaries.

Activities directed to counting, counting on, addition and subtraction were examined by the parents in light of the challenges and frustration experienced by their child. Through this, parents recognised that there were/may be pre-requisite skills that limit the opportunities for success.

Many of the topics identified by the parents were coded directly with The Foundation Year Achievement Standards, Proficiencies, Content Descriptors and Elaborations found in the Australian Curriculum: Mathematics (ACARA, 2014) (Authority, 2015 #322). Tasks related to Number and Algebra, Measurement and are noted below (the number following the item relates to the number of times that item was reported by the parents):

FOUNDATION

Number and Algebra

Number and Place Value:

Establish understanding of the language and processes of counting by naming numbers in sequences, initially to and from 20, moving from any starting point (ACMNA001)

Counting: Rote – 12	Counting: Items – 8	Counting: ICT – 4	Counting: Quantity – 19

Connect number names, numerals and quantities, including zero, initially up to 10 and then beyond (ACMNA002)

Numeral ID: 1-5 – 9	Numeral ID: 6 -14 – 7	Number line – 2	Missing number – 2	Teen/ty – 1

Subitise small collections of objects (ACMNA003)

Compare, order and make correspondences between collections, initially to 20, and explain reasoning (ACMNA289)

Ordering – 5	Sorting – 8	Comparison – 11	Matching – 7	Quantity – 19

Represent practical situations to model addition and sharing (ACMNA004)

Adding – 9	Subtracting – 4	Combinations for 10 – 6	Games – 18

Patterns and Algebra

Sort and classify familiar objects and explain the basis for these classifications. Copy, continue and create patterns with objects and drawings (ACMNA005)

Grouping –2	Tables – 3	Pairs – 7	Halves -2	Patterns – 8

Measurement and Geometry

Using units of measurement

Use direct and indirect comparisons to decide which is longer, heavier or holds more, and explain reasoning in everyday language (ACMMG006)

Shopping – 5	Money – 3	Driving: speed – 3	Clothes: size – 3	Cooking – 10

Compare and order duration of events using everyday language of time (ACMMG007)

Connect days of the week to familiar events and actions (ACMMG008)

Time – 19	Routines – 7	Cooking – 10		

Some topics beyond Foundation Level were also identified by the parents and included:

Literacy – 9	Maths Text – 1	Games – 18	Fine motor – 2	
Shopping – 5	Money – 3	Driving: speed – 3	Clothes: size – 3	Cooking – 10
Time – 19	Patterns – 8	Measuring – 2	Shapes – 1	

Diary 1 Identification of Initial Themes

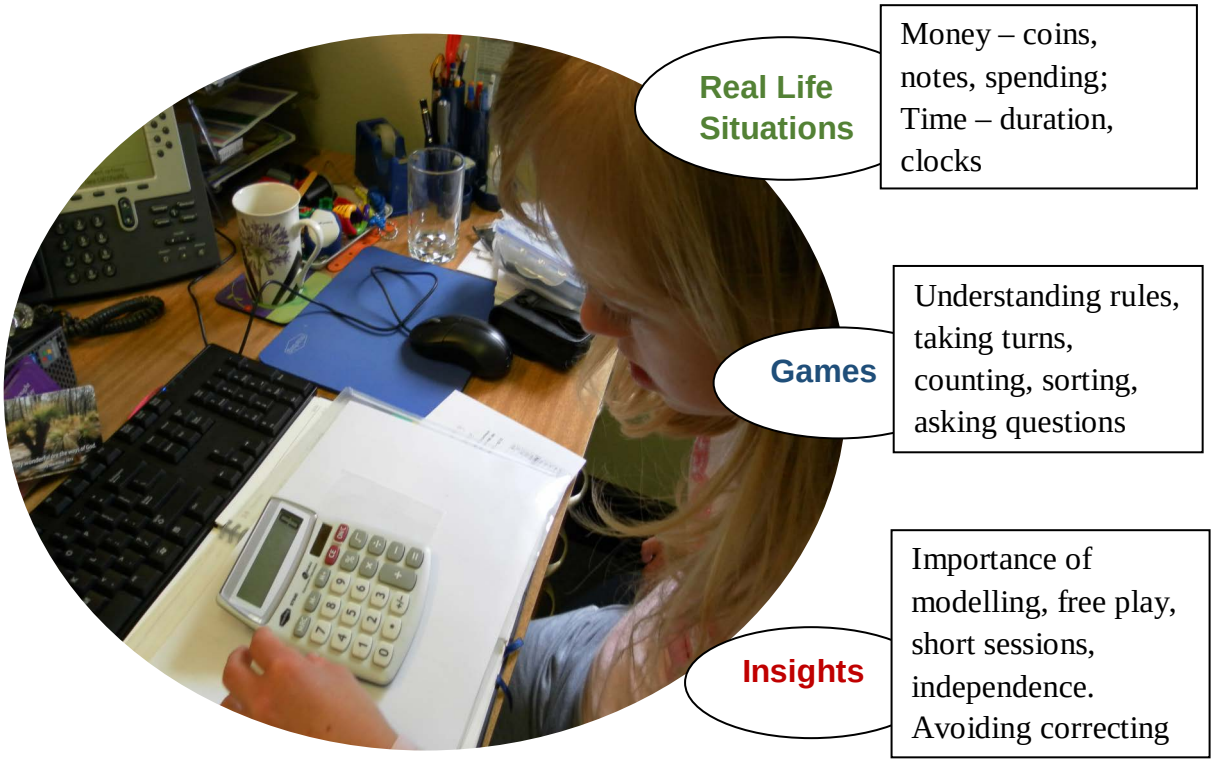
The data, accessed through the parent diaries, gave an insight into the parents' interactions with their child and the reflections documented by the parents subsequent to undertaking tasks that identify the mathematical basis.

One parent mentioned how the items in the surveys had supported her when considering tasks.

> *It is really good to do this and the questions you asked can now guide me on a daily basis to add other things to what I am already trying to do*. [MO3]

In the initial stage of analysing the diaries, these topic themes emerged as mathematical content – the mathematical aspect addressed. Sometimes this mathematical content was a direct mathematical task (e.g. the number of dots on the dice), at other times the mathematical content was embedded in a particular situation (e.g. folding the washing and comparing the sizes of the clothes).

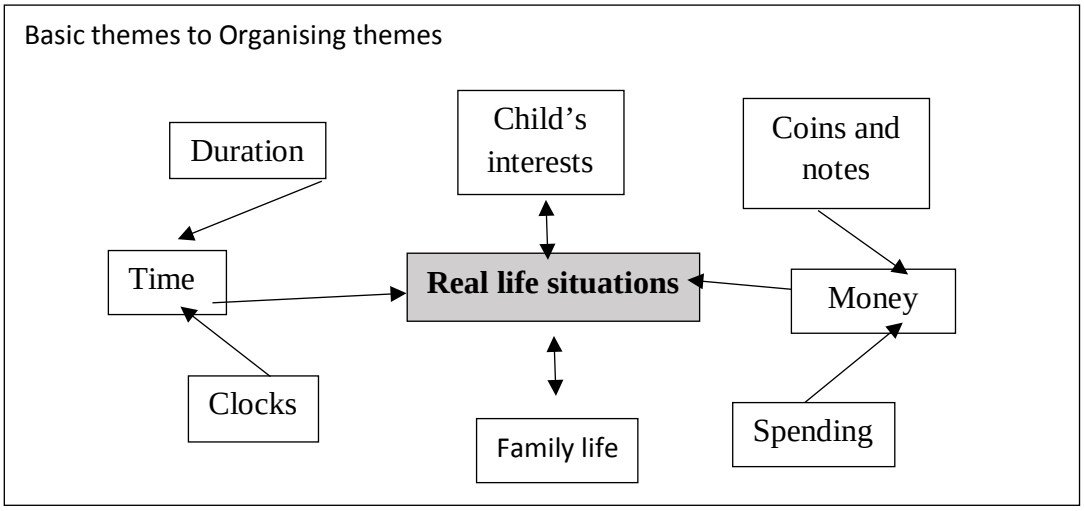
As the analysis progressed, more over-arching themes began to emerge, such as mathematics in real life situations, mathematics implicit in games, and the parents' reflections on the tasks undertaken (e.g. what was challenging for the child, what was successful, why it was successful).



The continued use of spreadsheets and the structure of Attride-Stirling's (2001) approach to analysing qualitative data enabled multiple themes to be explored in the analysis of the topics, the real life situations, and the insights described by the parents.

Each layer of the analysis presented new connections to be explored. Basic themes developed into organising themes. The initial themes were: real life situations, games and insights.

Diary 1 Basic Themes



Real Life Situations

Reflecting on money, parents became aware of the multiple challenges that face the child in understanding of the value of coins.

[MO9] Ordering hamburger at drive-through McDonald's

Gave him the coins to the total of $2.10 and talked about how much he had. We talked about the numbers on the coins.

Difficult concepts as even the like coins have different images on them.

[MO4] Money

Show different coins and ask – which are the same? Count the amount of the coins. Parent explained it was not about the amount of coins, but about what they look like and which ones were the same.

This did not work. Realise that with language, I know exactly what to do to simplify an activity when it is too difficult because I have a lot of experience with that. With

maths, I am getting stuck most of the time, because I do not know how to simplify the exercises. I just do something else.

Time was recognised as a life skill and parents undertook tasks that involved instances of telling the time, sequencing and duration.

[FA1] Time

Read 'Just a Minute' a book by Teddy Slater. Amy listened and helped read the story about a boy wanting to play with various members of his family but they say 'Just a minute' and he learns how long that is really. Discussed it along the way. I read and talked about the story with Amy. We could try guessing how long is a minute when we are awaiting and had nothing to do.

[MO3] Sequencing

Discussed what we were doing next. Pray first, then home, then eat, then bed – 4 things. She is improving her memory. She is able to remember things more and more.

[MO1] Telling the time

Played 'Dora Tell the Time' game: Each person gets a clock face and they take turns taking a card with a time on it and then both players try to be the first to make the time on the clock. She loves Dora and she is fascinated with clocks and time. She loves this game and has learned to tell the time pretty well but we play it from time to time to keep it in her memory. She is very quick at the o'clocks and half pasts and she does well at the other times.

[MO1] Longer, shorter, taller, sorting, pairs

Taking washing off the line:

We had two wash baskets and a line full of washing to come off. We started by sorting out who were big people and who would have people in our family. She helped put clothes in the basket according to whose clothes they belong to. Initially, mum's and dad's. When we got to big sister's pants we measured against mum's pants to discover they were practically the same length. So her clothes went with mum's and dad's. We then compared the length of her pants with her brother's. Asked questions like: Who is taller? Or is shorter? Also talked about Big Brother's

pants which were shorts! She knew he was almost as tall as big sister so she correctly sorted his clothes into the big tall people's basket. We went on to do pairing of socks which was easy for some that look quite obvious. But with one pair of short black explorer socks and one pair of long black explorer socks she was able to differentiate and sorted approximately.

I thought she enjoyed being able to help me and I realise just how much language and mathematics can occur with the simple things in life.

Other parents explored opportunities for mathematical language and numeral identification through the reading of favourite stories.

[FA7] Reading

Read 'Bears in the Night'; will stop in this favourite book with: in, out, up, down, around, between, through, up, down etc.; repeated a lot, prompted and left gaps. He understands these words after a lot of practice and is starting to repeat the pages. Repeated this book often.

[MO8] Counting

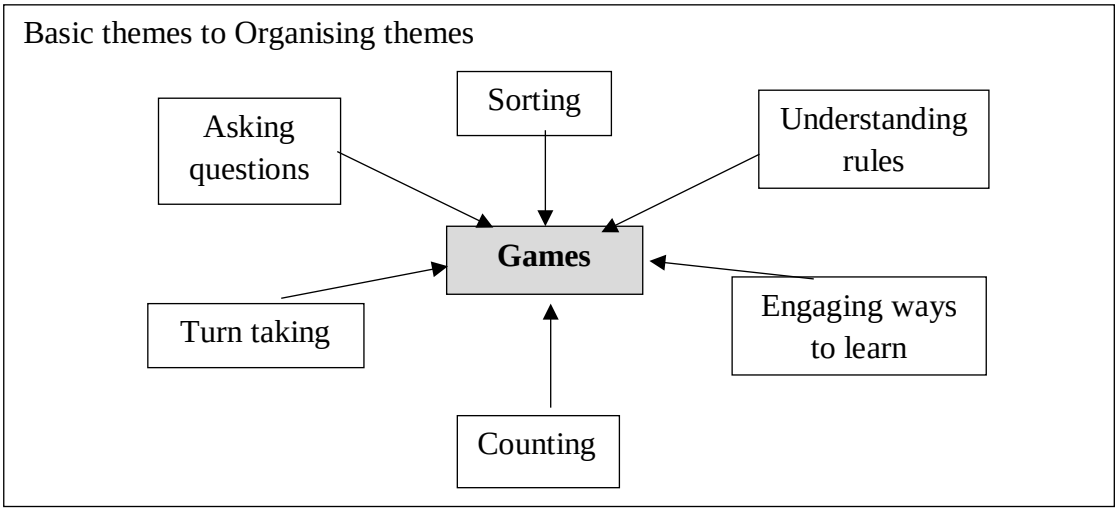
Whilst reading together 'Chugs the Tractor' we explored the pictures in the text. We counted all the big sheep; then we counted small sheep. He was successful in counting. I asked him which paddock had more sheep. He replied eight and pointed to the correct paddock. We discussed if the tractor was going up or down the hill to which he correctly replied down. On one page there were two tractors and I asked which tractor was big; he correctly pointed the [big] tractor out. We then counted all the sheep. He missed the number 12. I corrected him and we finished counting together.

Games

Games were identified as structures supporting motivation and perseverance – from "Snakes and Ladders" to "Hide and Seek".

[MO14] Playing Snakes and ladders

At one stage she tried to go straight up the board rather than the normal stair-like way. Gets very easily distracted, either what's going on around her or not wanting to land on a snake, and this leads to an issue with accuracy when playing. We enjoyed playing the game together though – in fact Katie enjoys playing games! LIFE IS A GAME – after all!! – According to Katie.



Parents' empathy for their child, a realisation of the challenges that may or may not have been recognised previously, are evident in the parents' documentation of their interaction with their child and their reflection on that interaction.

[MO9] Playing a game with dice

Taking turns rolling three dice; adding up the total score and recording them on paper. He was only able to add two dice and not the third. Need to make it [a] simpler game that delivered a result – winner – more quickly.

While challenges were identified, successes – no matter how small – were celebrated.

[FA11] Counting sequence to 5 and beyond

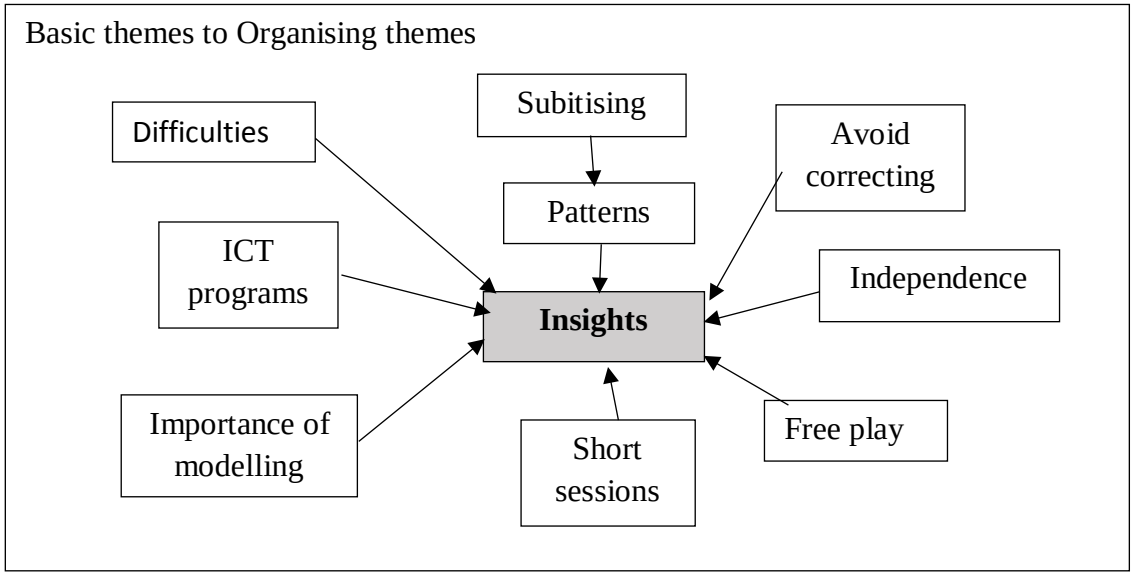
Our four kids were sitting with me waiting for dessert to be prepared. I started counting by saying "one" and having the sequence called out around the table. With minor prompting, she soon listened and said her number in turn – up to 5 at first. Each time a different person started with "one" so that she had a different number

for each of her turns. We then counted to 10 a few times so she had to answer between 1 to 5 and 6 to 10 which she did. Recently we have been introducing her to teens and beyond. So the last counting sequence continued on past 10 and up. With repeating that teens and some coaching she said her teens and took a turn to the 20s, 30s, 40s, and 50s. She listened to the others and followed by saying 20, 30, etc. before each number.

She was so pleased to participate with the big kids and answered readily, watching the count go around and waiting for her turn!

Insights

The insights described by parents, while undertaking tasks with their child, were another important aspect of analysing the data contained in the diaries. Separated from the topics and activities selected by the parents for recording, their personal reflections provided a whole new dimension to this study. The basic themes gave way to organising themes.



Diary 1 Key Findings

The coding for insights recorded by the parents was selected with a view to relating these insights to the five roles of Parental Involvement as identified by Cai et al. (1997) and presented in Survey 1. These were developed by the researcher through tabulating all keywords from the responses using a spreadsheet to identify basic themes and then

creating connections through the use of a visual representation as described by Attride-Stirling (2001). Visual representations assisted in defining the basic and organising themes for these insights.

The aim of the visual representations, as networks, was to ensure, as far as possible, that the essence of each parent's insights was not lost. Each diary entry contributed to the researcher's understanding from the parent's point of view – the "parent's voice".

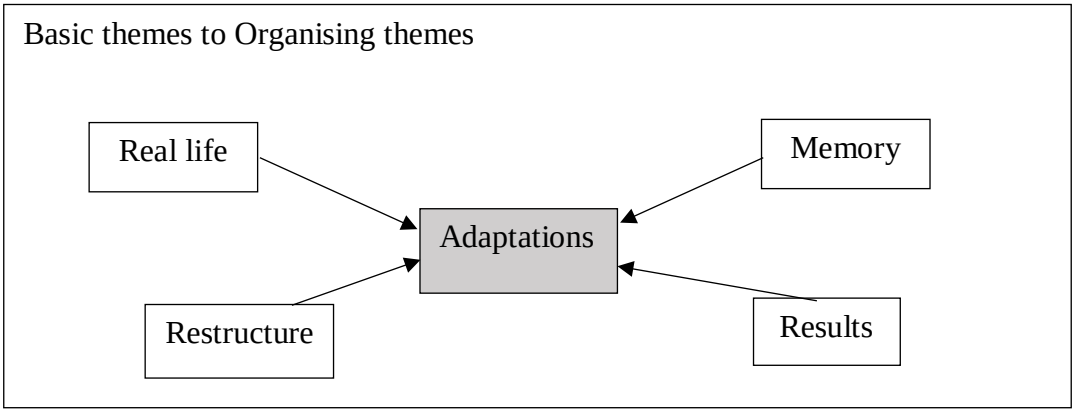
Table 4.8: Selected Samples of Diary 1 Insights Categorised

Insight	Key idea	Description from Parent Reflections in Diary 1
Adaptation	Result	Needed to make it simpler game that delivered a result – winner – more quickly.
Application	Real life	She stops asking when the guests will be arriving, she now understands the clock
Challenge	Fine motor	This is too difficult at this stage. Drawings are not clear, counting total is too difficult and she wrote the number in the wrong place.
Challenge	Frustration	This activity is still too difficult at this stage. She gets frustrated and not cooperative.
Challenge	Take for granted	I felt frustration at how difficult it is for her to learn concepts that we have taken for granted as basic with our other children.
Games	Excitement	She was really excited at the new games. I am hopeful that these games will help consolidate combinations for 10.
Games	Likes it	She asked to play the game with the squares. She likes that she remembered combinations much better than she did a few days ago.
Humour	Washing socks	We wash lots of socks, even clean ones, so we have 24 socks three times a week.
Humour	Number in your head	Not sure if she really got the concept of counting on too well. What I meant by put the number in your head. At one stage it was more an exercise of having fun balancing cards on her forehead!
Motivation	Enthusiasm	She did however enjoy herself and was then busy pulling out everything else from her backpack onto my kitchen floor – great! Where I needed to stand to drain a hot pot of spaghetti. Enthusiasm is still fine!
Observation	Everyday activities	Showed the importance of numerical skills for everyday activities.
Observation	Amazing fine motor	Yet when I watched her do amazing fine motor, tracing the letters and numbers almost exactly with great skill, I appreciate that this was an achievement in itself. I see this is a lesson in how often we focus on achieving a task but forget the journey and that individuals can choose different paths to eventually get to the same end.
Success	Subitising	Surprised that she could just see the fingers without having to count them separately.

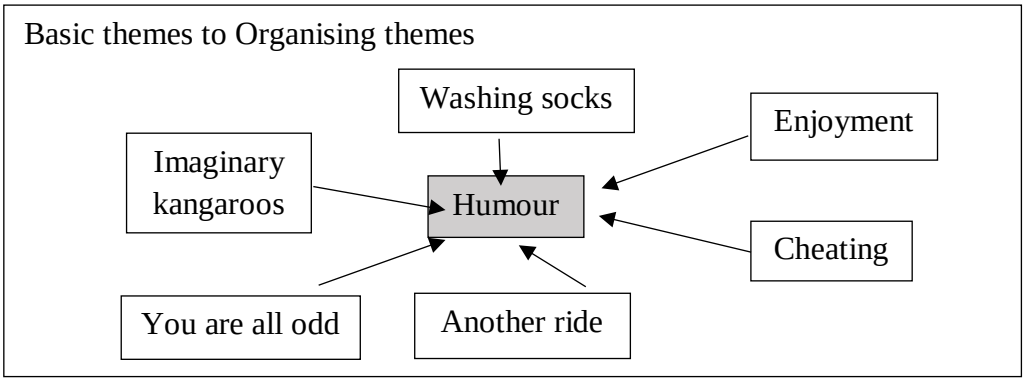
Success	ICT	Rainforest Maths website has easier exercises than Count Me in Too – so better suited for children with DS.
Success	Free play; independent	He really enjoyed it; very engaged; like some free play and being independent.
Understanding	Rules	Understood the rules; enjoyed calling out Bingo.

Diary 1 Organising Themes

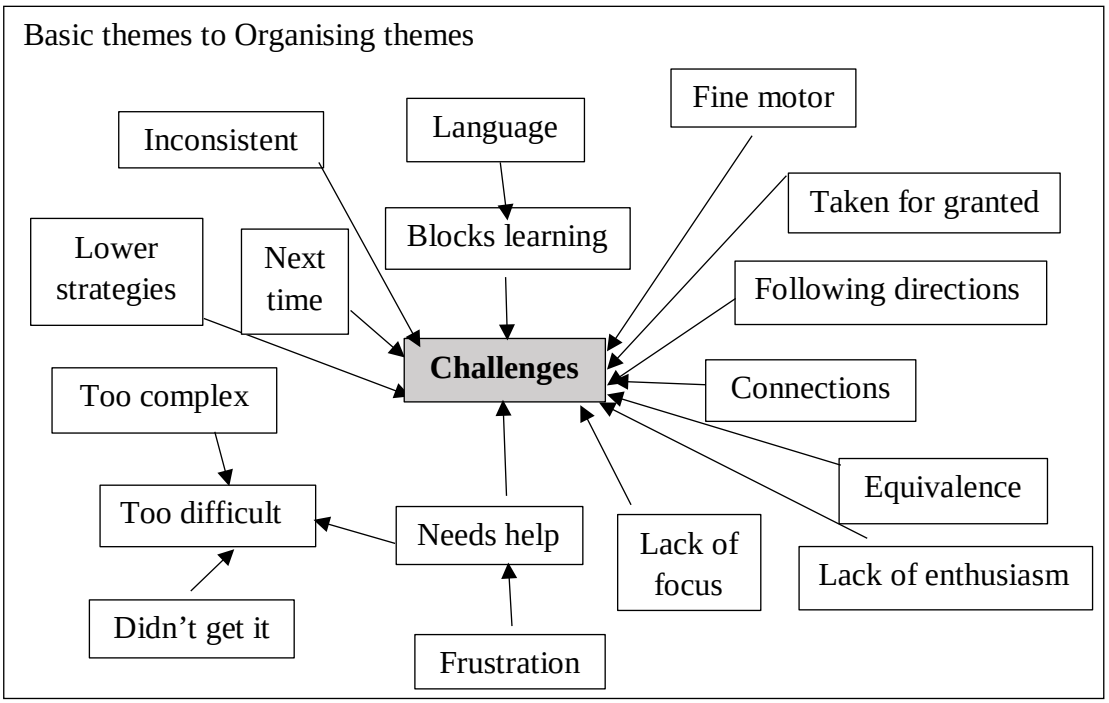
These insights have been categorised into seven organising themes: adaptation, humour, challenges, games, motivation, successes, and observations.



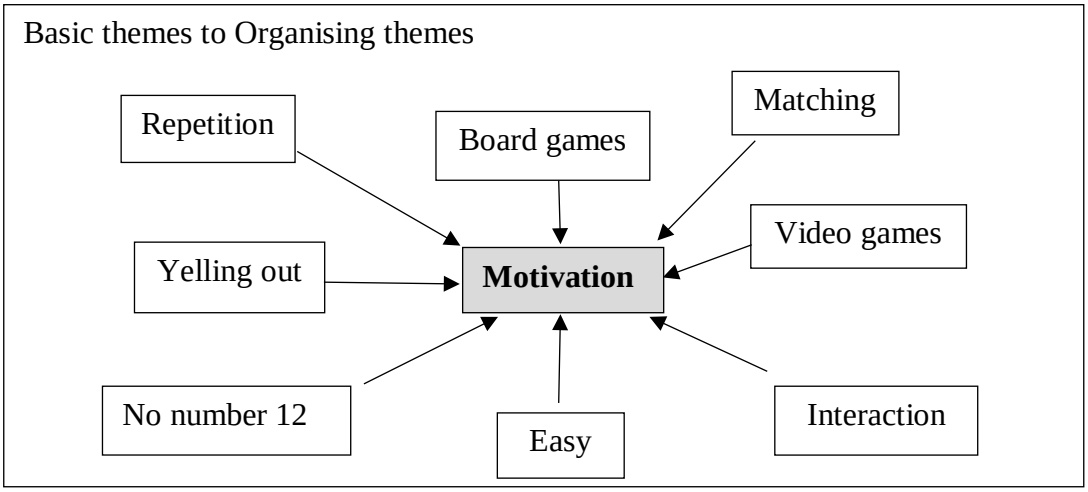
Recording in the diary provided parents with an opportunity to review what was happening and to take the opportunity to adapt the selected task.



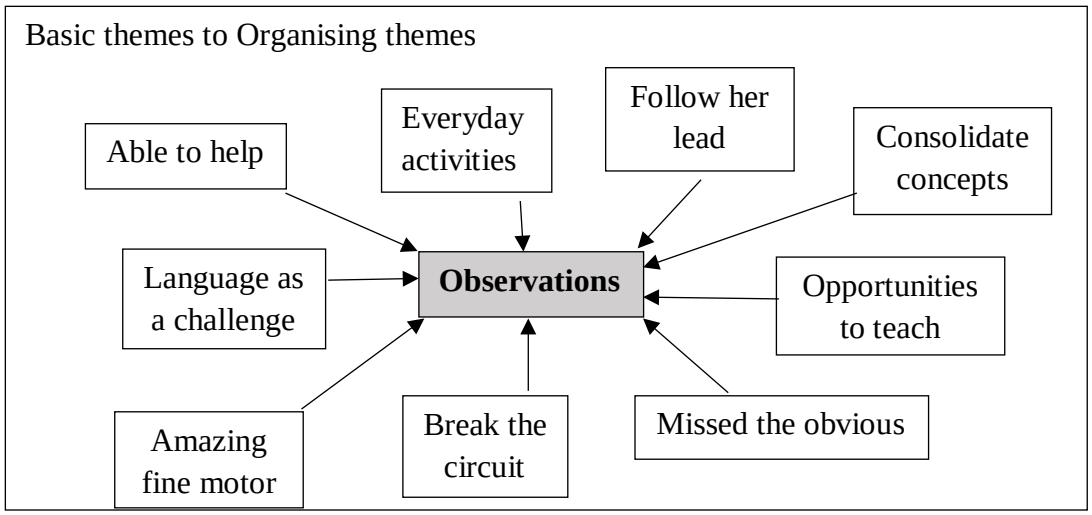
The theme of "Humour" was an unexpected one. Parents writing about themselves and their child and how they recorded elements of this theme, resounded with the researcher. It was a window into the very special relationship between parent and child.



Challenges proved to be one aspect that parents identified readily while undertaking mathematical tasks with their child. For the most part, these challenges were not specifically mathematical as is identified in the network of basic themes.

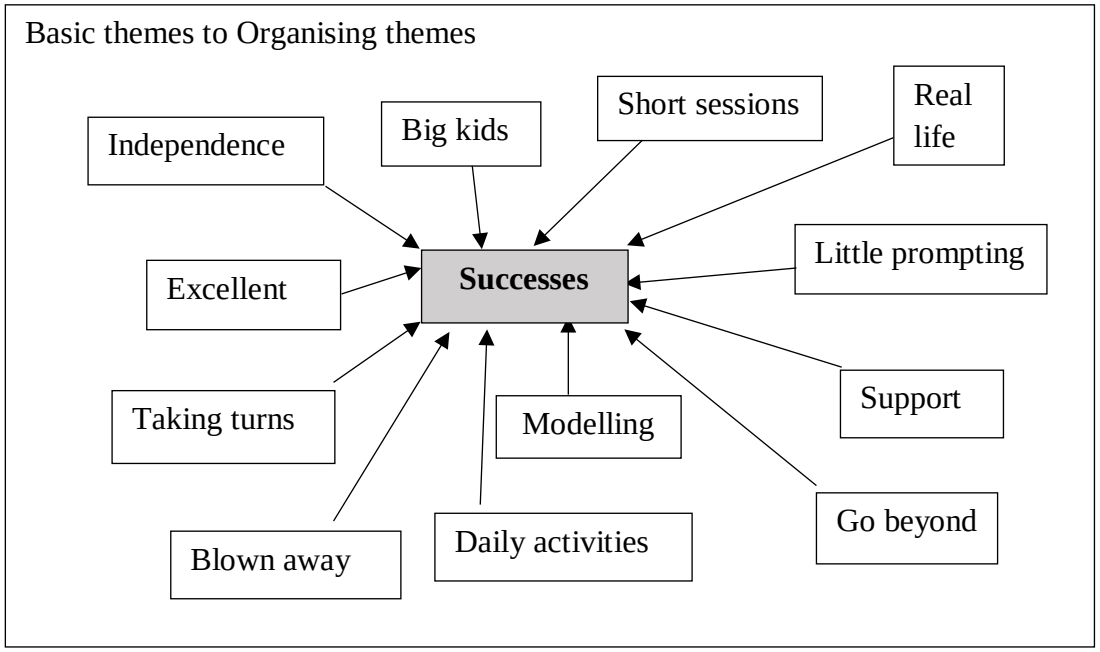


Parents, as first educators of their child, were aware of some situations where their child would be motivated. In this study, they have recorded some instances where the motivation had come from an unexpected source or from the child him or herself; from the child who was willing to persist with dice game, waiting for the combination of 12; to the child being motivated by being involved with the parent.



Through interacting with their child, parents gained insight into aspects other than the mathematics behind the tasks, e.g.

"*Easy daily activity with improved behaviour and maths" [MO 4]*



Parents noted a variety of successful aspects to their activities:

"She stops asking when the guests will be arriving, as she understands the clock." [MO3];

"We should count more often up to 20 instead of only up to 10." [MO4];

"He really enjoyed it; very engaged; liked the free play and being independent." [MO6]

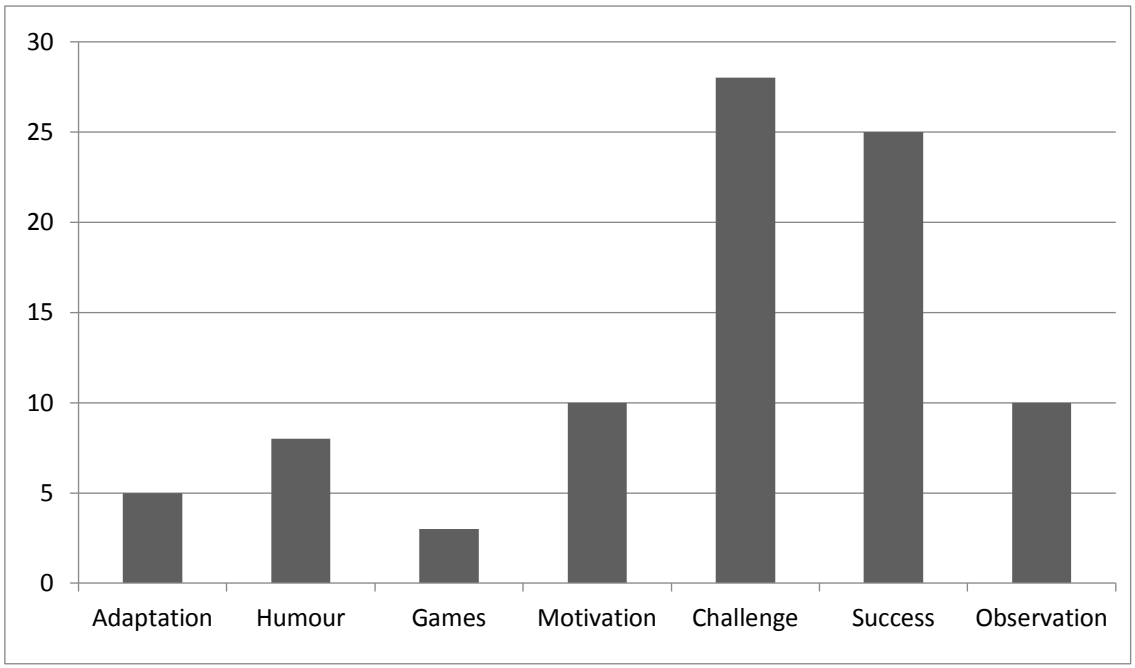


Figure 4.7: Frequency of Diary 1 Insights

Parental insights have proved to be a highly relevant and important aspect of this study. In some instances, parents' reporting has reflected how importantly they view their role in supporting the development of mathematical concepts. The majority of responses for this phase of diary writing were concerned with the range of challenges and successes as noted above.

The parental observations of what supports or challenges their child were very revealing. The diary element of this study provided parents with an opportunity to reflect not only on what was happening in the immediate present but also gave them an insight into the child's interaction with and responses to the task.

In identifying links to the roles presented by Cai (2003), as noted below, the themes of motivation and humour were linked to the parental role of "Motivator". The theme of games was linked to the role of "Resource Provider" and adaptations to the role of "Monitor". The themes of observations, challenges, and successes could be linked to "Mathematics Content Advisor" and "Mathematics Learning Counsellor".

Table 4.9: Diary 1 – Parental Roles and Organising Themes

Parental Role	Description	Organising themes
Motivator	Parents provide emotional support for students' learning.	Motivation Humour
Resource provider	Parents play the role of resource provider by providing an appropriate place to study, relevant reference books, and/or access to resources.	Games
Monitor	Parents monitor their children's learning and progress at home.	Adaptation
Mathematics content advisor	Parents provide advice to their children on mathematics content.	Challenges Observation Success
Mathematics learning counsellor	Parents understand their children's current situation, learning difficulties, potential, needs and demands, and provide appropriate support to help their children overcome their learning difficulties.	

Diary 1 Summary

The structure of the diaries enabled the researcher to identify the topics and the parent insights. Using Attride-Stirling's (2001) "Steps in analysis employing thematic networks" enabled the management of large amounts of text data. While successes and challenges were more frequently identified, so many other interesting aspects of the interactions were also identified. The act of recording their thoughts and actions over a short period of time gave insights not only to the parents but also to the researcher. While some fathers did engage with diary writing, mothers were more dedicated to the diary component of this study.

This section has detailed the analysis of the pre-intervention parent diaries. Using thematic networks, the analysis has involved both the topics of the tasks, as identified by the parents, and the insights gained by the parents.

Chapter 4 Summary

This chapter has provided the detailed analysis of Survey 1, Survey 2, Survey 3 and parent reflective diaries undertaken in Phase 1. This analysis sets the baseline for the analysis of the comparison of the pre- and post-intervention surveys and diary entries. In the next chapter, "Analysis of the Phase 1 and Phase 2 Group Data", data will be analysed and compared to establish the changes in perceived roles of a small group of parents subsequent to being involved in the intervention – the "Make and Take" workshop.

Chapter 5 ANALYSIS OF PHASE 1 AND PHASE 2 DATA

This study set out to establish the parents' perceived role in promoting the development of mathematical concepts for their child with Down syndrome.

Fifteen mothers and nine fathers participated in Phase 1 (pre-intervention). To highlight the "parent's voice" that resonates in this study, four parents (two mothers and two fathers of the same children) were selected for the analysis of the data collected in Phase 2. Data from the same four parents were used to identify any change in role perception between the first and second phases. All data were collected through self-reporting.

This chapter presents the results of the Phase 1 and Phase 2 responses of this selected group of parents. The next chapter will provide an in-depth analysis of these responses for these four parents as individuals. The selected group of parents provided comprehensive responses during both phases of the data collection.

Overview of Data Collection

In Phase 2, the responses from Survey 1 provided post-intervention data regarding the parents' perceptions of their roles. These data were then compared to those collected pre-intervention to identify any changes.

Data from the other surveys and the diaries are presented in this chapter and are analysed with reference to the five roles of Motivator, Resource Provider, Monitor, Mathematics Content Advisor and Mathematics Learning Counsellor. A full description of these roles, together with the interconnectedness among the sets of data from the various sources, has been presented in Chapter 3.

Phase 1 Group Data Collection

Baseline quantitative data were collected in Phase 1 from three pre-existing surveys and the detailed analysis is provided in chapter 4. The pre-intervention qualitative data from the diaries were collected after the completion of all surveys and were reported upon by both fathers and mothers.

Phase 2 Group Data Collection

After the intervention, the "Make and Take" workshop, Phase 2 quantitative data were collected from the three existing surveys with no alterations. Surveys 1, 2 and 3 were presented to parents by email and completed by fewer participants (n= 9) than in Phase 1 (n= 24). These parents provided the researcher with a purposeful sample that supports an in-depth analysis of the responses from these specific parents as a group.

Phase 2 qualitative data from the diaries were collected after the completion of all surveys and again there were fewer responses – 65 responses compared to 153 from Phase 1. There were entries from both fathers and mothers. This was important information to support the researcher in answering the second research question ("To what extent do mothers and fathers perceive their roles differently?") and an important contribution of this study to the literature. As noted in the literature review, Chapter 2, the perspectives of fathers are rarely obtained.

Quantitative Data – Phase 2

The second round of surveys was emailed to all parents involved in this study. The responses were fewer. Follow-up emails were sent to all participating parents. However, no further responses were received. Therefore, to analyse data in such a way as to compare them with the initial responses, the Phase 2 parents' responses were initially considered as a group. Individual parent's responses were then used to enable a greater understanding of the changes that occurred for these specific parents (Chapter 6). The analysis of each set of data was undertaken within the structure of the five roles identified in Survey 1. The changes in both the group's and individual parent's perceptions of their roles from Survey 1 are supported in each phase by aspects from Survey 2, Survey 3 and the parental diaries. Throughout the study the number of responses to the surveys and the diaries by fathers was fewer than those from mothers.

Survey 1: Phase 1 and Phase 2 Group Data

In analysing these data, the responses for this small group of four parents were calculated for both pre- and post-intervention. The role of Motivator showed a small increase (63.5% - 66%), while the roles of Monitor (67.5% - 60%), Mathematics Content

Advisor (81% - 78.1%) and Mathematics Learning Counsellor (70% - 68.5%) identified minor changes. The role of Resource Provider showed a significant decrease for this group of parents (68.7% - 42.9%). The reasons for these changes were not specifically investigated. The researcher considers that this may be a result of the parents realising that mathematics is encountered in all aspects of daily life and therefore no longer have a reason to provide specific mathematical resources. This was also evidenced in the diary entries in Phase 2.

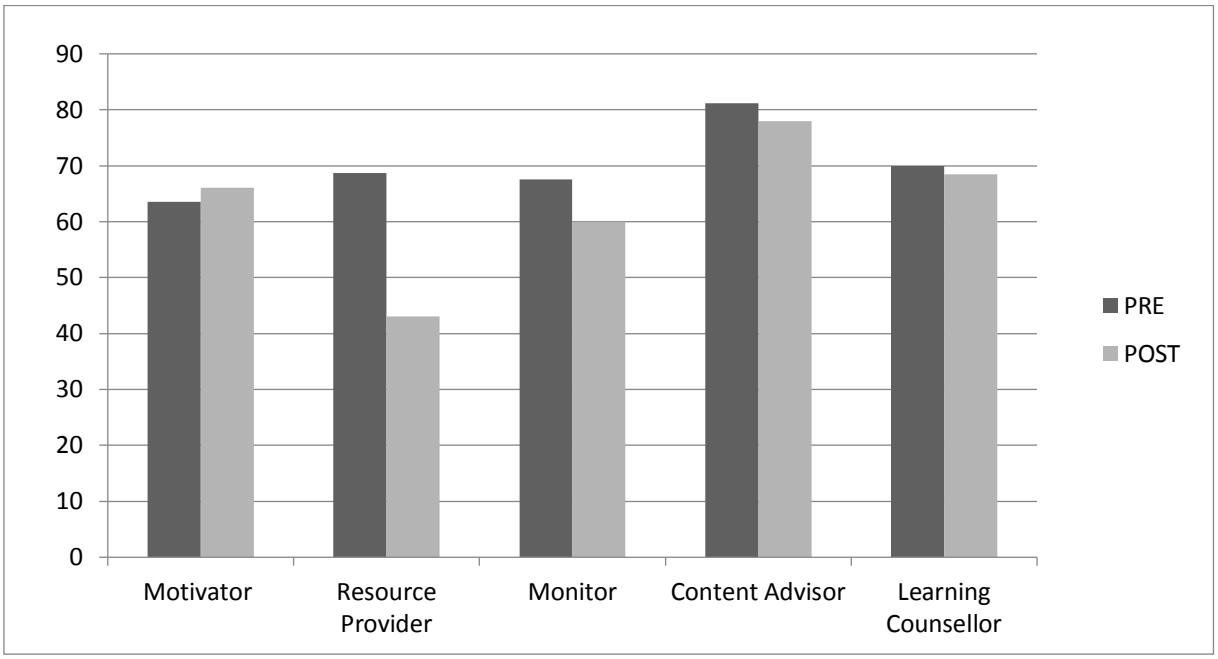


Figure 5.1: Survey 1 - Phase 1 and Phase 2 Group Data

Survey 1: Changes in Parent Group Responses from Phase 1 to Phase 2

For these parents, the summary of Phase 1 and Phase 2 responses indicates that the role where the greatest change was evident was that of Resource Provider.

Motivator

In the role of motivator, the greatest change from pre- and post- surveys was indicated in the statement "When my child says he/she is having trouble learning mathematics, I tell him/her not to worry about it because everybody has problems with mathematics" which changed from "disagree" to "agree" (37% - 50%). The only other change was minor in regard to motivation.

Resource Provider

Responses collated in the role of Resource Provider varied in each of the items, with each parent adjusting their scores for at least one item.

Monitor

Three of the parents indicated a change in rating the statement "I seldom spend time talking with my child about his/her progress in mathematics". One mother changed from "agree" to "disagree" and two fathers from "disagree" to "agree".

Mathematics Content Advisor

Three of these parents indicated that they had changed their rating to the statement "I often discuss with my child how mathematics is used in everyday life." with one parent changing from "I agree" to "I strongly agree", indicating a change in reported practice of this important aspect. In another instance, a parent changed the rating of the statement "I feel I can help my child solve problems from mathematics class." from "I agree" to "I disagree". This links to the parent diaries where parents became more aware of the challenges faced by their child.

Mathematics Learning Counsellor

In this category, mothers changed their rating for two or more items, while the fathers' ratings remained the same.

As these were self-reporting tasks, parents' understanding of and responses to each of the items are to be noted in the context of the time within the project that the responses were elicited. It may be that parents were more reflective in the second phase than in the first or that their perceptions had changed subsequent to the intervention.

Survey 1: Phase 1 and Phase 2 Summary

The results from the analysis of the data for the group of two mothers and two fathers indicates that the summed scores for the role of Motivator was slightly higher in the post-intervention phase compared to the pre-intervention phase. Results for other roles had decreased with that of Resource Provider indicating the greatest change.

Survey 2: Phase 1 and Phase 2 Data

As with Survey 1, the responses to Survey 2 were fewer. To analyse data in such a way as to compare it with the initial responses, the same parents' responses have been used. (Appendix 2) Responses from Phase 1 and Phase 2 were calculated as summed scores by using a spreadsheet and then presented as percentage of possible totals.

Survey 2: Changes in Parent Group Responses from Phase 1 to Phase 2

For these parents there was evidence of small overall changes in their perceptions of many aspects of Survey 2. In rating Self-efficacy (67% - 62%), General Invitations (85% - 81%), and School-based (59% - 39%) elements these parents had self-reported a negative change, with the greatest change occurring in School-based Activities.

A small increase was noted in the parents' ratings of Responsibility (76% - 77%), Valence (84% - 87%), Teacher invitations (47% - 50%), and Time and Energy (68% - 70%) and Home-based (80% - 79%) remaining reasonably constant. (Appendix 3)

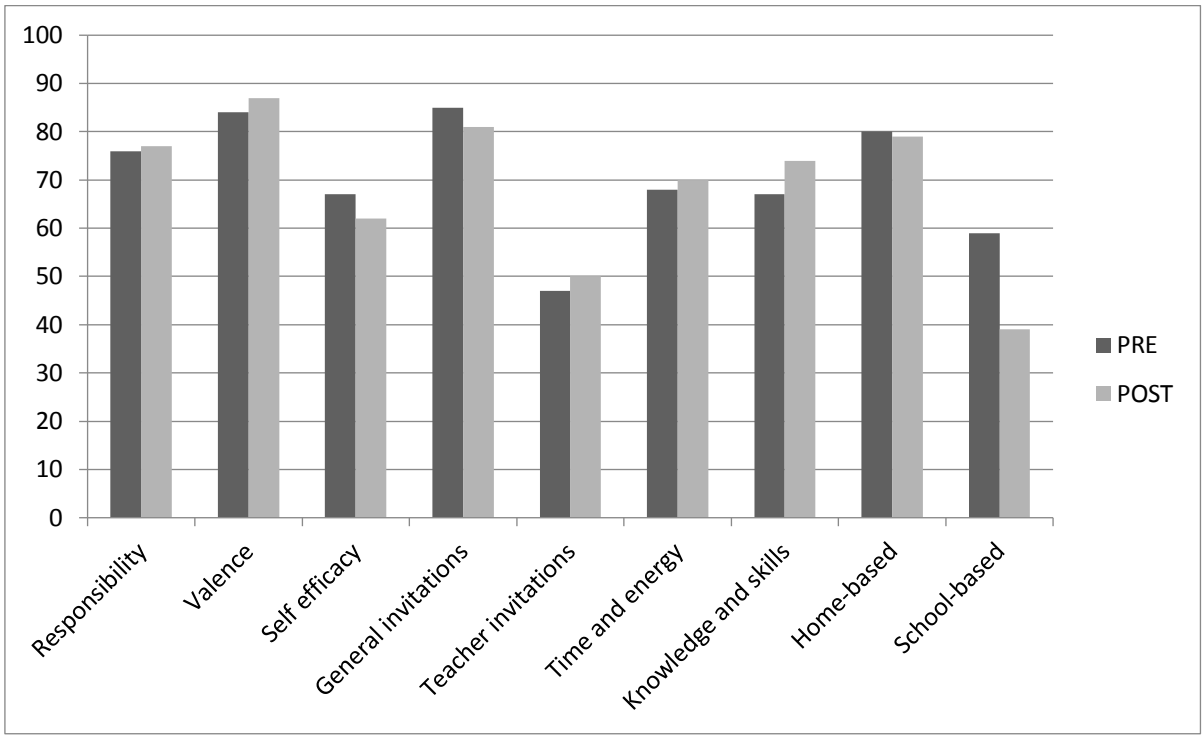


Figure 5.2: Survey 2: Phase 1 and Phase 2 Group Data

Knowledge and Skills was the construct where most change occurred (67% - 74%). The majority of personal changes in the aspect of Responsibility were reported by the

mothers. Minor changes occurred in items related to communicating with the teacher more regularly (75% - 81%), being aware of school requirements (75% - 81%), communicating with the child about the school day (75% - 81%) and talking to other parents from the child's school (68% - 62%). With regards to Valence toward school (i.e. their memories of their school experiences of mathematics), the majority of the parents' perceptions remained constant (84% - 87%).

When self-reporting on aspects of their self-efficacy for helping the child succeed in school, there was a mixed response – parents know if they're getting through to the child (68% - 75%), but they don't know how to help the child learn mathematics (62% - 56%). In this aspect, the only item not to have changes in responses was "I know how to help my child get good grades in school" (68%).

The item "I make a significant difference in my child's school performance" changed for the majority of the parents from "I agree" to "I disagree" (68% - 50%), whereas the statement "Other children have more influence on my child's grades than I do" changed from "I disagree" to "I agree" (50% - 62%). One reason that could be advanced for this change was that as parents became more involved in reflecting on their role, their perceptions changed and they may now be more aware of the influence of peers in their child's learning.

In most instances where there was a change in the aspect "Parents' Perceptions of General Invitations for Involvement from the School", mothers had a more positive change (83% - 92%) than fathers who were more negative (87% - 71%). All parents reported a decrease in their perceptions of requests from the teacher to help out at school (37% - 25%) and also in the regularity of teacher contact 81% - 75%). Both helping and supervising homework was the main focus of the shift for each parent in this construct (31% - 81%). There may have been a shift on the emphasis on homework from the school as the school year progressed.

Parents reported that they had enough time and energy to help out at school (50% - 62%) and the rating remained constant for helping and supervising their child's homework (68%). "Communicating effectively with the child about the school day" was

consistently higher in the Phase 2 responses (68% - 94%). Minor changes in parents' responses in regard to the knowledge and skills to communicate with teachers were evident in the Phase 2 survey.

The majority of responses with respect to the home-based activities rated higher, with two parents reporting an increase in frequency for all statements (75% - 85%). Again, parents indicated that the children do not participate in tests. Although not applicable to this group of parents, this statement was part of the survey developed by Walker et al. (2005).

With regard to school-based involvement, parent responses indicated that involvement in school-based activities happened less frequently (59% - 39%) than initially thought or that it had been happening more frequently during the pre-intervention period of surveying which was earlier in the school year.

Data gained from Survey 2, Parental Involvement in Education, indicates that these parents as a group, through self-reporting, identified changes in their perceptions of their roles as defined in Survey 1 from Phase 1 to Phase 2. The greatest change for this group was in the aspect of School-based Activities.

This section of this chapter detailed the group findings from Survey 2. This has been done by addressing the responses to each construct and to some items in the questionnaire as presented by the group.

Survey 2: Phase 1 and Phase 2 Summary

The analysis of data from Survey 2 for the small group of parents identified only small changes in their perceptions. There were changes in individual items with respect to invitations from the teacher with a decrease in requests for attendance at a special event, helping out at school and contacting the parent with regard to the child. In the same construct, responses indicated that there was a marked increase in requests from the teacher for helping and supervising homework during Phase 2.

Survey 3: Phase 1 and Phase 2 Group Data

Data from Survey 3 were analysed for each item by comparing the ratings provided by the selected group of parents in both phases for both relative importance and for frequency. (Appendix 3) Responses to selected items involving counting, comparison, and words for numbers have been summarised.

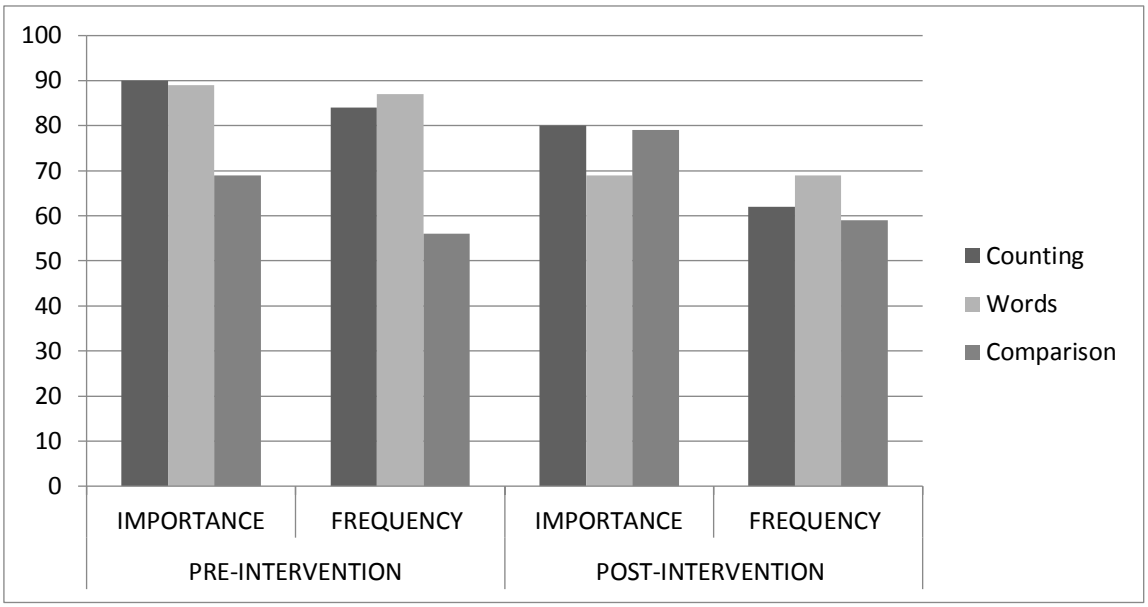


Figure 5.3: Phase1 and Phase 2 Selected Topics - Group Data

Survey 3: Changes in Parent Group Responses from Phase 1 to Phase 2

Counting

From Survey 3, items 2 and 15 involved counting. Responses for these two items indicate that parents changed their perceptions of relative importance and frequency. There were no reported incidences in the diaries from these parents that their perceptions had remained constant. There is no specific indication from this data to indicate why these changes occurred.

Words for the numbers

From Survey 3, items 1, 6, 11, 16 and 20 involved “words for numbers”. In the aspect of using number words, there are once again increases and decreases in relation to

both relative importance and frequency of tasks reported by parents. Again, the reasons for these changes were not investigated during this study.

Comparison

From Survey 3, items 7, 8, 9 and 14 addressed some aspect of comparison. In the majority of instances, the parents' perceptions with regards to relative importance of comparison changed, except for two parents who remained constant for items 7 and 14. When considering frequency, one parent consistently recorded higher than the other parents.

This section of this chapter records the responses from the parents in regards to the importance and frequency of selected mathematical activities undertaken with their child. The selected items were related to counting, words for numbers and comparison.

Survey 3: Phase 1 and Phase 2 Summary

Selected topics (counting, number words, and comparison) were used in analysing the data for Survey 3. In reviewing their perception of the relative importance of these three topics in Phase 2, parents identified counting and words for numbers as being less important while comparison was seen as more important. The reasons for these changes were not investigated. Similarly, in the aspect of frequency, activities involving counting and words for numbers were used less frequently, and comparison tasks slightly more frequently.

Qualitative Data – Phase 2

Diaries: Phase 2

In total, 63 diary entries were presented for Diary 2.

The data from this second phase, as with the first phase, gave a rich insight into both the parents' interaction with their child and the parents' documented reflections after their child had participated in tasks they identified as having a mathematical basis. All topics were again recorded using a spreadsheet (as in Chapter 4). In some instances, more than one topic was identified in the one diary entry.

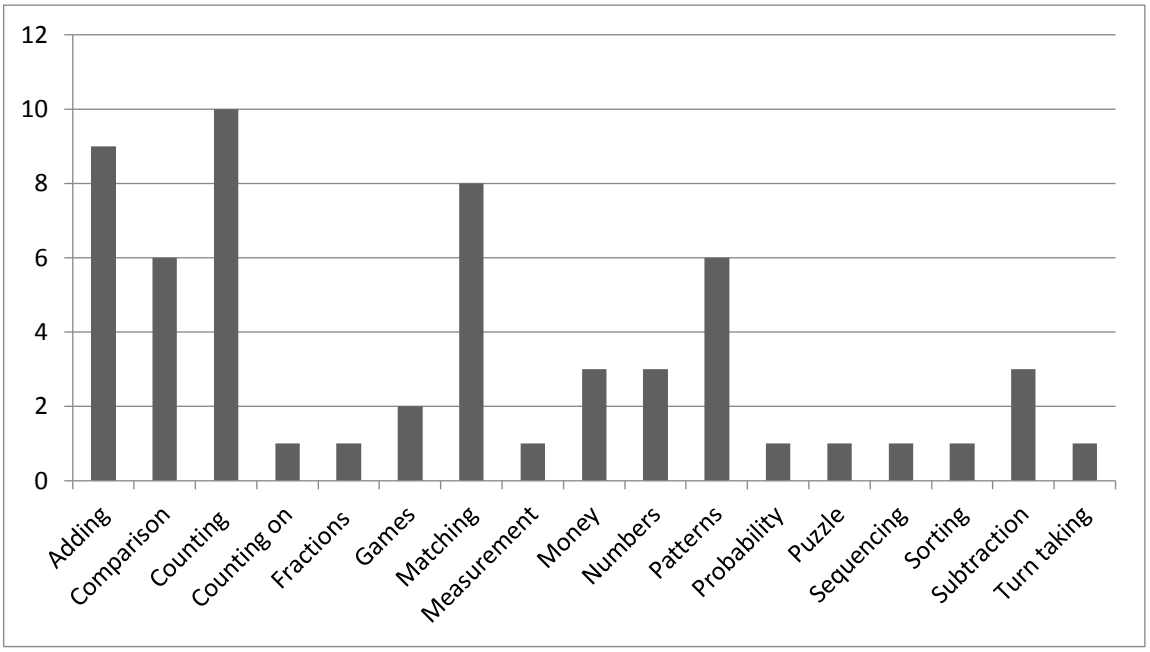


Figure 5.4: Frequency of Topics Identified in Diary 2

Addition and subtraction, comparison, counting, matching and patterns were the most common topics recorded in the Phase 2 diary entries. The focus on "Time" in Phase 1 of journaling was not recorded here in the second phase. These may have continued to be a focus but it was not recorded during Phase 2.

Comparison of the diaries was undertaken by using percentages of total tasks in each of the two diaries and only using topics that were common to both phases of data collection or with a relevant change. (Appendix 4)

Diaries: Changes in Topics in Parent Responses

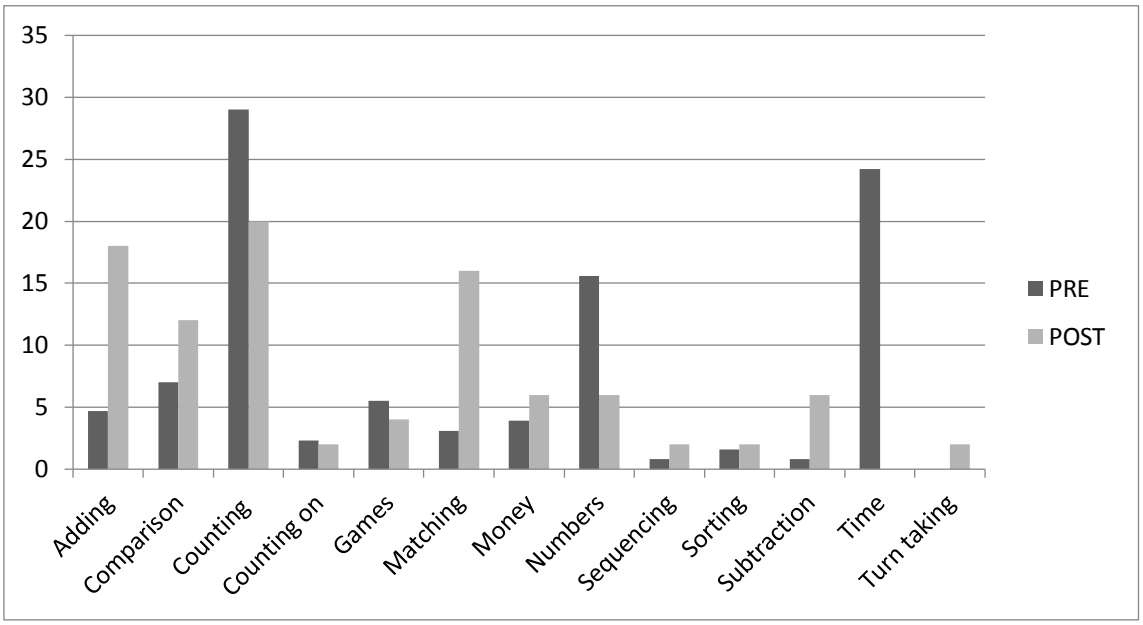


Figure 5.5: Comparison of Topics Recorded in Diary 1 and Diary 2

In Diary 1, there was a heavy emphasis on counting (24%), number recognition (13%) and aspects of time, both telling the time and understanding duration (20%).

In Diary 2, counting was still an emphasis with 16% of all tasks having counting as the main focus. There was a greater emphasis on adding and subtracting (19%). In two areas there was a new emphasis: matching (13%) and patterns (10%). This was possibly an outcome of the "Make and Take" workshop where such activities and resources were presented for parents to create tasks relevant to their child and "Matching" being an underlying structure. Aspects such as time, grouping, pairs and counting backwards were no longer recorded. Parents may have continued with these tasks, but not noted them while introducing new tasks.

Diaries: Initial Emerging Themes from Parent Insights

Thematic networks, as presented by Attride-Stirling (2001), were again used to identify basic themes and then further organising themes (see chapter 3).

The diaries from the small group of selected parents were studied with a view to isolating themes beyond those of the topics of the tasks undertaken by the parents with

their child. The most significant aspect of the diaries for this task was the parents' recorded insights under the heading "What did I think about it". Keywords from these insights were tabled in a spreadsheet, and then used to create connections through the use of visual representations. This was a similar process of analysing to that described in chapter 4.

As with Phase 1 data analysis, these insights were grouped firstly into the categories of adaptations, games and humour.

Adaptations

These included: the restructuring of tasks to ensure a successful outcome and long-term memory support, and by linking activities to real life situations.

I needed to make a simpler game that delivered a result – winner – more quickly.

I repeated the activity by trying a different tactic. Refer to the number nine, find the first number, keep it up, find a second, put it after etc. Much more successful!

Humour

These included: self-correcting, cheating at games, another reward, funny sayings, imaginary kangaroos, washing socks and enjoyment.

We wash lots of socks, even clean ones, so we have 24 socks three times a week.

She was quite argumentative and we talked about odd and even and she didn't like the terminology. At the end of the game, she had free play with the rolls [toilet rolls with different numbers on them] pretending they were dolls. I heard her say to them "You are odd – you come over here!"

Games

These included: an element of excitement and enjoyment in supporting the maintenance of skills and concepts.

Dora Tell the Time game – she loves it and is fascinated with clocks and time. We play it from time to time to keep it in her memory.

She asked to play the game with the squares. She likes that she remembered combinations much better than she did a few days ago.
She was really excited at the new games. I am hopeful that these games will help consolidate combinations for 10.

Diaries: Further Themes from Parent Insights

On another level, a further analysis of the insights described by parents while undertaking tasks with their child identified other important aspects emerging from the diaries.

These were again developed further by the researcher through tabulating all keywords from the responses using a spreadsheet. These insights have been categorised into seven clusters: adaptation, challenges, games, humour, motivation, observations and success. Of these, motivation and successes were the most commonly quoted in this second phase of journaling. The parents' observations of what supports and challenges their child's learning were very revealing.

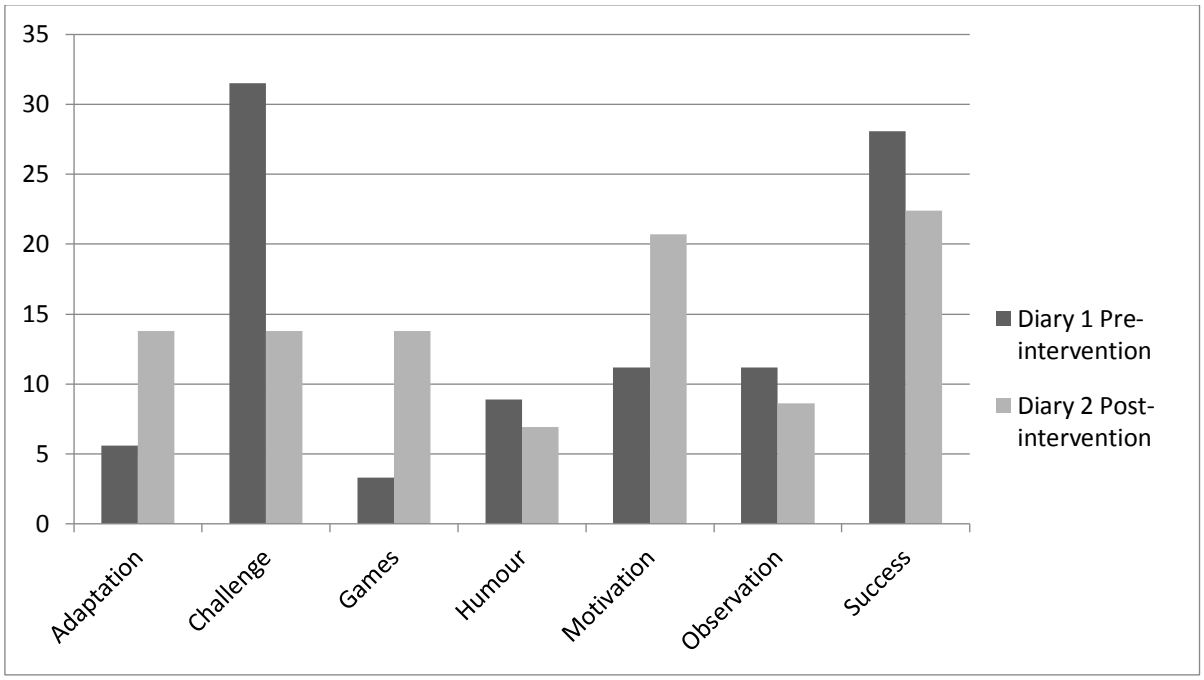


Figure 5.6: Frequency of Recorded Insights – Diary 1 and Diary 2

Challenges

The parents identified the challenges that were encountered by their child. These included: frustration, too difficult, lower strategy, too complex, inconsistent, didn't get it, following directions, lack of focus, lack of enthusiasm, needs help, do it for her, fine motor, language, blocks learning, and making connections.

> *No point in continuing on; she is just not focused and doesn't want to put the numbers in the correct order.*

> *This is too difficult at this stage. Drawings are not clear, counting total is too difficult and she wrote the number in the wrong place.*

> *I noticed the inconsistencies in her abilities. Where she can sometimes do excellent one-to-one counting, this was not happening with the marbles this time.*

Motivation

In this initial phase of data collection, the parents also identified many insights that can be categorised as motivation. These included: rewards, winning games, repetition, and the child's interactions with the parent, yelling out, and waiting in anticipation.

> *This is very motivating for her. We played it for a very long time since 12 would just not come up for either of us!*

> *She did however enjoy herself and was then busy pulling out everything else from her backpack onto my kitchen floor – great! Just where I needed to stand to drain a hot pot of spaghetti! Enthusiasm is still fine!*

> *This is a highly motivating task for him.* [What's the Time Mr Wolf?] *He enjoys the fun and drama. He is able to yell out random numbers between one and 10.*

Observations

These included: consolidating concepts, following her lead, language as a challenge, opportunities to teach, missed the obvious, breaks the circuit, able to help, everyday activities, take for granted, next time and amazing fine motor [skill].

Yet when I watched her do amazing fine motor, tracing the letters and numbers almost exactly with great skill, I appreciate that this was an achievement in itself. I see this as a lesson in how often we focus on achieving a task but forget the journey and that individuals can choose different paths to eventually get to the same end.

Need to work out which game she likes and can be readily used to consolidate concepts.

Trying to work out teaching strategies with the resources, this was more challenging than just finding opportunities teach in the context of the ordinary life.

I felt frustration at how difficult it is for her to learn concepts that we have taken for granted as basic with our other children.

Successes

These included: going beyond, games, ICT, big kids, support, modelling, little prompting, blown away, daily activities, independent, real life, short sessions and taking turns

Easy daily activities which result in improved behaviour and maths.

Good way to explain that there are different ways to get a total of five.

He wanted to cut the snakes in half. He cut snakes into many pieces not halves. However when he said he'd cut the cake in half and he did this correctly! He gave one half to me!

She was so pleased to participate with the big kids and answered readily, watching the count go around and waiting for her turn!

Diaries: Phase 1 and Phase 2 Summary

In the second phase of journaling, these parents focused less on the challenges that faced their child. Adaptation of tasks, a greater focus on motivation and the realisation that there is considerable value in pursuing numeracy through games were highlighted in many diary entries. Once again success was frequently noted.

Chapter 5 Summary

In this chapter the results from analysing the data collected during Phase 1 and Phase 2 for the group of four parents have been presented. Details of the data collecting instruments and the collection phases have been included. The data from the four selected instruments have been analysed using spreadsheets, tables of values, and transcriptions of diary entries with the relevant accompanying visual representations. The greatest change in the perceived roles for this group of parents was identified as a decrease in the group's perception of their role as Resource Provider. There were minor changes in the other four roles.

Chapter 6 ANALYSIS OF INDIVIDUAL PARENT'S PHASE 1 AND PHASE 2 DATA

In this chapter, individual analysis will be presented for the four parents (the mother and father of a female child and the mother and father of a male child) who were identified in the group analysis in Chapter 5. Data from Phase 1 and Phase 2 were analysed to report the changes for each individual parent's perceptions of their roles in supporting their child develop mathematical concepts. There is a great depth within the data collected from across the four different instruments (Survey 1, Survey 2, Survey 3, and Diaries). The analysis of individual parent's responses allows a closer examination of how parents differ in their perceptions of their roles and provides an opportunity to highlight these differences in the light of each "parent's voice".

In reporting this section of the study, the voices of the individual parents highlight that there was a range of responses among the parents in identifying their roles and that, for some parents, these may have changed over time. The reasons for these changes are not considered in this study. Also, the researcher has perceived that the individual responses of these parents each deserve a deeper analysis to identify their changed perceptions and how these may vary among individual parents.

As has been the case in earlier chapters, changes in perceptions for these specific parents have been investigated and an analysis was made in accordance with the roles identified by Cai et al. (1997). These roles (as defined in Chapter 3) are: Motivator, Resource Provider, Monitor, Mathematics Content Advisor and Mathematics Learning Counsellor.

Data were examined from Survey 2, Survey 3 and Diaries with a view to identifying elements that contribute to the identification of these roles for these individual parents in both the phases.

From the analysis of the Phase 1 data, the researcher identified that, while the perceived roles for each parent were determined by Survey 1, Survey 2 data provided an insight into the constructs of role construction, self-efficacy, perceptions of invitations,

and home and school involvement that may have impacted on the identified roles. While Survey 2 responses provided data on a parent's involvement in education in general, not exclusively on mathematics, connections have been made to the specific roles.

The extent to which the data from Survey 3 (relative importance and frequency of mathematical tasks) were related to the responses to Survey 2 was explored. Survey 3 data were identified as the basis for some topics/tasks undertaken by the parents with their child and recorded in their diaries. This interconnectedness among the data collected provided triangulation and expands the possible insights into the parents' perceived roles in supporting their child to develop early mathematical concepts. The processes undertaken by the researcher have been detailed in Chapter 3.

Through engaging with their child with mathematical tasks, completing Surveys 2 and 3 and completing diary tasks in both phases, individual parents' interpretations of some of the items stated in Survey 1 have changed. They have reported changes in their individual perceptions of their roles. These changes vary widely among the parents who participated in this study.

The intervention ("Make and Take" workshop) has been an added layer of this study. The extent to which this intervention resulted in changes in the individual parent's perceived roles is one focus of this chapter. Results are presented from the analysis of the data collected in both phases as an in-depth study of the responses reported by each of the four parents – two mothers and two fathers – in turn. The sequence of administering the four data collecting instruments has been detailed in Chapter 5.

Parent 1

This part of the chapter details the findings for Parent 1, to be known as Sarah, for both phases. This has been done by coding the responses to each part of each survey and the diary entries, and also addressing changes in the individual parent's responses within these.

Sarah is the mother of a six-year-old child girl with Down syndrome. She was a participant in the Sydney parent group. During the data collection process Sarah was identified as MO4.

In recording the data from the initial Survey 1, the roles of Mathematics Content Advisor and Mathematics Learning Counsellor rated highest scores for Sarah.

Data from Phase 2 of Survey 1 identified an increase in the rating for the Mathematics Content Advisor role for this parent. While the roles of Motivator, Monitor and Mathematics Learning Counsellor remained the same there was a small decrease for the role of Resource Provider.

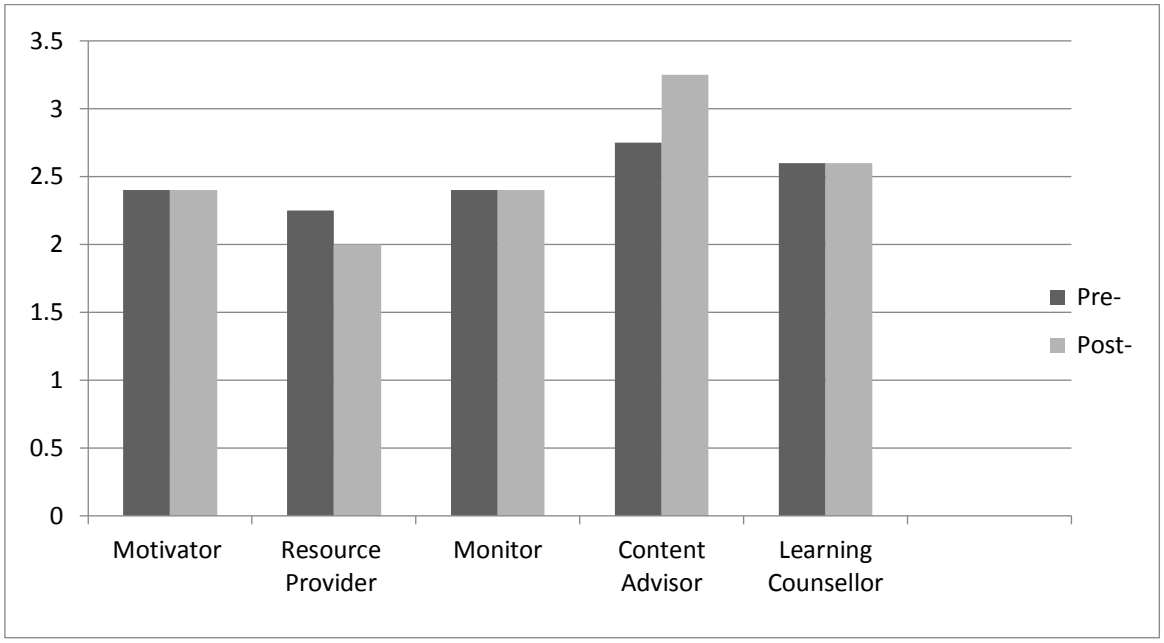


Figure 6.1: Changes in Perceived Roles for Sarah from Phase 1 to Phase 2

Motivator

Parents provide emotional support for child's learning.

In Survey 1, Sarah responded in a consistent manner in the role of Motivator in both phases of data collection. Subsequent to participation in the "Make and Take" workshop, Sarah reported a small increase in her awareness of her child's education being her responsibility. Her valence toward school remained constant, as did her rating for her self-efficacy. The statement "Mathematics plays an important role in my child's future" rated highly in both pre- and post-intervention responses. Supporting this from Survey 2, this parent's responses were consistent and she identified that she has a high level of valence towards her own education in mathematics. From Survey 3, Sarah's responses with regard to relative importance changed from a mixture of "important" to "essential" in the pre-intervention phase to one where all items were considered "essential".

Sarah recorded instances where she had engaged her child with an everyday task and that she had been able to identify the mathematics within that task.

Diary excerpts:

Counting

Hair brushing. Child is counting. Parent: "When you come to 10 we will have finished with the hair brushing."

Easy daily activity which results in improved behaviour and maths.

In both phases, Sarah's responses to Survey 3 identified counting and number recognition as having high relative importance but with a decrease in frequency post-intervention. This survey continued to have an impact in the second phase on the topics of the tasks undertaken with the child. As recorded in the diaries, Sarah's self-reported responses for "comparing" indicated that while this was seen as more important, she did not report an increase in frequency.

From the initial data from the diaries, Sarah reported that counting was the most frequent activity undertaken. In Diary 2, Sarah reported that matching, comparison, patterns, addition and money tasks were introduced in the post-intervention phase. The

challenges and successes for her child were readily identified by the parent. She acknowledged that it was easier to motivate her child in some instances than in others.

Diary excerpts:

Addition:

Throwing five cut up scourers on the floor and seeing how many are red and how many are yellow when the total is five. Structured the activity and parent feedback: "Yes, that's right." Successful. Went well.

Matching:

Using a pack of pattern cards, putting the same patterns on top of each other, from the pack of cards. Parent complimenting because it went very well.

Resource Provider

Parents play the role of resource provider at home by providing an appropriate place to study, relevant resources and opportunities.

In the role of Resource Provider, Sarah indicated that her home environment did provide support for the learning of mathematics.

Sarah's initial responses indicated that the aspects of Parental Role Construction (Responsibility and Valence toward school) from Survey 2 rated highly. Subsequent to participation in the "Make and Take" workshop, Sarah reported a small increase in her awareness of the child's education being her responsibility. The statement in Survey 1 referring to the library – "I often take my child to the public library" – was given a lower rating. It changed from "I disagree" to "I strongly disagree". However, in Survey 2 for the statement "Reads with this child", Sarah identified that reading was done at home on a daily basis. This identifies the parent's ongoing commitment to the development of language and literacy.

Responses to the initial phase of Survey 3 by this parent identified both rote counting and one-to-one counting as important aspects of mathematics. In the second phase, "grouping" and "aspects of money" were identified as having a greater focus. In

undertaking these tasks as identified in the diary, there was a corresponding shift of focus.

The use of Information and Communications Technology was reported as motivator by Sarah. Specific programs were identified in Sarah's diary.

Diary excerpts:

Putting numbers in order:

Count Me in Too: Washing line game

Child very focused and putting the numbers in the correct order.

Did very well this time. Only needed a little bit of prompting needed.

Ordering numbers 1 to 6:

Rainforest Maths website: putting numbers in correct order 1 to 6, with 1to 3 given. Dragging numbers 4, 5 and 6 to the correct place. Prompting only the first number. And upwards. Rainforest Maths website much easier exercises than Count Me in Too, so better suited for children with DS.

Games were identified by Sarah as an engaging resource that had a mathematical underpinning and often included the involvement of the whole family.

Diary excerpts:

Which two are the same?

Dominoes: first with numbers, later with pictures. Looking for the same number/picture.

Parent: structured the activity, which one is the same? Put it next to the…

Went well, but she found it difficult to count up the objects.

Monitor

Parents monitor their child's learning and progress at home.

For this role, Sarah reported an increase in the expectation from the teacher with regard to parents supervising homework. From Phase 1 to Phase 2, Survey 1's statement "I check my child's homework regularly" changed from "I disagree" to "I agree", and the

statement “I seldom spend time talking with my child about his/her progress in mathematics” changed from “I agree” to “I disagree”.

With regards to specific invitations for involvement from the teacher, helping with and supervising homework was the main focus of the shift. There was also a minor shift in perception of the number of times Sarah received specific invitations from the teacher.

Overall Sarah’s responses, with respect to the home-based activities, rated slightly lower with the exception of her response to homework. Sarah reported that she had enough time and energy to help out at school, and to help with and supervise her child’s homework.

In Survey 3, seven items involved rote counting: two items involved one-to-one counting, comparison was identified as the focus in four items, and reading and writing numbers were identified in two items. Grouping, ordering, money and addition facts were addressed in the other items. In the initial responses to this survey, rote counting, one-to-one counting, and reading and writing numbers were identified as important and relatively frequent by Sarah. Grouping objects, ordering, comparing and matching were regarded as less important and undertaken less frequently.

After participating in the “Make and Take” workshop, with regard to the aspect of counting, Sarah reported a decrease in frequency of rote counting while the importance remained high to essential. Reading and writing the numerals were identified as very important to essential but the frequency was lower. Sarah’s self-reported responses for “Comparison” indicated that while this was seen as more important she did not report an increase in frequency.

From the diaries, Sarah expanded the range for counting up to 20 (up from 10 previously). Again this was done in the real life context.

Diary excerpts:

Counting:

Counting ducks and swans in the Park up to 20. Parent assisted with gaps.

Should count more often up to 20 instead of only up to 10

Counting up to 20:

Taking turns to count up to 10, later to 20

Through taking turns, correcting is avoided by modelling the count.

Adding – counting up to 10 and backwards from 10 to 1:

Counting up to 10 and backwards and 10 to 1. Showing 2+2 fingers, 2+1 finger, 2+3 fingers. Parent prompting with counting backwards – what comes before five? Showing fingers and asking how many there are.

Surprised that the child could just see the total of fingers without having to count them separately.

There was no indication that mathematics had become a specific part of the assigned homework from any of the data provided by Sarah.

Mathematics Content Advisor

Parents provide advice to their child on mathematics content.

For this role, Sarah responses to Survey 1 indicated that there was an increase in the incidences of checking homework regularly, and more time was spent in discussing how mathematics is used in everyday life.

Survey 2 responses identified that in the aspect of self-efficacy, this parent's responses changed: "I know if I am getting through to my child" increased, while "I make a significant difference in my child's school performance" decreased.

In Survey 3, this parent's self-reported responses for "comparison" indicated that while this was seen as more important, she did not report an increase in frequency. The importance and frequency for "grouping" increased in the second phase of this survey. The corresponding tasks were identified in the diary writing.

From the initial data from the diaries, Sarah reported that counting was the most frequent activity undertaken. Ordering, adding and games were also topics identified at this time. Sarah was confident in using the *Rainforest Maths* website tasks with her child.

Diary 1 excerpts:

Same colour, size, weight:

Went through with a box of little objects. Talking about colour, size and weight of the objects. Parent asking questions: "Which one is bigger, heavier etc?"
Child finds weight difficult.

Diary 2 excerpts:

Money:

Showed different coins and asked "Which are the same? Count the amount of coins. Parent explained it was not about the amount of coins, but what they look like and which ones were the same.
Did not work. Realise that with language, I know exactly what to do to simplify an activity when it is too difficult because I have had a lot of experience with that. With maths I'm getting stuck most of the time, because I do not know how to simplify the tasks. I just do something else.

Mathematics Learning Counsellor

Parents understand their child's current situation, learning difficulties, potential, needs and demands, and provide appropriate support to help their child overcome learning difficulties.

In this role of Learning Counsellor, data provided by Sarah, in Phase 2 of Survey 1, indicated a greater understanding of their child's strengths and weaknesses in learning mathematics. The statement "I understand my child's strengths and weaknesses in learning mathematics." changed from "I disagree" to "I agree", while at the same time the responses to "I don't know strategies for helping my child overcome weaknesses in mathematics" changed from "I agree" to "I disagree".

Her responses in Survey 2 in responding to the aspect of self-efficacy remained consistently low for the statement "I don't know how to help my child learn maths" as did her responses to "I know how to explain things to my child about her homework".

She indicated that she is reaffirmed in knowing what works for her child on the one hand, but is less sure of making a significant difference in the child's school performance.

"Communicating effectively with the child about the school day" rated higher in the post-intervention responses than in the pre-intervention survey. This was also true for Sarah's perception of her knowledge and skills.

From the Diaries, Sarah indicated that she had become more aware of the aspects of tasks that became evident as successful or as challenges.

Diary excerpts:

Addition:

Throwing five cut up scourers on the floor. "How many are red and how many are yellow?" When the total is five. Structured activity with the parent giving feedback: "Yes, that's right. When there's two yellow then there are three red."

It went very well.

While games were seen as a useful resource, in the initial phase, Sarah identified structures that may prove challenging for the child.

Diary excerpts:

Snakes and Ladders:

Taking turns in rolling the dice and moving forward. Parent takes turns and prompts child.

It is complicated for a child to follow the direction of the numbers, left, right and upwards.

In Phase 2 of the diaries, Sarah also readily identified the limits of understanding for her child, that the next step was a challenge and that she recognised it as such.

Diary 2 excerpts:

Patterns:

Pattern of three different coloured pegs repeated and recorded. Press the record [button] and listen to the message many times with the colours to be used. Parent to record the message with the colours.

This activity was difficult. It changed to 2 colours because 3 was too difficult.

Same colour, size, mass:

Went through the box with little objects. Talking about colour, size and weight of objects. Parent asking questions with which one is heavier, bigger etc.

Found weight difficult.

Parent 1 Summary

Sarah identified that mathematics was important in the life of her child and in the second phase undertook a more proactive role as Content Advisor while maintaining her roles of Motivator, Monitor and Content Advisor.

Her understanding of her child's strengths and weaknesses were evidenced in an increase in the opportunities taken in the time devoted to discussing mathematics with her child, both in the spheres of progress and by identifying mathematics in everyday situations.

Her diary writing recorded her ability to identify mathematics within tasks and to also identify a wide variety of insights. There were changes in the topics addressed in the mathematical activities. Some of these changes were related to aspects presented in the intervention "Make and Take" workshop.

Sarah acknowledged that, to date, her ability to implement strategies to assist in the learning of mathematics for her child was not as successful as her strategies for language and literacy.

The "voice" of Parent 1 indicates that changes did occur over time and, to some extent, in relation to the "Make and Take" intervention. She demonstrated a clear understanding of her child's strengths and weaknesses.

Parent 2

The findings for Parent 2's Phase 1 and Phase 2 data are described in this section. Parent 2 is to be known as Kate. This has been done in a similar manner to Sarah's by examining the responses to each part of each survey and diary and also identifying changes in Parent 2's responses within these. This structure provides an opportunity to examine more closely the "parent's voice", from the individual parent's point of view.

Kate is the mother of a nine-year-old boy with Down syndrome. She was a participant in the Canberra group of parents. She has a daughter who is older. In the initial pre-intervention collection of data, Kate was identified as MO9.

In recording the data from the initial Survey 1, the roles of Monitor and Mathematics Content Advisor rated the highest scores for Kate.

Data from the post-intervention Survey 1 identified a decrease in the rating of Resource Provider, Monitor, Mathematics Content Advisor and, to a lesser extent, Mathematics Learning Counsellor for this parent. The overall rating for the role of Motivator remained constant but there were changes in certain individual items.

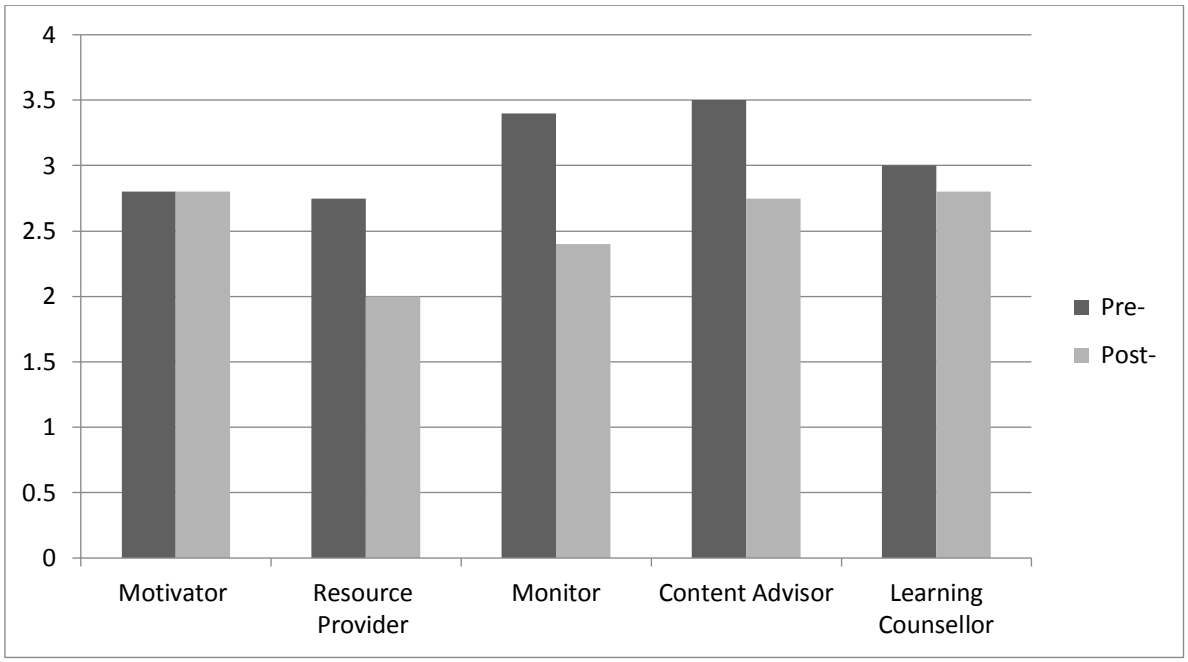


Figure 6.2: Changes in Perceived Roles for Kate from Phase 1 to Phase 2

Motivator

Parents provide emotional support for child's learning.

In Survey 1, Kate responded in a consistent manner in reporting against the role of Motivator. While rating the same score overall in the role of Motivator, this parent's responses recorded two changes in the individual statement ratings. In the item "When my child says he/she is having trouble learning mathematics, I tell him/her not to worry about it because everyone has problems with mathematics" the rating changed from "I strongly disagree" to "I disagree"; the item "I am usually able to motivate my child to learn mathematics well" changed from "I agree" to "I disagree".

From the diaries, Kate reported that she involved her child in the mathematics of everyday life, from cooking to ordering food, and from planning homework to driving to school. In these instances, she has identified the mathematics required in numeracy situations. Kate's reflections indicated that she readily understood where the challenges were for her child.

In Survey 2, subsequent to participation in the "Make and Take" workshop, Kate reported a small decrease in her awareness of her child's education being her responsibility. For the item "Talk with other parents from my child's school" the rating changed from "I agree" to "I disagree". When self-reporting on aspects of self-efficacy for helping the child succeed in school, Kate's responses reflected a change in her perceptions in four of the nine statements. She noted that she was less confident in helping her child do well in school at the same time as being more aware that she didn't know how to help her child learn maths.

The statement "Mathematics plays an important role in my child's future" rated highly in both pre- and post-intervention responses for this parent. Supporting this from Survey 2, Sarah's responses identified that when ranking the statements in the post-intervention phase, she has a slightly higher level of valence towards her own education in mathematics. Kate recorded instances where she was able to motivate her child by engaging in everyday tasks and that while she had been able to identify the mathematics

within that task, her reflections indicate that she is aware of the level of challenge for her child.

Diary excerpts:

School Canteen:

He had $.50 and we matched it to the signs on the cupcake tray.

He needs of a lot of assistance to make the connections.

In analysing the data from both phases of Survey 3, Kate's responses in the post-intervention phase identified that all items were viewed as slightly less important but some items were undertaken more frequently. Items involving "comparison" were rated more frequently as were the "words for numbers above 10". Diary entries supported these responses.

From the initial data from the diaries, Kate's most frequently reported tasks related to real life situations, many being related to money. Counting-on strategies were identified as challenges.

Diary excerpts:

Driving to school:

We counted the number of trucks we saw. He would count the trucks as we waited at the intersection. He would then restart counting from zero at the next intersection.

He was not able to count on from the previous total.

The application of mathematical skills to the situations could be viewed in relation to the child's age. He would be considered as a child at a perceptual level of counting.

Resource Provider

Parents play the role of resource provider at home by providing an appropriate place to study, relevant resources and opportunities.

The overall rating for this role decreased for Kate. Her responses resulted in the researcher identifying two changes in ratings. "I try hard to have a nice learning environment at home for my child to do mathematics" changed from "I strongly agree" to

“I disagree”, and “We have a variety of games and puzzles that encourage this development of my child's mathematical skills” changed from “I strongly agree” to “I agree”.

The aspects of Parental Role Construction (Responsibility and Valence toward school) from Survey 2 were rated lower in two items. “I believe that it is my responsibility to make sure the school has what it needs” and “Talk with other parents from my child’s school” both changed from “I agree” to “I disagree”. On the other hand, she had a more positive response to reflections her own education in mathematics.

Responses to the initial phase of Survey 3 by this parent identified all aspects as very important to essential, with rote counting and number facts frequently being the focus of tasks. In the second phase, counting at a higher range and using comparison were introduced but all items given a slightly lower rating for importance.

Diary excerpts:

Cooking the evening meal:

Set the timer to indicate when next to check the meal that was cooking. He kept resetting the timer to 18 – which is his favourite number.

He didn’t understand that he needed to leave it alone to cool down.

Monitor

Parents monitor their child's learning and progress at home.

The role of Monitor saw major changes in this parent’s perceptions. There was a change in four items. “I check my child's homework regularly” changed from “I strongly agree” to “I agree”; “At home it is important for my child to keep a balance between mathematics and his/her other subjects” changed from “I strongly agree” to “I agree”; “I always try to monitor the amount of time my child spends on mathematics at home” changed from “I strongly agree” to “I disagree”; and “I am always aware of my child's mathematics requirements by checking notebooks, using learning online, or through phone calls to the school” changed from “I disagree” to “I strongly disagree”.

In comparison to these, the responses from Kate to her perceptions of general invitations for involvement from the school were more positive to all of the items.

She recorded a major shift in the perceptions of the number of times she received specific invitations from the teacher. Helping with and supervising homework was one of the main foci of the shift. Frequency of being contacted by the teacher was reduced in the second phase.

The responses with respect to the home-based activities rated more highly, with Kate reporting an increase in frequency for all statements except the one indicating that her child did not participate in tests.

With regard to school-based involvement, Kate's responses indicated that involvement in school-based activities occurred less frequently during the pre-intervention period of surveying.

Survey 3 responses from Kate indicated that while "counting" was seen as less important, it was still frequently undertaken.

From the diaries, Kate expanded the range for adding up to three one-digit numbers instead of only two. This was done in the context of a game.

Diary excerpts:

Playing a game with dice:

Taking turns to roll three dice; adding up the total score and recording it on paper.

He was only able to add two dice and not the third.

Needed to play a simpler game that delivered a better result.

As previously noted, there was no indication from any of the data provided by Kate that mathematics had become a specific part of the assigned homework.

Mathematics Content Advisor

Parents provide advice to their child on mathematics content.

Three items changed in the role of Mathematics Content Advisor for Kate. These items were: "I think I know enough about maths to help my child" changed from "I

strongly agree” to “I agree”; “I often discuss with my child how mathematics is used in everyday life” had the same recorded changes; and “I make an effort to understand the mathematics my child is studying” changed from “I agree” to “I disagree”.

For this role, Kate’s responses to Survey 1 indicated that there was an overall decrease in agreement with the statements. However, in the diaries there was an increase recorded in the incidences of using mathematics in everyday life.

Survey 2 responses identified that in the aspect of self-efficacy, this parent’s responses changed: “I know if I am getting through to my child” increased, while “I make a significant difference in my child’s school performance” decreased.

In Survey 3, Kate’s self-reported responses for “comparison” indicated that while this was seen as more important, she did not report an increase in frequency. The importance and frequency for “grouping” increased in the second phase of this survey. The corresponding tasks were identified in the diary writing.

From the initial data from the diaries, Kate reported that counting was the most frequent activity undertaken but done so in context.

Mathematics Learning Counsellor

Parents understand their child's current situation, learning difficulties, potential, needs and demands, and provide appropriate support to help their child overcome learning difficulties.

Four items changed in the role of Mathematics Learning Counsellor. This change for Kate was the largest change for any parent in this group. The response to the item “I am aware of the approaches used to teach mathematics at my child's school” changed from “I disagree” to “I agree”; the item “I always try to figure out good approaches for helping my child learn different mathematics topics” changed from “I strongly agree” to “I agree”; the item “I understand my child's strengths and weaknesses in learning mathematics” changed from “I disagree” to “I agree”; and the item “I try to match my expectations with my child's potential” changed from “I strongly agree” to “I disagree”. These insights into Kate’s perceptions are noteworthy.

Kate reported that she had enough time and energy to help out at school and to help with and supervise her child's homework. "Communicating effectively with the child about the school day" rated higher in the post-intervention responses than in the pre-intervention survey. Communicating with the teacher and helping with homework also rated more highly in this aspect.

For Kate the only change in her responses in regard to knowledge and skills to communicate with teachers, was that she now communicated more effectively with her child about the school day.

However, her responses in Survey 2 in responding to the aspect of self-efficacy, remained consistent for the statement "I know how to help my child do well in school" as did her responses to "I know how to help my child get good grades in school" and "I know if I am getting through to my child". Within this role, Kate also noted a decrease in three of the other items: "I feel successful about my efforts to help my child to learn"; "I don't know how to help my child learn maths"; and "I make a significant difference in my child's school performance". Her perceptions of her knowledge and skills remained constant.

She indicated that she is reaffirmed in knowing what works for her child on the one hand, but is less sure of making a significant difference in the child's school performance.

From the Diaries, Kate indicated that she had become more aware of the aspects of tasks that she could negotiate with the child.

Diary excerpts:

Negotiating how much homework would be done:

He had three activities for homework. He did not want to do any. So we negotiated that he would do his reader and then one of the activity sheets.

He understood the numbers below three.

In phase 2 of the diaries, Kate also readily identified she continued to present mathematics in a real life situation. The limits of her child's understanding became evident to her in the task undertaken.

Parent 2 Summary

Kate was consistent in identifying that mathematics had an important role to play in her child's life. The role of Motivator, as identified by the pre- and post-intervention responses, remained constant. The other roles of Resource Provider, Monitor, Mathematics Content Advisor and Mathematics Learning Counsellor were all, to some extent, reduced in the ratings. The greatest number of changes occurred in the role of Mathematics Learning Counsellor with four of the statements changing dramatically.

This parent readily identified the mathematics within everyday living – numeracy. In her self-reporting, she indicated that she is less confident in assisting her child to be successful and had become more aware that she did not have effective strategies to overcome this. Her lack of confidence was also reflected in her responses that indicated that she was undertaking more home-based mathematical activities but at the same time being less positive about the home environment for learning mathematics.

The diaries written by Kate indicated that she was aware of the mathematics in the practical tasks and that she understood the challenges for her child. Her responses, in the post-intervention data, indicated that she was able to communicate more effectively with her child about the school day and with the teacher about her child.

Kate's "voice" represents someone who knows when she is getting through to her child and is reaffirmed in knowing what works.

Parent 3

This section describes the results from the pre-and post-intervention data for the third parent, to be known as Jack. As with Sarah and Kate, all data from Jack's Survey 1 was firstly analysed to identify the Parental Role as defined by Cai et al. (1997). Data from Survey 2 and Survey 3, as well as the coded data from the parent diaries, were integrated in such a manner as to provide triangulation evidence for the roles.

Jack is the father of a six-year-old girl with Down syndrome. He was a participant in the Sydney parent group. During the data collection process Jack was identified as FA4.

In analysing the data from the initial Survey 1, the roles of Mathematics Content Advisor and Mathematics Learning Counsellor rated the highest scores for Jack.

Data from the post-intervention Survey 1 identified an increase in the rating for the roles of Motivator and Resource Provider. Mathematics Content Advisor role for this parent decreased while the roles of Monitor and Mathematics Learning Counsellor remained the same.

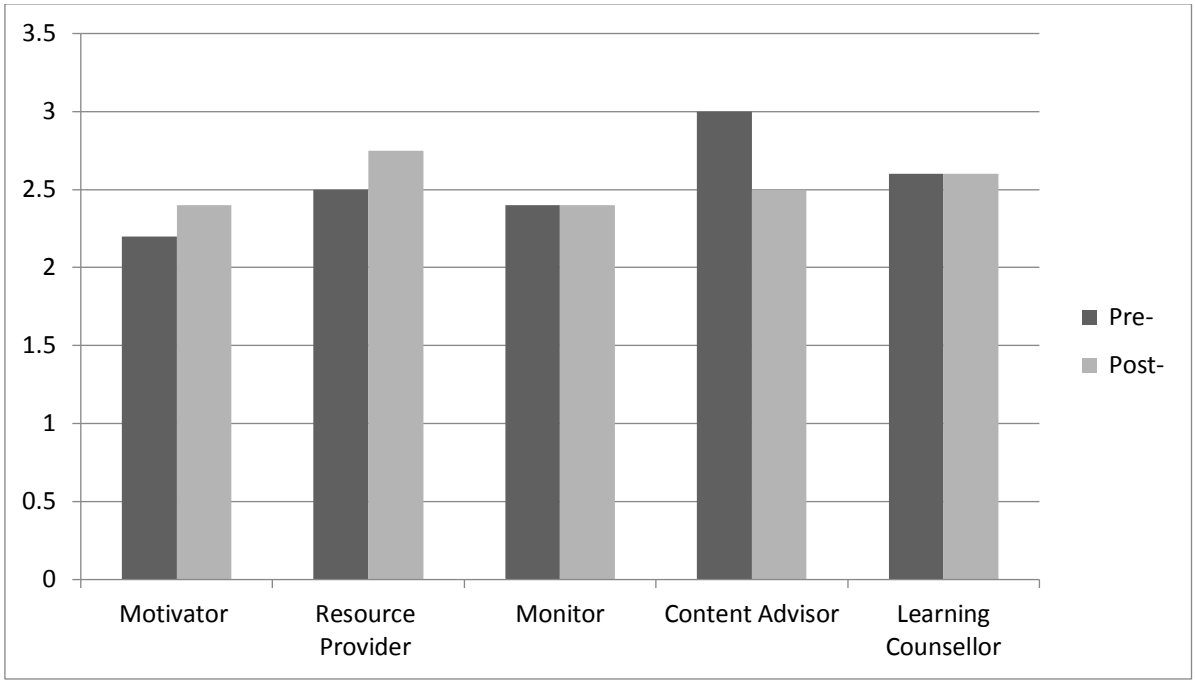


Figure 6.3: Changes in Perceived Roles for Jack from Phase 1 to Phase 2

Motivator

Parents provide emotional support for child's learning.

For Jack in the role of Motivator, one item changed. "When my child says he/she is having trouble learning mathematics, I tell him/are not to worry about it because everyone has problems with mathematics" changed from "I disagree" to "I agree". All other items' ratings remained the same.

This father indicated a change in his response to "I talk with other parents from my child's school" with his response moving from "I agree" to "I disagree", and in regard to his memories of his school experiences of mathematics, Jack's perceptions remained constant. In the aspect of self-efficacy, Jack changed his response to the statement "I know how to help my child do well in school" from "I agree" to "I disagree".

Responding to Survey 3, Jack changed majority of responses for both the perceived relative importance and frequency of tasks being undertaken with the child. One-to-one matching, comparison, number facts and money were the only items where the responses from pre- and post-intervention remained constant at "important" and "once a week" or "not at all".

Diary entries from Jack indicated that he responded when opportunities arose to identify mathematics in situations that were real for the child.

Diary excerpts:

Grouping

Playing with dolls: they collected dolls and stuffed toys, blankets and beds altogether. They made sure that there is enough for each doll. I pointed out that each doll had two things. They counted.

I don't think they were too interested. But they were happy to count.

Measurement:

Baking biscuits: we made biscuits. I helped to measure the ingredients according to the recipe.

It was fun and motivating.

Resource Provider

Parents play the role of resource provider at home by providing an appropriate place to study, relevant resources and opportunities.

Similarly, in the role of Resource Provider, the analysis for Jack resulted in one change of ratings. “I often buy mathematics-related books for my child” changed from “I disagree” to “I agree”. This statement in Survey 1 may have influenced this parent’s responses in the diary. In journaling in the diaries, Jack primarily used books and games in the first phase.

Diary excerpts:

Reading:

Read ‘Bears in the Night’ a favourite book. She listened and helped read the story. In, out, up, down, around, between, through, up, down etc. repeated it a lot, prompted and left gaps. She understands these words after a lot of practice and is starting to repeat the pages.

We read this book often.

Reading:

Reading at night: counting sheep, possums etc.

She enjoys this.

In the second phase of the diaries, Jack used mathematics in real life everyday situations.

Diary 2 excerpts:

Problem-Solving:

Finish setting the table. She saw what was already set out and worked out how many more knives, forks and spoons were needed.

I gave her a clue and told her who would be at dinner; talked about what was needed first. She did better when she saw what was needed.

Monitor

Parents monitor their child's learning and progress at home.

The role of Monitor saw two changes in ratings for Jack: “I seldom spend time talking with my child about his/her progress in mathematics” changed from a rating of “I disagree” to “I agree”, and “I am always aware of my child's mathematics requirements by checking notebooks, using learning online, or through phone calls to school” changed from “I disagree” to “I strongly disagree”.

When responding to Survey 2, Jack rated the majority of items in the aspect of “Parental self-efficacy for helping the child succeed in school” as “I disagree” in both the pre-and post-intervention phases. Invitations to assist with homework were consistently reported as “I strongly disagree”. However, the parent responded positively with regard to the time and energy to assist with homework and communicating effectively with his child. In regard to Jack’s perceptions of his knowledge and skills to assist with homework and to communicate effectively with this child about the school day, the ratings changed from “I disagree” to “I agree”. He noted that he was less confident in helping his child to do well in school at the same time as being more aware that he didn't know how to help his child learn maths.

In Survey 3, there was no recorded increase in the frequency of any of the identified mathematical tasks. The minimum number of five diary entries was recorded by this parent.

Diary excerpts:

Addition:

Using Numicon shapes. She solved the problems. I helped her work out how to answer.

I think she needs to memorise the facts but she enjoyed working out the answers.

Mathematics Content Advisor

Parents provide advice to their child on mathematics content.

Only one item changed in the role of Mathematics Content Advisor. “I feel I can help my child solve problems from mathematics class” changed from “I agree” to “I

disagree". This perception was also reflected in Survey 2. The response to the statement "I don't know how to help my child learn maths" changed from "I disagree" to "I agree".

Responding to statements regarding self-efficacy, Jack indicated a consistently low score for both pre-and post-intervention phases. Relative frequency and importance in Survey 3 were also consistently scored at a low level.

Jack reported that he had enough time and energy to help out at school and to help with and supervise his child's homework. The researcher found it interesting to note that with regard to the home-based activities, Jack's responses changed from "three times a week" to "daily" for all items except the one relating to tests.

Mathematics Learning Counsellor

Parents understand their child's current situation, learning difficulties, potential, needs and demands, and provide appropriate support to help their child overcome learning difficulties.

In the role of Mathematics Learning Counsellor, the perceived role responses for Jack were consistent in both pre-and post-intervention phases. The statements "I don't know strategies for helping my child overcome weaknesses in mathematics" and "I understand my child's strengths and weaknesses in learning mathematics" both rated as "I disagree". "I am aware of the approaches used to teach mathematics at my child's school", "I always tried to figure out good approaches for helping my child learning different mathematics topics" and "I try to match my expectations with my child's potential" all rated "I agree".

With regard to school-based involvement, Jack's responses indicated that involvement in school-based activities was perceived as taking place more frequently than in the first phase. Also, Jack was the only parent to respond in a less negative way for two of the items: "Helps out at this child's school" and "Goes to school's open house". In the responses to "Parent activities are scheduled at this school so I can attend", Jack responded in a less positive manner than in the pre-intervention Survey 2.

Parent 3 Summary

In both the pre-and post-intervention phases, Jack identified mathematics as being important in his child's future. In the initial phase, Mathematics Content Advisor and Mathematics Learning Counsellor were identified by this parent as the perceived roles with the highest ratings. In the post-intervention phase, the roles of Motivator and Resource Provider were given a higher rating, while that of Mathematics Content Advisor was lower. Through both phases, Jack reported his self-efficacy for helping his child as consistently low and subsequent data indicated that the frequency of undertaking mathematics activities with the child was reported as "once a week". In the second phase, he reported more positive responses with respect to his knowledge and skills to assist with homework and to communicate effectively with this child about the school day.

Jack submitted the minimal number of diary entries. Buying and reading of books was identified in the surveys and reported in the diaries. In the second phase, Jack reported that home-based activities were undertaken daily yet he identified himself as less confident but more aware of not knowing how to assist his child to learn mathematics.

This parent's responses presented a "voice" quite different from Sarah and Kate. The analysis for this parent is more open to interpretation as there is not the same consistency across the various sources of data. Changes have occurred in the topics and frequency of tasks undertaken with the child with an ongoing focus on literacy as a context.

Parent 4

This chapter section details with the results for Parent 4, to be known as Peter, from both pre-and post-intervention phases. This has been done by coding the responses to each part of the surveys and diaries and also addressing changes in this individual parent's responses within these.

As with Sarah, Kate and Jack, all data for Peter from Survey 1 were firstly analysed to identify the Parental Role as defined by Cai et al. (1997). Data from Survey 2 and Survey 3, as well as the coded data from the parent diaries, were integrated in such a manner as to provide triangulation evidence for these roles.

Peter is the father of a nine-year-old boy with Down syndrome. He was a participant in the Canberra parent group. During the data collection process Peter was identified as FA9.

In analysing the data from Survey 1 in Phase 1, Peter's responses indicated that the roles of Resource Provider and Mathematics Content Advisor were rated the highest. Data from the post-intervention Survey 1 identified that the perceived roles of Resource Provider and Mathematics Learning Counsellor remained constant. Results for this parent also indicated a slight decrease in the rating for the role of Monitor and an increase in the ratings for the roles of Motivator and Mathematics Content Advisor.

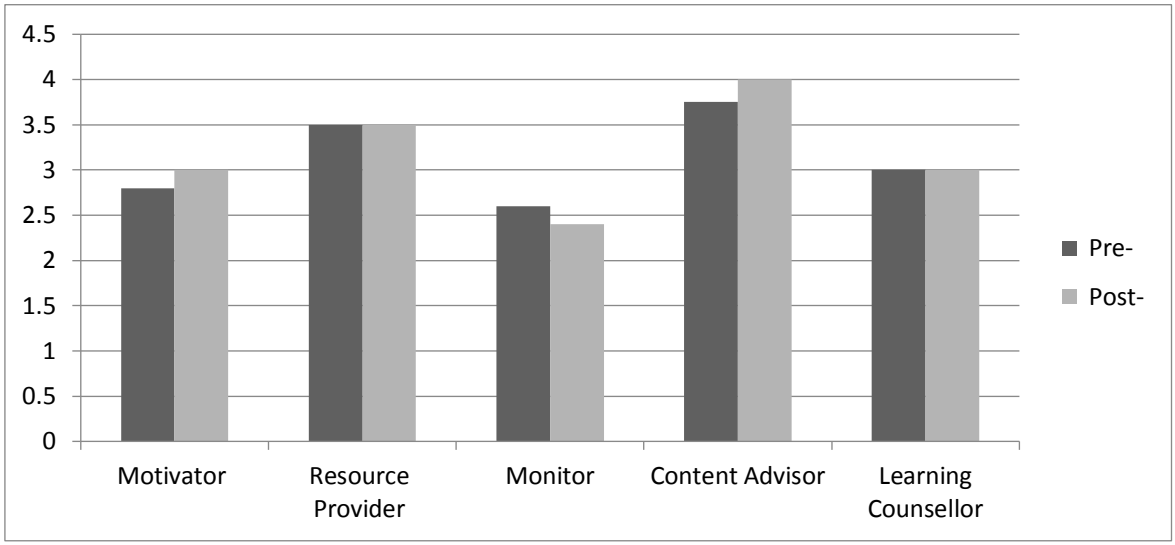


Figure 6.4: Changes in Perceived Roles for Peter from Phase 1 to Phase 2

Motivator

Parents provide emotional support for child's learning.

As with the other parents in this group, Peter confirmed in both phases that "Mathematics plays an important role in my child's future". In this role of Motivator, Peter's responses were consistent except for the last item. "I don't know how to motivate my child to do a good job on his or her mathematics assignments" was the only item where the rating changed. It changed from "I disagree" to "I agree". Responses to all other statements remained with an "I agree" rating.

The analysis of the data from Survey 2 in the aspect of responsibility, indicated a change in Peter's response to "I talk with other parents from my child's school" moving from "I agree" to "I disagree". This parent reported very positive memories of his own experiences of mathematics when he was a student. When self-reporting on the current situation of helping his child to succeed in school, Peter changed his responses from "I agree" to "I disagree" in three significant items. These were: "I feel successful about my efforts to help my child learn", "I don't know how to help my child learn maths" and "I make a significant difference in my child's school performance".

Peter consistently the identified the mathematics in real life situations. All diary entries from this parent presented the mathematics in a real life context.

Diary excerpts:

Time and numbers:

Various activities associated with getting ready for school: started off with telling him the time to get up, counted the stairs on the way down. He was given five minutes to show, told him when two minutes and one minute to go. Counted down the final 10 seconds.

Shows the importance of knowing timeframe for getting ready.

Driving:

After picking him up from school, we talked about the various speed limits on the way home. Firstly, we talked about how this school limit applies to certain hours and then we discussed whether we went faster as we pass through various speed zones. Showed the importance of numerical skills for everyday activities.

Resource Provider

Parents play the role of resource provider at home by providing an appropriate place to study, relevant resources and opportunities.

The responses addressing the role of Resource Provider resulted in no changes for Peter. The researcher noted that this parent has indicated that home-based activities are undertaken on a daily basis.

Responding to Survey 3 items, Peter reported an increase in either the relative importance or in frequency, or both, for 13 of the statements. While frequency of rote counting to 10, one-to-one counting , grouping and comparing increased, the change to "essential" with regard to importance was recorded for eight items in contrast to two items in the pre-intervention phase.

Real life situations were again recorded by this parent in the diaries. In many instances, the duration of the activities were the longest recorded by any parent.

Diary excerpts:

Cooking:

We made cupcakes. First we had to count the ingredients – two eggs, 4 ounces of butter, one third of a cup of water. We then had to wait for the oven to reach a temperature before putting the time on for the minutes to cook the cakes. After baking we had to wait for a time for them to cool and then stirred the icing for three minutes. Finally we counted the number of cakes as we iced them.

An opportunity to introduce many mathematical concepts while doing an enjoyable task.

Monitor

Parents monitor their child's learning and progress at home.

The responses to the statements identified for the Monitor role for Peter resulted in one change. "I seldom spend time talking with my child about his/her progress in mathematics" changed from "I disagree" to "I agree".

Peter changed his rating from “I agree” to “I strongly agree” for the statement “I have enough time and energy to communicate effectively with my child about the school day”. With regards to knowledge and skills, this parent changed the rating for one item only: “I know how to communicate effectively with my child about the school day” changed from “I disagree” to “I agree”.

Peter reported a decrease in his perceptions of requests to help out at school and also in the regularity of teacher contact.

Once again, Peter identified tasks where the challenges for this child were recorded through the diary entries.

Diary excerpts:

Quantity:

We went to the bakery to buy cakes. I gave him some money and he said it was $10. When we got change – $2.50, he counted out three coins.

Clearly he did not understand that different coins have different values, although he does with the notes as they have numbers.

Mathematics Content Advisor

Parents provide advice to their child on mathematics content.

The responses given by Peter to the statements for the Mathematics Content Advisor role resulted in one change only from the pre-intervention phase. “I often discuss with my child how mathematics is used in everyday life” changed from “I agree” to “I strongly agree”. This parent’s responses to the other statements were consistently at the highest level.

While there was minor positive change in this parent’s responses in regard to the knowledge and skills to communicate with teachers, as evidenced in the post-intervention Survey 2, Peter recorded a major shift in the perceptions of the number of times he received specific invitations from the teacher. Helping with and supervising homework was the main focus of the shift. The other items recorded no change in responses between pre- and post-intervention for Survey 2.

Diary excerpts:

Numbers:

We went to the ATM to withdraw cash. Firstly, we had to enter the numbers for the PIN. We then had to work out how much we wanted and then counted how much we got.

It reinforced to me the importance of understanding that numbers can be for something more than counting; that is as a PIN.

Numbers and scores:

We read the football score from the paper. We looked at how many points each team had scored and he had to tell me which team won.

Mathematics Learning Counsellor

Parents understand their child's current situation, learning difficulties, potential, needs and demands, and provide appropriate support to help their child overcome learning difficulties.

For Peter, there were no changes in the responses to the item for Mathematics Learning Counsellor role. The statement "I don't know strategies for helping my child overcome weaknesses in mathematics" was responded to in a consistent manner with the rating "I disagree".

From Survey 2, Peter reported that he had enough time and energy to help out at school and to help with and supervise his child's homework. "Communicating effectively with the child about the school day" rated higher in the post-intervention responses than in the pre-intervention survey changing from "I disagree" to "I agree".

The diary entries, related to the role of Mathematics Learning Counsellor from Peter, were once again in a real life context. Successes and challenges were two insights recorded.

Diary excerpts:

Counting backwards:

We watched the top 20 Countdown on his TV. I asked him each time a song came on, to tell me the number and which number would be coming up next.
I thought he was excellent at counting backwards.
Driving:
When driving to school again we looked at speed limits. This time we connected the signs to the speedometer in the car. As the speedometer went up in 20km units, we had to look at the line halfway between the two numbers shown.
Too challenging. At this point he confused Street numbers with speed limits.

Parent 4 Summary

The importance of mathematics in his child's future was identified by Peter as a high rating item. Tasks involving mathematics were undertaken daily in the second phase and most tasks were identified as essential. Motivator and Mathematics Content Advisor were the roles identified as having a higher rating in the post-intervention phase.

Peter's diary entries consistently reported tasks that were undertaken in an everyday situation where father and son interacted. However, this father was unsure about the extent to which his time and energy, and knowledge and skills will impact on his child's learning of mathematics. This has raised some concerns for this parent.

On the other hand, he knows how to communicate and has dedicated more time to communicating with his child about his mathematical progress and can also communicate effectively with his child about the school day.

This parent's "voice" registers a special bond with his son. His endeavours to identify mathematics in everyday situations are a feature of his role.

Chapter 6 Summary

This chapter has detailed the findings from four individual parents, in both the pre- and post-intervention phases. This has been done by addressing the responses to each aspect of the surveys and diaries from each parent individually, identifying connections across the data, and also addressing changes in individual parents' responses within these.

Addressing the individual parent's "voice", has provided an added value to the current literature and has enriched the understandings of how and why parents undertake specific roles in supporting mathematical development for their child with Down syndrome.

In the pre-intervention phase, each parent provided responses to the surveys and documented tasks undertaken with the child. These data became the basis for identifying their perceived roles. Each of the four parents perceived their five roles to a different extent. Similarly, in Phase 2 the five roles were different for each parent, and were different from their perceived roles in Phase 1.

Through engaging with their child with mathematical tasks, completing Surveys 2 and Survey 3, and completing diary tasks pre- and post-intervention, individual parents' interpretation of the items stated in Survey 1 have changed. They have reported significant changes in their perception of their roles. The changes of their individual perceptions of their roles vary widely among parents in this study.

When comparing the variation in the perceived roles, firstly among the four parents, and secondly between the phases for each parent, the analysis clearly identifies the added value of exploring the "voice" of each individual parent. No two parents responded in a similar manner in any of the aspects discussed in this chapter. Each parent's responses were analysed solely with reference to their perceived roles. Elements of this study not considered for analysis in this chapter include the age of the child, the gender of the child and the gender of the parent.

The analysis of quantitative data for these four individual parents, provided through the completion of the surveys in Phase 1 and Phase 2, was greatly enhanced by the analysis of the qualitative data recorded in the parents' diaries. A very valuable aspect of this mixed methods study was the parents' identification of the mathematical topics and their insights into the challenges and successes of engaging with their child in mathematics tasks.

The extent to which each parent's motivational beliefs of role construction and self-efficacy, their perceptions of invitations for involvement from school and teachers, and their perceived life contexts of skills and knowledge, time and energy, and their home and school involvement will all have a contributing influence will be discussed in Chapter 7.

Chapter 7 FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to examine parents' perceptions of their roles in supporting the development of early mathematical concepts for their child who has Down syndrome. The research questions that guided this study are to be found in chapter 2.

Framework of the chapter

This chapter presents the findings identified through the analysis of all the quantitative and qualitative data collected during this study. A summary of the study is presented. The details of the sources and structures of the data collecting instruments are noted with considerations for future research. The findings that emerged from the analysis of the data are presented in response to the three research questions, with reference to relevant findings from the initial sources – Cai et al. (1997), Walker et al. (2005), Blevins Knabe and Musun Miller (1996) and Skwarchuk (2009). The questionnaire that gathers the data for the five roles has been revised and updated by considering the parental responses from the current study and experience gained from administering the original questionnaire. Limitations and recommendations conclude this chapter.

Summary of the study

This study focused on developing early mathematical concepts and was undertaken with parents who have a primary-aged child with Down syndrome. The initial correspondence encouraged both fathers and mothers to participate. The study was undertaken in two locations – Canberra and Sydney. This study was presented in two phases which were identified as Phase 1 – Pre-intervention and Phase 2 – Post-intervention. The intervention was a "Make and Take" workshop. This research adopted a mixed methods methodology. Three survey and reflective diaries were used to collect the quantitative and qualitative data. The Phase 1 self-reported responses were collated and analysed and the results provided a direction for the aspects to be addressed in the intervention. During the second phase, the same surveys and the diaries were completed, collated and analysed.

By committing to this study, the participating parents provided an insight into their world. They demonstrated an interest in the area of supporting early mathematical concepts for their child. They viewed their involvement as an opportunity for them to extend their understanding and strategies, and to explore further avenues for extending their knowledge, and their self-efficacy. Time and effort had been an ongoing commitment from each parent prior to involvement in the research.

Data Collecting Instruments

In this mixed methods study, the range of data collecting instruments provided the parents with multiple opportunities to record their perceptions. The wealth of data gained, both quantitative and qualitative, melded in such a way as to provide the researcher with an opportunity to make connections rather than responding to the four individual data collections.

Table 7.1: Summary of Phase 1 and Phase 2

	Phase 1 – Pre-intervention			**Phase 2 – Post-intervention**	
Survey 1	Parental Roles	Analysis of each instrument's responses for parents as a group	"Make &Take' Workshop"	Analysis of all responses from four parents as a group	Analysis of all the responses for the same for parents as individuals
Survey 2	Parental Involvement in Education				
Survey 3	Parent – Child Home Activities				
Diary	Mathematical Topics; Parental Insights				

Quantitative Data

In this study, quantitative data were sourced by parents self-reporting against items presented in three different surveys. Through the process of identifying research relevant to this topic in the Literature Review, three existing surveys were identified that would provide data relevant to answering the stated research questions. These surveys all related to some aspect of parent involvement in education. Each survey used Likert scales. Parents responded either to the level of "agreement with the statement" or to

"the frequency of undertaking stated task". Survey 1, sourced from Cai (2003) and known as "Parent Involvement Questionnaire" (PIQ), identifies the roles parents undertake in supporting mathematical knowledge and skills for their child. It became the core structure for the analysis of all data. Survey 2 related to parent involvement in their child's education. This survey, based on the Parent Involvement Process, as presented by Hoover Dempsey and Sandler (1997) and revised by Walker at al. (2005), provided the theoretical framework under which the study evolved and was also identified as a data collecting instrument. Survey 3 addressed a selection of at-home activities that are representative of common mathematical tasks parents engage in with their child. These were sourced from Blevins-Knabe and Musun-Miller (1996). This survey required the parents to respond with regard to how they rated the relative importance of the task for their child, and how frequently they undertook the task with their child.

Survey 1 provided specific statements to identify the roles of Motivator, Resource Provider, Monitor, Mathematics Content Advisor and Mathematics Content Counsellor. The definition for Mathematics Content Counsellor as "Parents understand their children's current situation, learning difficulties, potential, needs and demands, and provide appropriate support to help their children overcome learning difficulties", was identified as possibly being particularly relevant to this study. These surveys were completed by the parents pre- and post- the intervention.

Qualitative Data

Qualitative data were sourced from the open-ended question at the end of Survey 1 and through parents' journaling in a collaboratively-determined diary format, in both phases of this study.

The interconnectedness of the quantitative and the qualitative data has proven to be highly relevant in answering the research questions. To this end, while undertaking the analysis of all the data, links and connections were noted. This has resulted in insights of greater depth with regard to the parents' perceptions of their roles.

Intervention

During the "Make and Take" workshop, the researcher provided insights into early mathematical concept development, demonstrated supporting resources and provided a range of materials to enable parents to create relevant task-related resources for their child. Parents were provided with a Maths Kit for storage purposes.

Discussion on the Data Collection Instruments following Implementation

In this section, each of the instruments are considered in turn indicating what was learned from implementation and data analysis.

Survey 1 – Parent Involvement Questionnaire

Survey 1 contained three negative statements: "I don't know how to motivate my child to do a good job on his/her mathematics assignments", "I seldom spend time talking to my child about his/her progress in mathematics" and "I don't know strategies for helping my child overcome weaknesses in mathematics". These may have been open to misinterpretation by the parents when the others were phrased positively. In analysing the data, these negative statements had to be reverse-scored for these items when calculating summed scores. In addition, variation between Phase 1 and Phase 2 responses was greater than expected and may have been due, at least in part, to the negative form of the statement.

Survey 2 – Parental Involvement Process

In this study, the decision was made to omit the "Parental Involvement Process" section of the questionnaire relating to "Parent's Perceptions for Specific Invitations for Involvement from the Child". This decision was made in order to narrow the scope to the direct impact on the parental participation. In hindsight, this data may have supported the responses found in the parent diaries with regards to the parent-child relationships.

Survey 3 – Parent – Child Number Activities

A wider range of tasks could have been presented to the parents. However, for the level of mathematical understanding as identified by these parents these were probably sufficient. An open-ended statement may have resulted in further data being obtained.

Diary – Parents' Reflective Journaling (mathematical tasks undertaken with the child)

For some parents, the responses noted have been limited by the unintentional connection to the mathematical tasks identified in Survey 3. However this did provide support to the parents when recording in Phase 1.The researcher could have selected only five responses from each parent so as to reduce the amount of text data. However, each of these responses was found to be intrinsic and insightfully valuable to this study. It provided an opportunity to hear the 'voice' of the parents which otherwise would have been available to the researcher in a more limited way.

Intervention – "Make and Take" workshop

The intervention workshop was effective. A follow-up workshop may have supported parents further by providing an opportunity to discuss the progress made by their child and reflecting on what might be their next focus. In addressing the impact of the "Make and Take" workshop for the group of parents and for the parents as individuals, the findings identified that changes did occur. Parents did respond to the workshop by introducing a wider range of mathematical task topics in Phase 2 when interacting with their child.

The Interconnected Model

A significant outcome of this research is the development of an interconnected model to explain how the data from the four sources combined to give a broader picture. In the process of analysing all the data, the interconnectedness among the data and the relationships to the five roles became more apparent.

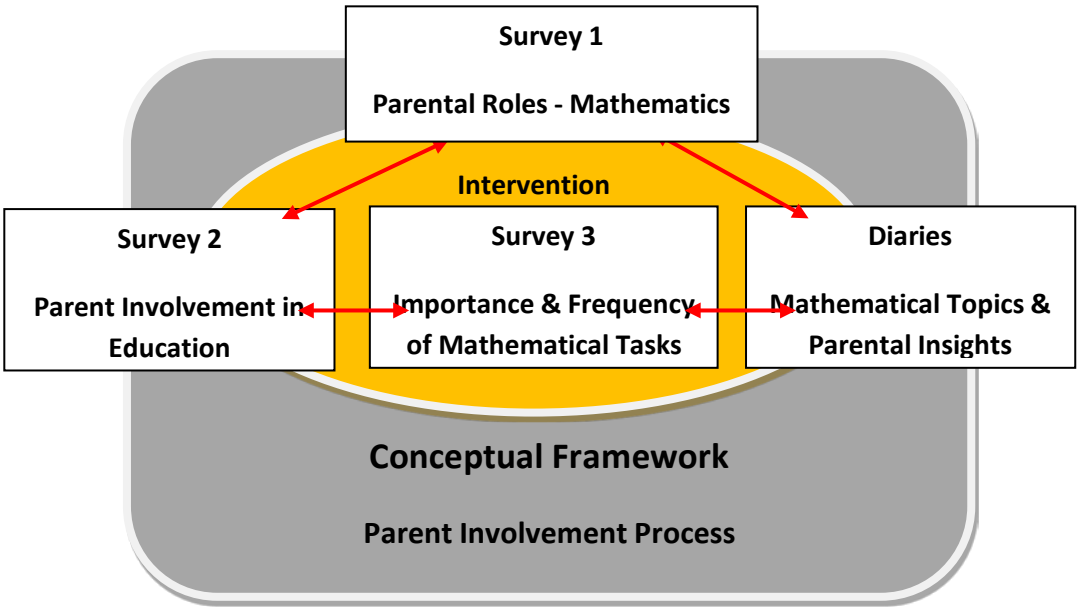


Figure 7.1: Interrelated Connections among Data

Addressing the Research Questions

The Nature of the Role

Research Question 1: ***What is the nature of the roles the parents engage in, to support their child with Down syndrome develop mathematical concepts?***

Building on the work of Cai (2003) where five roles were identified, this study reports on the findings for each role for this particular group of parents. Across all the analyses, this group of parents did identify with the role of Motivator (71%). They identified the importance of mathematics for their child and their willingness to take on this role. In the study conducted by Cai et a. (1997) 90% of parents responded that they provide emotional support but 30% do not know how to motivate their child to do well in mathematics. The corresponding responses in the current study 20% of the parents agreed with the negative statement. It is unsure if the negative statement reported an accurate response.

The role of Resource Provider rated the lowest of the five roles in this study. This may be due to the statement "I often take my child to the public library" scoring low for the majority of parents and hence the overall rating for this role being low. In Cai's (1997)

study results for this role varied considerably to each item – more than 90% provided a positive learning environment; 29% buy mathematics related books; 60% have used games to encourage mathematical skills. In the current study, the corresponding items' scoring is - 87%; 57%; 80%. In the overall scoring for this role for mothers (69.1%) was considerably higher than that of fathers (57.6%). To the specific item "I often buy mathematics related books for my child", the responses scored were mothers 66% and fathers 33%.

The role of Monitor may have rated higher but for the statement "I check my child's homework regularly". Many responded that their child did not have homework and if they did, mathematics was not involved. in Cai et al.'s (1997) homework was more relevant and scored 80% for checking and 60% for viewing homework. About 40% seldom spent time talking about mathematics to their child. This was similar to the current study parents' responses.

The Mathematics Content Advisor role rated highly for the whole group, rated higher in Phase 2 than in Phase 1 for the small selected group, and remained the same for the individual parents. The results from Cai et al. (1997) study report that 90% try to understand the mathematics their child is learning but less than half know enough to help their child. As these children were in junior high school, it is unrealistic to compare the parents' mathematical knowledge at high school level. In the current study, 83% reported that they try to understand and 66% reported that they know enough mathematics to help their child. The level of mathematical understanding for the current participants

The role of Mathematics Learning Counsellor varied across the three analyses. For the whole group it rated lower than other roles, for the small selected group changes occurred for specific items within the role, and for the individual parents two increased and two decreased their rating for this role. In the Cai et al. (1997) study 70% of parents indicated that they knew their child's strengths and weaknesses compared to 50% of parents in the current study. For the item referring to the parent having strategies to assist approximately the same results was noted for both studies at 40%. In the current study 87% reported that they try to match their expectations to their child's ability which was higher that Cai et al.'s (1997) result of 75%. In both studies more than 60% of parent

reported that they were more familiar with the approaches to mathematics learning implemented in their school.

In the Cai et al. (1997) study the findings indicate that the parents who identified most strongly with the roles of motivator, resource providers, and monitors had the better outcomes for their child's mathematical success.

In this current study, initially the parents identified most strongly with the roles of Mathematics Content Advisor, with little or no variation for the other roles. However in reporting the Phase 1 and Phase 2 results from the small group the role of Mathematical Content Advisor remained important. There was an increase in the result for the role of Motivator. Reporting on the Phase 1 and Phase 2 for the individual parents demonstrated the variations: Mathematics Content Advisor increasing for Parent 1 and Parent 4, Mathematics Content Advisor decreasing for Parent 2 and Parent 3.

Differences in Parents' Perceptions – Mothers and Fathers

Research Question 2: ***To what extent do mothers and fathers perceive their roles differently?***

Fathers did respond differently to mothers. Fathers were more likely to be Mathematics Content Advisors whereas mothers led in the roles of Resource Provider and Mathematics Learning Counsellor. The responses from individual parents and thus their identified roles varied as much among the fathers and among the mothers as it did between the mothers and the fathers. These differences were also evident over the duration of the study and subsequent to the intervention. This emphasises that while there are differences in the roles undertaken by fathers and mothers, these are fluid and did change over time and may be impacted by the parent's heightened awareness of mathematics and the role it plays in their child's life.

While proportionally the fathers completed fewer diary entries, their focus tended to be more centred in the real life situations. The majority of mothers were more likely to record activities that included counting, time, sorting and patterns.

This study has valued the "voices" of the father as they are often silent in research. From the current study, it is evident that fathers approach their interactions with their child in a different way to mothers, when considering both the mathematical topics and the insights from the diaries. This is supported by the findings of Downer et al. (2008) that report that "a father's socialising role might involve introducing the child to the world and realities outside the home" (p. 70). The life contexts of many of the fathers' mathematical tasks are evidence of this. Fathers did approach the task-focused interactions with their child different from the mothers but also different from each other. While not a focus of this study, Saracho (2013) reported that for literacy, fathers reporting on their choice of approach depended on their own self-efficacy and their child's engagement with the task. This is also reported by Nicholas and Fletcher (2013). The majority of studies into parents and their involvement with education, and with mathematics in particular, report on mothers' perspectives. They, the mothers, may have been a more accessible and willing group for the purposes of research.

Impact of Intervention

Research Question 3: ***What is the impact of intervention on the parents' perception of their roles?***

The intervention, the "Make and Take" workshop, resulted in change to the perceived roles and to the parents' reported practices. The greatest change in parents' perceived roles following the intervention was in the role of Motivator. They either confirmed their Phase 1 rating or increased it. Parents indicated that the role of Resource Provider was lessened but their journaling reflected changes in both the selection of topics and the recorded insights. This seeming contradiction may be related to the relevance of statements in this role in the survey to these parents.

Future opportunities for similar workshops could promote new concepts for parents to engage in with their child. Recent research into parent-focused intervention in mathematics (Lopez & Donovan, 2009; For et al., 1998; De La Cruz, 1999) has reported that a more comprehensive approach has resulted in parents being more aware of their child's thinking, needs and attitudes and that "wrong answers can be a lens into their child's understanding" (p. 226). The opportunity to undertake further journaling may

promote the benefits of such an intervention as it clarifies for the parent where the challenge lies and where successes are achieved. While some of these recorded changes were linked to the aspects addressed in the intervention, others may have a basis in the parents extending the mathematical experiences for their child.

Conclusions from this Study

Through this research, the statements for the five parental roles that were developed over 20 years ago have been revised to apply to parents with a child with Down syndrome. The description of the roles remains valid but a revision of the statements was undertaken.

The Revised Survey for the Five Roles

The five roles as identified by Cai et al. (1997) included statements that were either unclear or irrelevant to this group of parents. To promote the further use of such a survey a revision of some of the items within each role as defined by Cai et al. (1997) would provide an opportunity to re-evaluate the responses from this particular group of parents or from others in the future.

The rewriting of the three negative statements as positive ones would reduce the incidences of the misreading and provide a more accurate overall response. Rewriting of the first statement for the role of Motivator was also needed: “When my child says he/she is having trouble learning mathematics, I tell him/her not to worry about it because everybody has problems with mathematics” as this statement perpetuates a negative attitude towards mathematics within the community.

To address these issues, a revision of the survey of parental roles has been undertaken. In the revised survey, the statement in the Motivator role has been written as “When my child says he/she is having trouble learning mathematics, I tell him/her to do his/her best”. Input from the other sources of data identified the need for schools and teachers to communicate their current approaches to teaching mathematics to the parents. Therefore the statement “I have attended mathematics workshops for parents” has been added. Changes in available resources, which were once largely available

through public libraries, are catered for by the inclusion of “I provide technology-based tasks to assist my child learn mathematics”. Many of the original statements remain in the revised survey. Overall there are now five statements for each role, an increase of two statements.

The original PIQ (Cai et al., 1997) had a Likert scale of 4: 1 = I strongly disagree; 2 = I disagree; 3 = I agree; 4 = I strongly agree. The proposed survey has a Likert scale of 5: 1 = I strongly disagree; 2 = I disagree; 3 = neutral; 4 = I agree; 5 = I strongly agree.

An open-ended statement for each role covering aspects not included in the role statements would provide parents an opportunity to provide extra information about their situation – their personal story. This has been added to the revised questionnaire which is given in Table 7.2. As before, the questionnaire is administered without the role heading and with questions randomised.

Table 7.2: Revised Parental Roles Questionnaire – Shellshear (2016)

Revised Parental Involvement Questionnaire – Shellshear (2016)	
Responses: 1 = I strongly disagree; 2 = I disagree; 3 = Neutral; 4 = I agree; 5 = I strongly agree	
Motivator:	
When my child says he/she is having trouble learning mathematics, I tell him/her to do his/her best.	1 2 3 4 5
At home, I encourage my child to work hard on mathematics problems, even if the problems are difficult.	1 2 3 4 5
I am usually able to motivate my child to learn mathematics well.	1 2 3 4 5
Mathematics plays an important role in my child's future.	1 2 3 4 5
I know how to motivate my child to do a good job on his/her mathematics tasks.	1 2 3 4 5
I motivate my child by:	
Resource Provider	
I try hard to have a nice learning environment at home for my child to do mathematics.	1 2 3 4 5
I provide technology-based tasks to assist my child learn mathematics.	1 2 3 4 5
I have access to a variety of home-based activities.	1 2 3 4 5
I often buy mathematics related books for my child.	1 2 3 4 5

At our house, we have a variety of games and puzzles that encourage the development of my child's mathematical skills.	1 2 3 4 5
When doing mathematics tasks my child prefers to use:	
Monitor	
I am involved with planning my child's mathematics program.	1 2 3 4 5
I often spend time talking with my child about his/her progress in mathematics.	1 2 3 4 5
At home, it is important for my child to keep a balance between mathematics and his/her other subjects.	1 2 3 4 5
I always try to monitor the amount of time my child spends on mathematics at home.	1 2 3 4 5
I am always aware of my child's mathematics requirements by checking notebooks, emails, or through phone calls to school.	1 2 3 4 5
My child completes mathematics homework that involves:	
Mathematics Content Advisor	
I feel I can help my child solve problems from mathematics class.	1 2 3 4 5
I think I know enough about mathematics to help my child.	1 2 3 4 5
I have attended mathematics workshops for parents.	1 2 3 4 5
I often discuss with my child how mathematics is used in everyday life.	1 2 3 4 5
I make an effort to understand the mathematics my child is studying.	1 2 3 4 5
The aspects of mathematics my child achieves well in are:	
Mathematics Learning Counsellor	
I know strategies for helping my child overcome weaknesses in mathematics.	1 2 3 4 5
I am aware of the approaches used to teach mathematics at my child's school.	1 2 3 4 5
I always try to figure out good approaches for helping my child learn different mathematics topics.	1 2 3 4 5
I understand my child's strengths and weaknesses in learning mathematics.	1 2 3 4 5
I try to match my expectations with my child's potential.	1 2 3 4 5
The aspects of mathematics my child is most challenged by are:	

Further research is required to determine if these revised statements will provide the opportunity for valid and reliable data being generated.

While this is important to the participating parents, it will be relevant to a wider audience. It adds to the existing research in the field of parental involvement in education. Further to this, it adds to the research base in the development of mathematics for children and to that of research for children with Down syndrome.

The mixed methods approach provided an opportunity to address the research questions in greater depth. The findings from the quantitative data have been greatly enhanced by the qualitative data provided by the parents. The data collecting instruments, the surveys and the diaries, used in this study have enabled the collection of both quantitative and qualitative data. The researcher was privileged to access the qualitative data through the parent diaries.

The results of this study affirm the importance of the parental roles as identified by Cai (1997, 2003) in supporting children's conceptual development in mathematics.

While the parents readily participated in the 'Make and Take' workshop, there was limited opportunity to determine the extent to which this had an impact on the data collected in the second phase and hence the reasons behind any changes in their perceived roles. This could be an area where future research could be undertaken.

This study offers an opportunity for further research to be undertaken in the area of parental involvement with mathematics using a similar approach – mixed methods, the identified data collection instruments, the Interconnected Model, and the Revised Survey.

Limitations

In this small scale research study, limitations exist that need consideration for interpretation of the findings. These have been grouped under participants, researcher and methodology.

The parent participants

The design of this study inherently involved a selection bias in the participants. All the parents for this study were approached through the relevant Down Syndrome Association, of which they were members. Parents registered an expression of interest to

participate in the project. The majority of parents, who did identify as interested, became part of the participant groups. Two locations were nominated for group meetings and for the "Make and Take" workshops. As expressed in writing, the parents were keen to participate with the view of increasing their awareness and knowledge of how to assist their child in developing mathematical concepts. Other parents, who may have been unaware, unable or disinterested in joining the study, may have different role perspectives. Some parents, who did commit to the study, lived in regional New South Wales and travelled to participate in meetings and the workshop. The findings represent the perceptions of these parents only. The study involves only a small number of parents. The extent to which these findings may be generalised to others cannot be determined.

The methodology

Research (Creswell, 2008) identifies various limitations in selecting mixed mode as a methodology. For this study, two of these are relevant: the sample size and the loss of participants between Phase 1 and Phase. The depth of analysis could have gone deeper and the study could have been further enhanced with the addition of one-on-one interviews to clarify aspects of both quantitative and qualitative responses. In this instance, this small-scale exploratory study has presented promising results and the benefits of accessing both quantitative and qualitative data are evident. Further analysis of this data could be explored to identify further connections, such as the parent's self-efficacy and its impact on the perceived roles.

The researcher

Being the main instrument for the collection of both quantitative and qualitative data, the researcher was aware of the breadth of the information gained and that selections had to be made regarding which data answered the research questions. Crosschecking of responses from all data sources refined this process. Further opportunities for analysis of the data still remain.

Recommendations for further research

The data collected in the current study invites a further analysis that would answer other questions. The Interconnected Model created for this research brings together resources from other researchers. It has proven to be a very useful model for the purposes of data collection and analysis in the current study and could be used for further research. The implementation of the Revised Parental Involvement Questionnaire with another group of parents would provide an opportunity to test the design and investigate the statistical properties, validity and reliability of the instruments.

From this study, the following recommendations can be made with regard to future research in the area of parental involvement with mathematics learning:

1 A parallel study be undertaken with parents of typically developing children to compare their roles to those identified in this study with this specific parent group using the Interconnected Model;
2 A detailed study to evaluate the validity and reliability of the Revised Parental Involvement Questionnaire;
3 A follow-up study with this same group of parents when the child is in high school to review their perceived roles using the Revised Parental Involvement Questionnaire developed as an outcome of this study;
4 A comparative study into the perceived roles of parents who have a child with a learning difficulty in mathematics.

Recommendations for Teacher/school Support

From this study, there is little indication from the parents that they are regularly kept up-to-date with current approaches to teaching of mathematics in primary schools. Also, as parents with a child who has a learning difficulty, their knowledge of their child's level of achievement was not highlighted. To engage parents with both of these, the researcher makes the following recommendations with regard to teacher/school support:

1. Opportunities are provided for teachers to engage more regularly with parents in regards to their child's mathematical achievements and challenges;

2. Opportunities are provided to introduce parents to the current classroom practices for teaching and learning mathematics;
3. Opportunities are provided to engage with parents in identifying relevant at-home tasks for their child;
4. A study to investigate the question "How does home-based parental involvement make a difference to achievement in mathematics for children with Down syndrome?"

Conclusion

This chapter has presented a summary of the study which involved parents who have a child with Down syndrome. Both fathers and mothers were involved in this study that related to their perceived roles in supporting the development of early mathematical concepts for their child. The findings from the analysis of the quantitative and quantitative data were presented to answer the research questions. The Interconnected Model and the Revised Parental Involvement Questionnaire have emerged directly from the undertaking of this study. The limitations of the study have been identified with respect to the participants, the methodology and the researcher. Recommendations have been made regarding the possible directions of future research in this field and also to certain identified processes for further engagement to support the parents.

APPENDIX 1: SURVEY 1: Cai (2003) Parental Involvement Questionnaire

Response format: 1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree				
Motivator				
When my child says he/she is having trouble learning mathematics, I tell him/her not to worry about it because everybody has problems with mathematics.	1	2	3	4
At home, I encourage my child to work hard on mathematics problems, even though the problems are difficult.	1	2	3	4
I am usually able to motivate my child to learn maths well	1	2	3	4
Mathematics plays an important role in my child's future.	1	2	3	4
I don't know how to motivate my child to do a good job on his/her mathematics assignments	1	2	3	4
Resource Provider				
I try hard to have a nice learning environment at home for my child to do mathematics.	1	2	3	4
I often take my child to the public library.	1	2	3	4
I often buy mathematics related books for my child.	1	2	3	4
At our house, we have a variety of games and puzzles that encourage the development of my child's mathematical skills.	1	2	3	4
Monitor				
I check my child's homework regularly.	1	2	3	4
I seldom spend time talking with my child about his/her progress in mathematics.	1	2	3	4
At home, it is important for my child to keep a balance between mathematics and his/her other subjects.	1	2	3	4
I always try to monitor the amount of time my child spends on mathematics at home.	1	2	3	4
I am always aware of my child's mathematics requirements by checking notebooks, using leading line, or through phone calls to school.	1	2	3	4
Mathematics Content Advisor				
I feel I can help my child solve problems from mathematics class.	1	2	3	4
I think I know enough about algebra to help my child.	1	2	3	4
I often discuss with my child how mathematics is used in everyday life.	1	2	3	4
I make an effort to understand the mathematics my child is studying.	1	2	3	4
Mathematics Learning Counsellor				
I don’t know strategies for helping my child overcome weaknesses in mathematics.	1	2	3	4
I am aware of the approaches used to teach mathematics at my child's school.	1	2	3	4
I always try to figure out good approaches for helping my child learning different mathematics topics.	1	2	3	4
I understand my child's strengths and weaknesses in learning mathematics.	1	2	3	4
I try to match my expectations with my child's potential.	1	2	3	4

Survey 1: Parent Involvement Questionnaire

RESEARCH STUDY: Parents supporting primary school-age children with Down syndrome with their numeracy development

Parent's name: _____ Pseudonym: _____

Family Details:

PARENT	**AGE**	**20-30**	**31-40**	**41-50**	**>51**	**SEX**	**Male**	**Female**	**Region**	**Canberra**	**Sydney**
CHILD	**AGE**	**5-6**	**7-8**	**9-10**	**11-12**	**SEX**	**Male**	**Female**	**Sibling/s**	**Male**	**Female**

Parent's role:

Response Format: 1 = I strongly disagree; 2 = I disagree; 3 = I agree; 4 = I strongly agree.	
Mathematics plays an important wall in my child's future.	**1 2 3 4**
At our house, we have a variety of games and puzzles that encourage the development of my child's mathematical skills.	**1 2 3 4**
I often discussed with my child, are mathematics is used in everyday life.	**1 2 3 4**
When my child says, he/she is having trouble learning mathematics, I tell him/her not to worry about it because everybody has problems with maths.	**1 2 3 4**
I often buy mathematics related books for my child.	**1 2 3 4**
I think I know enough about maths to help my child.	**1 2 3 4**
At home, I encourage my child to work hard on mathematics problems, even though the problems are difficult.	**1 2 3 4**
At home, it is important for my child to keep a balance between mathematics, and his/her other subjects.	**1 2 3 4**
I try to match my expectations with my child's potential.	**1 2 3 4**
I am usually able to motivate my child to learn mathematics well.	**1 2 3 4**
I check my child's homework regularly.	**1 2 3 4**
I am aware of the approach is used to teach mathematics at my child's school.	**1 2 3 4**
I don't know how to motivate my child to do a good job on his/her mathematics assignments.	**1 2 3 4**
I always try to monitor the amount of time my child spends on mathematics at home.	**1 2 3 4**
I always tried to figure out good approaches for helping my child learning different mathematics topics.	**1 2 3 4**
I try hard to have a nice learning environment at home for my child to do mathematics.	**1 2 3 4**
I don't know strategies for helping my child to overcome weaknesses in mathematics.	**1 2 3 4**
I seldom spend time talking with my child, about his/her progress in mathematics.	**1 2 3 4**
I often take my child to the public library.	**1 2 3 4**
I make an effort to understand the mathematics might child is studying.	**1 2 3 4**
I understand my child's strengths and weaknesses in learning mathematics.	**1 2 3 4**
I am always aware of my child's mathematics requirements by checking notebooks, using e-mails, or through phone calls to the school.	**1 2 3 4**

Other comments:

Questions organised in a random manner to collect data from Cai (2003) *Investigating parental roles in students' learning of mathematics from a cross-national perspective.*

Survey 1: Selected PIQ items – Phase 1 Responses

Selected PIQ items Pre-intervention	Response percentages				
	Strongly agree	Agree	Disagree	Strongly disagree	
Motivator	Overall agreement		Overall disagreement		
I am usually able to motivate my child to learn mathematics well	8%	63%	30%	0%	Parents
	71%		30%		
	6%	66%	26%	0%	Mothers
	72%		26%		
	11%	55%	33%	0%	Fathers
	66%		33%		
Resource Provider					
I try hard to have a nice learning environment at home for my child to do mathematics.	21%	66%	4%	0%	Parents
	87%		4%		
	26%	60%	6%	0%	Mothers
	86%		6%		
	11%	78%	0%	0%	Fathers
	89%		0%		
I often buy mathematics – related books for my child.	8%	49%	33%	13%	Parents
	57%		46%		
	6%	60%	33%	13%	Mothers
	66%		46%		
	11%	22%	33%	11%	Fathers
	33%		44%		
Monitor					
I check my child's homework regularly.	42%	38%	21%	0%	Parents
	80%		21%		
	53%	33%	13%	0%	Mothers
	86%		13%		
	22%	44%	33%	0%	Fathers
	66%		33%		
Mathematics Content Advisor					
I often discuss with my child how mathematics is used in everyday life.	13%	50%	30%	8%	Parents
	63%		38%		
	20%	40%	33%	6%	Mothers
	60%		39%		
	0%	66%	22%	11%	Fathers
	66%		33%		
I think I know enough about mathematics to help my child.	33%	33%	25%	8%	Parents
	66%		33%		
	20%	33%	40%	6%	Mothers
	56%		46%		
	55%	33%	0%	11%	Fathers
	88%		11%		
Mathematics Learning Counsellor					
I understand my child's strengths and weaknesses in learning mathematics.	8%	42%	33%	8%	Parents
	50%		41%		
	13%	40%	26%	13%	Mothers
	53%		39%		
	0%	44%	44%	0%	Fathers
	44%		44%		
I try to match my expectations with my child's potential.	38%	49%	16%	0%	Parents
	87%		16%		
	53%	40%	6%	0%	Mothers
	93%		6%		
	11%	55%	33%	0%	Fathers
	66%		33%		

Survey 1: Phase 1 and Phase 2 Group Results

Group of Parents	**Motivator** Max 20	**Resource Provider** Max 16	**Monitor** Max 20	**Content Advisor** Max 16	**Learning Counsellor** Max 20
Parents - pre	12.7	11.0	13.5	13.0	14
	63.5%	68.7%	67.5%	81.2%	70%
Parents - post	13.2	10.1	12.0	12.5	13.7
	66%	42.9%	60%	78.1%	68.5%

Survey 1: Phase 1 and Phase 2 Individual Parent Responses

Response format: 1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree

Motivator:
Defined: Parents provide emotional support for child's learning

	Parent 1 Female		**Parent 2 Female**		**Parent 3 Male**		**Parent 4 Male**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
When my child says he/she is having trouble learning mathematics, I tell him/her not to worry about it because everybody has problems with mathematics.	1	1	1	2	2	3	2	2
At home, I encourage my child to work hard on mathematics problems, even though the problems are difficult.	2	2	3	3	2	2	3	3
I am usually able to motivate my child to learn maths well	3	3	3	2	2	2	3	3
Mathematics plays an important role in my child's future.	4	4	4	4	3	3	4	4
I don't know how to motivate my child to do a good job on his/her mathematics assignments	2	2	3	3	2	2	2	3

Resource provider
Defined: Parents play the role of resource provider at home, by providing an appropriate place to study, relevant resources and opportunities.

	Parent 1 Female		**Parent 2 Female**		**Parent 3 Male**		**Parent 4 Male**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
I try hard to have a nice learning environment at home for my child to do mathematics.	3	3	4	2	3	3	3	3
I often take my child to the public library.	2	1	1	1	2	2	3	3
I often buy mathematics related books for my child.	2	2	2	2	2	3	4	4
At our house, we have a variety of games and puzzles that encourage the development of my child's mathematical skills.	2	2	4	3	3	3	4	4

Monitor **Defined: Parents monitor their child's learning and progress at home.**								
	Parent 1 Female		**Parent 2 Female**		**Parent 3 Male**		**Parent 4 Male**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
I check my child's homework regularly.	2	3	4	3	3	3	3	3
I seldom spend time talking with my child about his/her progress in mathematics.	3	2	3	3	2	3	2	3
At home, it is important for my child to keep a balance between mathematics and his/her other subjects.	3	3	4	3	3	3	3	3
I always try to monitor the amount of time my child spends on mathematics at home.	2	2	4	2	2	2	2	2
I am always aware of my child's mathematics requirements by checking notebooks, using leading line, or through phone calls to school.	2	2	2	1	2	1	3	3
Mathematics Content Advisor **Defined: Parents provide advice to their child on mathematics content.**								
	Parent 1 Female		**Parent 2 Female**		**Parent 3 Male**		**Parent 4 Male**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
I feel I can help my child solve problems from mathematics class.	3	3	3	3	3	2	4	4
I think I know enough about maths to help my child.	3	3	4	3	3	3	4	4
I often discuss with my child how mathematics is used in everyday life.	2	4	4	3	3	3	3	4
I make an effort to understand the mathematics my child is studying.	3	3	3	2	3	2	4	4
Mathematics Learning Counsellor **Defined: Parents understand their child's current situation, learning difficulties, potential, needs and demands, and provide appropriate support to help their child overcome learning difficulties.**								
	Parent 1 Female		**Parent 2 Female**		**Parent 3 Male**		**Parent 4 Male**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
I don't know strategies for helping my child overcome weaknesses in mathematics.	3	2	3	3	2	2	2	2
I am aware of the approaches used to teach mathematics at my child's school.	2	2	2	3	3	3	3	3
I always try to figure out good approaches for helping my child learning different mathematics topics.	3	3	4	3	3	3	3	3
I understand my child's strengths and weaknesses in learning mathematics.	2	3	2	3	2	2	3	3

I try to match my expectations with my child's potential.	3	3	4	2	3	3	4	4

APPENDIX 2: SURVEY 2: Parent Involvement: Model Revision through Scale Development

Walker, J. M. T., Wilkins, A. S., Dallaire, J. R., Sandler, H. M., & Hoover-Dempsey, K. V. (2005).

A. **PARENTAL ROLE CONSTRUCTION FOR INVOLVEMENT IN THE CHILD'S EDUCATION**

1 = I disagree very strongly; 2 = I disagree; 3 = I disagree just a little; 4 = I agree just a little; 5 = I agree; 6 = I agree very strongly

Part 1: Role Activity Beliefs. I believe that it is my responsibility to…

1. Volunteer at the school	1 2 3 4 5 6
2. Communicate with my child's teacher regularly	1 2 3 4 5 6
3. Help my child with homework	1 2 3 4 5 6
4. Make sure the school has what it needs	1 2 3 4 5 6
5. Support decisions made by the teacher	1 2 3 4 5 6
6. Stay on top of things at school	1 2 3 4 5 6
7. Explain tough assignments to my child	1 2 3 4 5 6
8. Talk with other parents from my child's school	1 2 3 4 5 6
9. Make the school better	1 2 3 4 5 6
10. Talk with a child about the school day	1 2 3 4 5 6

Part 2: Valence toward school

People have different feelings about school.
Please mark the number on each line below that best describes your feelings about your school experiences **when you were a student.**

My school:	disliked	1 2 3 4 5 6	liked
My teachers were	mean	1 2 3 4 5 6	very nice
My teachers	ignored me	1 2 3 4 5 6	cared about me
My school experience:	bad	1 2 3 4 5 6	good
I felt like	an outsider	1 2 3 4 5 6	I belonged
My overall experience:	failure	1 2 3 4 5 6	success

B. **PARENTAL SELF-EFFICACY FOR HELPING THE CHILD SUCCEED IN SCHOOL**

Please indicate how much you AGREE or DISAGREE with each of the following statements. Please think about *your current school year* as you consider each statement.
Response format: **1 = I disagree very strongly; 2 = I disagree; 3 = I disagree just a little; 4 = I agree just a little; 5 = I agree; 6 = I agree very strongly**

1. I know how to help my child do well in school	1 2 3 4 5 6
2. I know if I am getting through to my child	1 2 3 4 5 6
3. I know how to help my child get good grades in school	1 2 3 4 5 6
4. I feel successful about my efforts to help my child to learn	

	1 2 3 4 5 6
5. Other children have more influence on my child's grades than I do	1 2 3 4 5 6
6. I don't know how to help my child learn	1 2 3 4 5 6
7. I make a significant difference in my child's school performance	1 2 3 4 5 6
C. **PARENTS' PERCEPTIONS OF GENERAL INVITATIONS FOR INVOLVEMENT FROM THE SCHOOL**	
Please indicate how much you AGREE or DISAGREE with each of the following statements. Please think about *your current school year* as you consider each statement. Response format: **1 = I disagree very strongly; 2 = I disagree; 3 = I disagree just a little; 4 = I agree just a little; 5 = I agree; 6 = I agree very strongly**	
1. Teachers at the school are interested and cooperative when they discuss the child	1 2 3 4 5 6
2. I feel welcome at the school	1 2 3 4 5 6
3. Parent activities are scheduled at this school so that I can attend	1 2 3 4 5 6
4. This school lets me know about meetings and special school events	1 2 3 4 5 6
5. This school's staff contacts me promptly about any problems involving my child	1 2 3 4 5 6
6. The teachers at this school, keep me informed about my child's progress in school	1 2 3 4 5 6
D. **PARENTS' PERCEPTIONS OF SPECIFIC INVITATIONS FOR INVOLVEMENT FROM THE CHILD**	
Please indicate HOW OFTEN the following have happened SINCE THE BEGINNING OF THIS SCHOOL YEAR Response format: **1 = never; 2 = 1 or 2 times; 3 = 4 or 5 times; 4 = once a week; 5 = a few times a week; 6 = daily**	
1. My child asked me to help explain something about his or her homework	1 2 3 4 5 6
2. My child was asked me to supervise his or her homework	1 2 3 4 5 6
3. My child talks with me about the school day	1 2 3 4 5 6
4. My child asked me to attend a special event at school	1 2 3 4 5 6
5. My child asked me to help out at the school	1 2 3 4 5 6
6. My child asked me to talk with his or her teacher	1 2 3 4 5 6
E**. PARENTS' PERCEPTIONS OF SPECIFIC INVIVATIONS FOR INVOLVEMENT FROM THE TEACHER**	
Please indicate HOW OFTEN the following have happened SINCE THE BEGINNING OF THIS SCHOOL YEAR Response format: **1 = never; 2 = 1 or 2 times; 3 = 4 or 5 times; 4 = once a week; 5 = a few times a week; 6 = daily**	
1. My child's teacher asked me or expected me to help my child, with homework	1 2 3 4 5 6
2. My child's teacher asked me or expected me to supervise my child's homework	1 2 3 4 5 6
3. My child's teacher asked me to talk with my child about the school day	1 2 3 4 5 6
4. My child's teacher asked me to attend a special event at school	

	1 2 3 4 5 6
5. My child's teacher asked me to help out at the school	1 2 3 4 5 6
6. My child's teacher contacted me, for example, sent a note, phoned, e-mail	1 2 3 4 5 6
F. **PARENTS' PERCEIVED LIFE CONTEXT**	
Please indicate how much you AGREE or DISAGREE with each of the following statements. Please think about *your current school year* as you consider each statement. **1 = I disagree very strongly; 2 = I disagree; 3 = I disagree just a little; 4 = I agree just a little; 5 = I agree; 6 = I agree very strongly** **Part 1: Time and energy: I have enough time and energy to ….**	
1. Communicate effectively with my child about the school day	1 2 3 4 5 6
2. Help out at my child's school	1 2 3 4 5 6
3. Communicate effectively with my child's teacher	1 2 3 4 5 6
4. Attend special events at school	1 2 3 4 5 6
5. Help my child with homework	1 2 3 4 5 6
6. Supervise my child's homework	1 2 3 4 5 6
7. Explain tough assignments to my child	1 2 3 4 5 6
F. **PARENTS' PERCEIVED LIFE CONTEXT** **1 = I disagree very strongly; 2 = I disagree; 3 = I disagree just a little; 4 = I agree just a little; 5 = I agree; 6 = I agree very strongly** **Part 2: Knowledge and Skills**	
1. I know about volunteering opportunities at my child's school	1 2 3 4 5 6
2. I know about special events at my child's school	1 2 3 4 5 6
3. I know effective ways to contact my child's teacher	1 2 3 4 5 6
4. I know how to communicate effectively with my child about the school day	1 2 3 4 5 6
5. I know how to explain things to my child about his or her homework	1 2 3 4 5 6
6. I know enough about the subjects of my child's homework to help him or her	1 2 3 4 5 6
7. I know how to communicate effectively with my child's teacher	1 2 3 4 5 6
8. I know how to supervise my child's homework	1 2 3 4 5 6
9. I have the skills to help out at my child's school.	1 2 3 4 5 6
G. PARENTS' INVOLVEMENT IN HOME-BASED AND SCHOOL BASED ACTIVITIES	
Families do many different things when they are involved in their children's education. We would like to know how true the following statements are for your family. Think about ***your current school year*** as you consider each statement. **1 = never; 2 = 1 or 2 times; 3 = 4 or 5 times; 4 = once a week; 5 = a few times a week; 6 = daily** **Part 1: Home-Based Involvement** **Someone in the family ….**	

1. Talks with the child about the school day	1 2 3 4 5 6
2. Supervises this child's homework	1 2 3 4 5 6
3. Helps this child study for tests	1 2 3 4 5 6
4. Practises spelling, maths, or other skills with this child	1 2 3 4 5 6
5. Reads with this child	1 2 3 4 5 6
Part 2: School-Based Involvement	
1. Helps out at this child's school	1 2 3 4 5 6
2. Attends special events at school	1 2 3 4 5 6
3. Volunteers to go on class field trips	1 2 3 4 5 6
4. Attends PTA meetings	1 2 3 4 5 6
5. Goes to the school's open house.	1 2 3 4 5 6

Survey 2: Phase 1 & Phase 2 Responses for Group/Individual Parents

A. **PARENTAL ROLE CONSTRUCTION FOR INVOLVEMENT IN THE CHILD'S EDUCATION**												
Part 1: Role Activity Beliefs.				MA4		MA9		FA4		FA9		
I believe that it is my responsibility to..				Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Volunteer at the school				3	**3**	3	**3**	3	**3**	3	**3**	
Communicate with my child's teacher regularly				3	**4**	3	**3**	3	**3**	3	**3**	
Help my child with homework				4	**4**	3	**3**	3	**3**	3	**3**	
Make sure the school has what it needs				3	**4**	3	**2**	3	**3**	3	**3**	
Support decisions made by the teacher				4	**4**	3	**3**	3	**3**	3	**3**	
Stay on top of things at school				3	**4**	3	**3**	3	**3**	3	**3**	
Explain tough assignments to my child				4	**3**	3	**3**	3	**3**	3	**3**	
Talk with other parents from my child's school				3	**3**	3	**2**	2	**3**	3	**2**	
Make the school better				3	**3**	3	**3**	2	**3**	3	**3**	
Talk with a child about the school day				4	**4**	3	**3**	2	**3**	3	**3**	
121	76%	123	77%	34	**36**	30	**28**	27	**30**	30	**29**	
Part 2: Valence toward school												
People have different feelings about school.												

Please mark the number on each line below that best describes **your feelings** about your school experiences of mathematics when you were a student.												
			MA4		MA9		FA4		FA9		
			Pre	Post	Pre	Post	Pre	Post	Pre	Post	
My maths class	I disliked it		4	**4**	2	**1**	4	**4**	4	**4**	I liked it
My maths teachers were	mean		4	**4**	3	**4**	4	**4**	4	**4**	very nice
My maths teachers	ignored me		4	**4**	2	**2**	3	**3**	4	**4**	cared about me
My school maths experiences were	bad		4	**4**	2	**2**	3	**4**	4	**4**	good
I felt like	an outsider		4	**4**	2	**2**	3	**3**	4	**4**	I belonged
My overall maths experience was	a failure		4	**4**	2	**4**	3	**3**	4	**4**	a success
81	84%	84	87%	24	**24**	13	**15**	20	**21**	24	**24**	

B. **PARENTAL SELF-EFFACACY FOR HELPING THE CHILD SUCCEED IN SCHOOL**								
Please think about ***your child's current school year*** as you consider each statement.	MA4		MA9		FA4		FA9	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
I know how to help my child do well in school	3	**3**	3	**3**	3	**2**	3	**3**
I know if I am getting through to my child	3	**4**	3	**3**	2	**2**	3	**3**
I know how to help my child get good grades in school	3	**3**	3	**3**	2	**2**	3	**3**
I feel successful about my efforts to help my child to learn	2	**2**	3	**2**	2	**2**	3	**2**
Other children have more influence on my child's grades than I do	2	**2**	2	**3**	2	**2**	2	**3**
I don't know how to help my child learn maths	2	**2**	3	**2**	2	**3**	3	**2**
I make a significant difference in my child's school performance	3	**2**	3	**2**	2	**2**	3	**2**
75 67% 69 62%	18	**18**	20	**18**	15	**15**	20	**18**

C. PARENTS' PERCEPTIONS OF GENERAL INVITATIONS FOR INVOLVEMENT FROM THE SCHOOL								
Please think about ***your child's current school year*** as you consider each statement.	MA4		MA9		FA4		FA9	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Teachers are interested and cooperative when they discuss my child	4	**4**	3	**4**	3	**3**	4	**3**
I feel welcome at the school	4	**4**	3	**4**	3	**3**	4	**3**
Parent activities are scheduled at this school so that I can attend	4	**2**	3	**4**	3	**2**	4	**3**
This school lets me know about meetings and special school events	3	**3**	3	**4**	3	**3**	4	**3**
This school's staff contacts me promptly about any problems involving my child	3	**3**	3	**4**	3	**2**	4	**3**

The teachers at this school keep me informed about my child's progress				4	**4**	3	**4**	3	**3**	4	**3**
82	85%	78	81%	22	**20**	18	**24**	18	**16**	24	**18**
E. PARENTS' PERCEPTIONS OF SPECIFIC INVITATIONS FOR INVOLVEMENT FROM THE TEACHER											
Please indicate **HOW OFTEN** the following have happened **SINCE THE BEGINNING OF THIS SCHOOL YEAR my child's teacher:**				MA4		MA9		FA4		FA9	
				Pre	Post	Pre	Post	Pre	Post	Pre	Post
Asked me or expected me to help my child with homework				1	**4**	2	**4**	1	**1**	1	**4**
Asked me or expected me to supervise my child's homework				1	**4**	2	**4**	1	**1**	1	**4**
Asked me to talk with my child about the school day				1	**1**	2	**1**	1	**1**	1	**1**
Asked me to attend a special event at school				4	**1**	2	**2**	1	**1**	4	**1**
Asked me to help out at the school				1	**1**	2	**1**	2	**1**	1	**1**
Contacted me, for example, sent a note, phoned, e-mail				4	**3**	3	**2**	2	**1**	4	**3**
45	47%	48	50%	12	**14**	13	**14**	8	**6**	12	**14**
F. PARENTS' PERCEIVED LIFE CONTEXT											
Please think about ***your child's current school year*** as you consider each statement.											
Part 1: Time and energy				MA4		MA9		FA4		FA9	
I have enough time and energy to ….				Pre	Post	Pre	Post	Pre	Post	Pre	Post
Communicate effectively with my child about the school day				3	**4**	2	**4**	3	**3**	3	**4**
Help out at my child's school				2	**2**	2	**3**	2	**3**	2	**2**
Communicate effectively with my child's teacher				3	**3**	3	**3**	3	**2**	3	**3**
Attend special events at school				3	**2**	3	**3**	3	**3**	3	**2**
Help my child with homework				3	**3**	3	**3**	2	**3**	3	**3**
Supervise my child's homework				3	**3**	3	**3**	2	**3**	3	**3**
Explain tough assignments to my child				3	**2**	3	**3**	2	**2**	3	**2**
76	68%	79	70%	20	**19**	19	**22**	17	**19**	20	**19**
Part 2: Knowledge and Skills				MA4		MA9		FA4		FA9	
I know:				Pre	Post	Pre	Post	Pre	Post	Pre	Post
About volunteering opportunities at my child's school				2	**3**	3	**3**	2	**3**	3	**3**
About special events at my child's school				3	**3**	3	**3**	2	**3**	3	**3**
Effective ways to contact my child's teacher				3	**4**	3	**3**	2	**2**	3	**3**
How to communicate effectively with my child about the school day				3	**4**	2	**3**	2	**3**	2	**3**
How to explain things to my child about his or her homework				3	**3**	3	**3**	2	**2**	3	**3**
Enough about the subjects of my child's homework to help him/her				3	**3**	3	**3**	2	**2**	3	**3**

How to communicate effectively with my child's teacher				3	**4**	3	**3**	2	**2**	3	**3**		
How to supervise my child's homework				3	**3**	3	**3**	2	**3**	3	**3**		
I have the skills to help out at my child's school.				3	**3**	3	**3**	2	**3**	3	**3**		
96	67%	107	74%	26	**30**	26	**27**	18	**23**	26	**27**		
G. **PARENTS' INVOLVEMENT IN HOME-BASED AND SCHOOL BASED ACTIVITIES**													
Think about ***your child's current school year*** as you consider each statement. Response format: 1 = not at all; 2 = one or two times per week; 3 = three times a week; 4 = daily													
Part 1: Home-Based Involvement				MA4		MA9		FA4		FA9			
Someone in the family ….				Pre	Post	Pre	Post	Pre	Post	Pre	Post		
Talks with the child about the school day				4	**4**	3	**4**	4	**4**	3	**4**		
Supervises this child's homework				1	**4**	3	**4**	4	**4**	3	**4**		
Helps this child study for tests				1	**X**	3	**1**	4	**1**	3	**1**		
Practices, spelling, maths, or other skills with this child				4	**X**	3	**4**	4	**4**	3	**4**		
Reads with this child				4	**4**	3	**4**	4	**4**	3	**4**		
64	80%	63	79%	14	**12**	15	**17**	20	**17**	15	**17**		
Part 2: School-Based Involvement				MA4		MA9		FA4		FA9			
Someone in the family…				Pre	Post	Pre	Post	Pre	Post	Pre	Post		
Helps out at this child's school				4	**1**	2	**2**	1	**2**	2	**2**		
Attends special events at school				4	**2**	3	**2**	2	**2**	3	**2**		
Volunteers to go on class field trips				4	**1**	2	**1**	1	**1**	2	**1**		
Attends PTA meetings				1	**1**	3	**2**	2	**1**	3	**2**		
Goes to the school's open house.				1	**2**	3	**1**	1	**2**	3	**1**		
47	59%	31	39%	14	**7**	13	**8**	7	**8**	13	**8**		

APPENDIX 3: SURVEY 3: Mathematics Activities At Home

Survey 3: Frequency of Mathematics Activities in Numeracy Development

1 = not at all; 2 = one or two times per week; 3 = 3 to 5 times a week; 4 = six more times per week				
CHILD & PARENT ACTIVITIES	**RATING**			
1. Use the words 'one', 'two' or 'three' with your child.	**1**	**2**	**3**	**4**
2. Encouraged your child to count.	**1**	**2**	**3**	**4**
3. Encourage your child to group objects. For example 'Put all the red ones here.'	**1**	**2**	**3**	**4**
4. Ask your child to order objects from smallest to biggest or from biggest to smallest.	**1**	**2**	**3**	**4**
5. Encouraged matching. For example, 'Give everyone one biscuit.'	**1**	**2**	**3**	**4**
6. Used any of the following words with your child: four, five, six, seven, eight, nine or ten.	**1**	**2**	**3**	**4**
7. Use the concept of 'more' with your child. For example, 'Billy has more marbles than you.'	**1**	**2**	**3**	**4**
8. Use the concept of least with your child. For example, 'I have less cake than you.'	**1**	**2**	**3**	**4**
9. Use the concept 'same number' with your child. For example, 'You have the same number of dolls as Becky.'	**1**	**2**	**3**	**4**
10. Mentioned a number fact to your child. For example, ' 1 + 1 = 2, or 3 – 1 = 2	**1**	**2**	**3**	**4**
11. Used any of the following words with your child: eleven, twelve, thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen	**1**	**2**	**3**	**4**
12. Encouraged your child to write numbers.	**1**	**2**	**3**	**4**
13. Praised your child for using numbers. For example, 'That's right, 2 +2 equals 4' or 'Very good, you ***do*** have three blocks.'	**1**	**2**	**3**	**4**
14. Discuss number values with your child. For example, 'Seven is more than three.'	**1**	**2**	**3**	**4**
15. Show at your child how to current objects. For example, 'See, there are 3: 1, 2, 3.' (pointing to objects while counting)	**1**	**2**	**3**	**4**
16. Recited the numbers 1 to 10 for your child.	**1**	**2**	**3**	**4**
17. Sang a number song to with your child.	**1**	**2**	**3**	**4**
18. Told your child about the value of money. For example, 'A dollar is worth more than 20 cents.'	**1**	**2**	**3**	**4**
19. Worked with your child on recognising written numbers.	**1**	**2**	**3**	**4**
20. Try to teach your child how to recite the numbers in order. For example, telling your child. 'One, two, three, four, five …'	**1**	**2**	**3**	**4**

'Number use at home by children and their parents and its relationship to early mathematical performance' Sherri-Lyn Skwarchuk (2009) from Belinda Blevins - Knabe and Linda Musun-Miller (1998)

Survey 3:

Relative Importance of These Mathematics Activities in Numeracy Development

0 = Do not know; 1 = not important; 2 = slightly important; 3 = Important; 4 = Very important; 5 = Essential						
CHILD & PARENT ACTIVITIES	**RATING**					
1. Use the words 'one', 'two' or 'three' with your child.	**0**	**1**	**2**	**3**	**4**	**5**
2. Encouraged your child to count.	**0**	**1**	**2**	**3**	**4**	**5**
3. Encourage your child to group objects. For example 'Put all the red ones here.'	**0**	**1**	**2**	**3**	**4**	**5**
4. Ask your child to order objects from smallest to biggest or from biggest to smallest.	**0**	**1**	**2**	**3**	**4**	**5**
5. Encouraged matching. For example, 'Give everyone one biscuit.'	**0**	**1**	**2**	**3**	**4**	**5**
6. Used any of the following words with your child: four, five, six, seven, eight, nine or ten.	**0**	**1**	**2**	**3**	**4**	**5**
7. Use the concept of 'more' with your child. For example, 'Billy has more marbles than you.'	**0**	**1**	**2**	**3**	**4**	**5**
8. Use the concept of least with your child. For example, 'I have less cake than you.'	**0**	**1**	**2**	**3**	**4**	**5**
9. Use the concept 'same number' with your child. For example, 'You have the same number of dolls as Becky.'	**0**	**1**	**2**	**3**	**4**	**5**
10. Mentioned a number fact to your child. For example, ' 1 + 1 = 2, or 3 – 1 = 2	**0**	**1**	**2**	**3**	**4**	**5**
11. Used any of the following words with your child: eleven, twelve, thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen	**0**	**1**	**2**	**3**	**4**	**5**
12. Encouraged your child to write numbers.	**0**	**1**	**2**	**3**	**4**	**5**
13. Praised your child for using numbers. For example, 'That's right, 2 +2 equals 4,' or 'Very good, you ***do*** have three blocks.'	**0**	**1**	**2**	**3**	**4**	**5**
14. Discuss number values with your child. For example, 'Seven is more than three.'	**0**	**1**	**2**	**3**	**4**	**5**
15. Show at your child how to current objects. For example, 'See, there are 3: 1, 2, 3.' (pointing to objects while counting)	**0**	**1**	**2**	**3**	**4**	**5**
16. Recited the numbers 1 to 10 for your child.	**0**	**1**	**2**	**3**	**4**	**5**
17. Sang a number song to with your child.	**0**	**1**	**2**	**3**	**4**	**5**
18. Told your child about the value of money. For example, 'A dollar is worth more than 20 cents.'	**0**	**1**	**2**	**3**	**4**	**5**
19. Worked with your child on recognising written numbers.	**0**	**1**	**2**	**3**	**4**	**5**
20. Try to teach your child how to recite the numbers in order. For example, telling your child. 'One, two, three, four, five …'	**0**	**1**	**2**	**3**	**4**	**5**
21. Other activity/ies:	**0**	**1**	**2**	**3**	**4**	**5**

Survey 3: Importance and Frequency of Mathematical Activities: Phase 1 responses

	FREQ	IMPORT
CHILD & PARENT ACTIVITIES	**%**	**%**
1. Use the words 'one', 'two' or 'three' with your child.	**98%**	**94%**
2. Encouraged your child to count.	**92%**	**99%**
3. Encourage your child to group objects. For example 'Put all the red ones here.'	**58%**	**91%**
4. Ask your child to order objects from smallest to biggest or from biggest to smallest.	**53%**	**80%**
5. Encouraged matching. For example, 'Give everyone one biscuit.'	**72%**	**85%**
6. Used any of the following words with your child: four, five, six, seven, eight, nine or ten.	**88%**	**92%**
7. Use the concept of 'more' with your child. For example, 'Billy has more marbles than you.'	**75%**	**80%**
8. Use the concept of least with your child. For example, 'I have less cake than you.'	**52%**	**81%**
9. Use the concept 'same number' with your child. For example, 'You have the same number of dolls as Becky.'	**68%**	**71%**
10. Mentioned a number fact to your child. For example, ' 1 + 1 = 2, or 3 – 1 = 2	**63%**	**77%**
11. Used any of the following words with your child: eleven, twelve, thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen	**45%**	**85%**
12. Encouraged your child to write numbers.	**52%**	**81%**
13. Praised your child for using numbers. For example, 'That's right, 2 +2 equals 4' or 'Very good, you ***do*** have three blocks.'	**70%**	**91%**
14. Discuss number values with your child. For example, 'Seven is more than three.'	**47%**	**87%**
15. Show at your child how to count objects. For example, 'See, there are 3: 1, 2, 3.' (pointing to objects while counting)	**72%**	**90%**
16. Recited the numbers 1 to 10 for your child.	**75%**	**89%**
17. Sang a number song to with your child.	**42%**	**75%**
18. Told your child about the value of money. For example, 'A dollar is worth more than 20 cents.'	**50%**	**79%**
19. Worked with your child on recognising written numbers.	**47%**	**90%**
20. Try to teach your child how to recite the numbers in order. For example, telling your child. 'One, two, three, four, five …'	**75%**	**86%**

Survey 3: Selected Topics Phase 1 and Phase 2 Parent Responses

Selected Topics	IMPORTANCE - FREQUENCY	IMPORTANCE - FREQUENCY
CHILD & PARENT ACTIVITIES	Pre-Intervention	Post-Intervention
Counting	90% - 84%	80% - 62%
Words – Oral Rote Counting	89% - 87%	69% - 69%
Comparison	69% - 56%	79% - 59%

Survey 3: Individual Parent Responses

IMPORTANCE: 0 = do not know; 1= not important; 2 = slightly important; 3 = important; 4 = very important; 5 = essential.
FREUQUENCY: 1 = not at all; 2 = 1-2 per week; 3 = 3-5 per week; 4 = 6 or more per week

Responses		IMPORTANCE - FREQUENCY				IMPORTANCE - FREQUENCY			
CHILD & PARENT ACTIVITIES	Aspect	Pre-Intervention				Post-Intervention			
		MO4	MO9	FA4	FA9	MO4	MO9	FA4	FA9
1. Use the words 'one', 'two' or 'three' with your child.	Rote	5-4	5-4	3-4	4-4	5-4	4-4	3-2	5-4
2. Encouraged your child to count.	Rote	5-4	5-3	3-4	5-4	5-2	4-4	3-2	5-3
3. Encourage your child to group objects. For example 'Put all the red ones here.'	Group	0-2	5-2	3-2	3-2	3-1	4-2	3-1	5-3
4. Ask your child to order objects from smallest to biggest or from biggest to smallest.	Order	3-2	5-2	3-2	3-1	3-1	4-2	3-1	3-3
5. Encourage matching. For example, 'Give everyone a biscuit.'	Match	4-3	5-3	3-2	3-1	3-2	4-2	3--21	4-3
6. Used any of the following words with your child: four, five, six, seven, eight, nine or ten.	Rote	5-4	5-1	3-4	4-4	4-3	4-2	2-2	5-4
7. Use the concept of 'more' with your child. For example, 'Billy has more marbles than you.'	Compare	-4	5-3	3-2	2-2	4-3	4-3	3-2	5-3
8. Use the concept of least with your child. For example, 'I have less cake than you.'	Compare	3-2	5-1	3-3	3-2	4-2	4-3	3-2	5-3
9. Use the concept 'same number' with your child. For example, 'You have the same number of dolls as Becky.'	Compare	3-3	5-3	3-4	3-2	4-2	4-2	3-2	5-3
10. Mentioned a number fact to your child. For example, '1 + 1 = 2, or 3 – 1 = 2	Fact	3-3	5-1	3-2	4-4	3-2	4-1	3-2	3-2
11. Used any of the following words with your child: eleven, twelve,	Rote	5-3	5-1	4-4	5-4	4-2	4-3	-2	3-2

thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen									
12. Encouraged your child to write numbers.	**Write**	**5-3**	**5-1**	**4-2**	**3-3**	**4-2**	**4-1**	**3-1**	**3-2**
13. Praised your child for using numbers. For example, 'That's right, 2 + 2 equals 4', or 'Very good, you have three blocks"	**Fact**	**4-3**	**5-3**	**4-2**	**4-2**	**4-2**	**4-1**	**3-1**	**5-3**
14. Discuss number values with your child. For example, 'Seven is more than three.'	**Compare**	**4-2**	**5-1**	**4-1**	**4-1**	**4-2**	**42**	**3-1**	**4-3**
15. Show at your child how to count objects. For example, 'See, there are 3: 1, 2, 3.' (pointing to objects while counting)	**One-to-one**	**5-4**	**5-3**	**4-3**	**4-2**	**4-3**	**4-3**	**3-2**	**4-4**
16. Recited the numbers 1 to 10 for your child.	**Rote**	**5-3**	**5-4**	**4-4**	**4-4**	**5-3**	**4-3**	**3-2**	**4-3**
17. Sang a number song to with your child.	**Rote**	**4-**	**5-1**	**4-2**	**4-2**	**1-1**	**4-3**	**3-2**	**4-2**
18. Told your child about the value of money. For example, 'A dollar is worth more than 20 cents.'	**Money**	**4-2**	**5-1**	**3-1**	**4-3**	**5-3**	**4-2**	**3-1**	**4-2**
19. Worked with your child on recognising written numbers.	**Read**	**5-4**	**5-2**	**4-2**	**4-4**	**4-2**	**4-2**	**3-1**	**4-3**
20. Try to teach your child how to recite the numbers in order. For example, telling your child. 'One, two, three, four, five …'	**Rote**	**5-4**	**5-4**	**4-2**	**4-4**	**4-3**	**4-2**	**3-1**	**4-4**

APPENDIX 4: Parent Diaries

Sample Parent Diaries

Date	Time	Duration	Topic	What we did together	What did I think about it
21/5	1:30 PM	10	Adding up and counting up to 10 and backwards from 10 to 1	Counting up to 10 and backwards 10 to one. Showing 2+2 fingers, 2+ 1 finger, 2+3 fingers. Parent prompting with counting backwards – what comes before five? Ensuring fingers and asking how many there are.	Surprised that the child could just see the total of fingers without having to count them separately.
29/5	2 PM	30	Ordering numbers 1 to 10	Count Me in Too – Washing Line Game; put numbers in correct order by dragging them from bottom to top. Parent asking what comes after two? Where is 'three'?	Child wants to put numbers up in the same order as they are ready instead of the correct order.
30/5	7:48 AM	30	Playing with numbers and counting	Count Me in Too Website. Watching maths related DVDs, sang songs with numbers, washing line game 1 to 10. Parent prompting to get numbers in correct order	No point continuing on the child is not focused just not want to put numbers in the correct order.
30/5	3 PM	5	Counting	Counting ducks and swans in the park up to 20. Parent assisted with gaps.	Should count more often up to 20 instead of only up to 10.
17/8	5:30 PM	15	Driving	After picking him up from the school we talked about the various speed limits on the way home. Firstly we talked how this school limit on the applied to certain hours and then discussed whether we went faster or slower as we pass through various speed zones.	Showed the importance of numerical skills for everyday activities.
	8:15 AM	10	Driving	Driving the school again, we looked at speed limits. This time we connected the signs to the speedometer in the car. As the speedometer goes up in 20 K units, where in an odd number speed limit applied we had to look at the line halfway between the two numbers shown.	At this point he confused street numbers with the speed limit.

Diaries: Topics Directly Related To Survey 3

Adding	Comparison	Counting	Grouping	Matching	Money	Numbers
10, 13	4, 7, 8, 9, 14	1, 2, 6, 11, 15, 16, 20	3	5	18	12, 19

Diaries: Topics Linked to Australian Curriculum Mathematics

Foundation Year Level Description

The proficiency strands understanding, fluency, problem-solving and reasoning are an integral part of mathematics content across the three content strands: number and algebra, measurement and geometry, and statistics and probability. The proficiencies reinforce the significance of working mathematically within the content and describe how the content is explored or developed. They provide the language to build in the developmental aspects of the learning of mathematics. The achievement standards reflect the content and encompass the proficiencies.

At this year level:

- understanding includes connecting names, numerals and quantities
- fluency includes readily counting numbers in sequences, continuing patterns and comparing the lengths of objects
- problem-solving includes using materials to model authentic problems, sorting objects, using familiar counting sequences to solve unfamiliar problems and discussing the reasonableness of the answer
- reasoning includes explaining comparisons of quantities, creating patterns and explaining processes for indirect comparison of length.

Foundation Year Achievement Standard

By the end of the Foundation year, students make connections between number names, numerals and quantities up to 10. They compare objects using mass, length and capacity. Students connect events and the days of the week. They explain the order and duration of events. They use appropriate language to describe location.

Students count to and from 20 and order small collections. They group objects based on common characteristics and sort shapes and objects. Students answer simple questions to collect information and make simple inferences.

Australian Curriculum Mathematics Version 8

http://www.australiancurriculum.edu.au/mathematics/curriculum/f-10?layout=1

Frequency of Topics Identified by Parents in Diary 1

Numeral ID:	1-5 – 9; 6 -14 – 7	Number line –2	Missing number – 2	Teen/ty – 1
Counting:	Rote – 12	Items – 8	ICT – 4	Quantity – 19
Grouping –2	Tables – 3	Pairs – 7	Halves -2	
Ordering – 5	Sorting – 8	Comparison –11	Matching – 7	
Adding – 9	Subtracting – 4			
Literacy – 9	Maths Text – 1	Games – 18	Fine motor –2	
Shopping – 5	Money – 3	Driving: speed– 3	Clothes: size –3	Cooking –10
Time - 19	Patterns – 8	Measuring –2	Shapes – 1	

APPENDIX 5: Links between Statements in Survey 1 and Survey 2

Survey 1		Survey 2	
	Agree		Agree
MOTIVATOR			
2. At home, I encourage my child to work hard on mathematics problems, even though the problems are difficult.	**44%**	***Role Activity Beliefs*** *A7. Explain tough assignments to my child* ***Parents Perceived Life Context – time and energy*** *F7. Explain tough assignments to my child*	**None** **50%**
3. I am usually able to motivate my child to learn maths well	**53%**	***Parental Self-Efficacy for Helping the Child Succeed in School*** *B 4 I feel successful about my efforts to help my child to learn*	**48%**
4. Mathematics plays an important role in my child's future.	85%	***Blevins Knabe – frequency and relative importance***	
5. I don't know how to motivate my child to do a good job on his/her mathematics assignments	**20%**	***Parental Self-Efficacy for Helping the Child Succeed in School*** *B 6 I don't know how to help my child learn*	**20%**
RESOURCE PROVIDER			
7. I often take my child to the public library.	**33%**	***Parents involvement in home-based Activities*** *G 5 Reads with this child*	**95%**
MONITOR			
10. I check my child's homework regularly.	**70%**	***Role Activity Beliefs*** *A 3 Help my child with homework* ***Parents perceptions of specific invitations for involvement from the teacher*** *E 1 My child's teacher asked me or expected me to help my child, with homework* ***Parents perceptions of specific invitations for involvement from the teacher*** *E 2 My child's teacher asked me or expected me to supervise my child's homework* ***Parents Perceived Life Context – Knowledge and Skills*** *F 15 I know how to supervise my child's homework* ***Parents involvement in home-based Activities*** *G 2 Supervises this child's homework*	**91%** **41%** **39%** **69%** **69%**
11. I seldom spend time talking with my child about his/her progress in mathematics.	**32%**	***Role Activity Beliefs*** *A 10 Talk with a child about the school day* ***Parents Perceived Life Context – time and energy*** *F 1. Communicate effectively with my child about the school day* ***Parents Perceived Life Context – Knowledge and Skills*** *F 11 I know how to communicate effectively with my child about the school day* ***Parents involvement in home-based Activities*** *G 1 Talks with the child about the school day*	**86%** **45%** **50%** **94%**

13. I always try to monitor the amount of time my child spends on mathematics at home.	**34%**	***Parents Perceived Life Context – time and energy*** *F5. Help my child with homework* ***Parents Perceived Life Context – time and energy*** *F6. Supervise my child's homework* ***Parents involvement in home-based Activities*** *G 4 Practises spelling, maths, or other skills with this child*	**76%** **76%** **76%**
14. I am always aware of my child's mathematics requirements by checking notebooks, using learning line, or through phone calls to school.	**43%**	***Role Activity Beliefs*** *A1. 2 Communicate with my child's teacher regularly* ***Role Activity Beliefs*** *A1. 6 Stay on top of things at school* ***Parents perceptions of specific invitations for involvement from the teacher*** *E 6 My child's teacher contacted me, for example, sent a note, phoned, e-mail* ***Parents Perceived Life Context – time and energy*** *F3 Communicate effectively with my child's teacher* ***Parents Perceived Life Context – Knowledge and Skills*** *F10. I know effective ways to contact my child's teacher*	**92%** **76%** **37%** **58%** **72%**
MATHEMATICS CONTENT ADVISOR			
15. I feel I can help my child solve problems from mathematics class.	**68%**	***Parental Self-Efficacy for Helping the Child Succeed in School*** *B 2 I know if I am getting through to my child* ***Parental Self-Efficacy for Helping the Child Succeed in School*** *B 3 I know how to help my child get good grades in school*	 **22%** **34%**
16. I think I know enough about algebra to help my child.	**58%**	***Parental Self-Efficacy for Helping the Child Succeed in School*** *B 7 I make a significant difference in my child's school performance* ***Parents involvement in home-based Activities*** *G 3 Helps this child study for tests* *Knowledge and Skills* *F 13 I know enough about the subjects of my child's homework to help him/her*	**55%** **23%** **87%**
18. I make an effort to understand the mathematics my child is studying.	**69%**	***Parents involvement in home-based Activities*** *G 3 Helps this child study for tests*	**23%**
MATHEMATICS LEARNING COUNSELLOR			
19. I don't know strategies for helping my child overcome weaknesses in mathematics.	**34%**	***Parental Self-Efficacy for Helping the Child Succeed in School*** *B 6 I don't know how to help my child learn*	**20%**
20. I am aware of the approaches used to teach mathematics at my child's school.	**47%**	***Parents Perceived Life Context – Knowledge and Skills*** *F2. 6 I know enough about the subjects of my child's homework to help him or her*	**76%**
21. I always try to figure out good approaches for helping my child learning different mathematics topics.	**59%**	***Parental Self-Efficacy for Helping the Child Succeed in School*** *B 1 I know how to help my child do well in school*	**42%**

		Parents Perceived Life Context – Knowledge and Skills *F 12 I know how to explain things to my child about his or her homework*	**70%**
22. I understand my child's strengths and weaknesses in learning mathematics.	**40%**	***Parents perceptions of general invitations for involvement from the school*** *C 5 This school's staff contacts me promptly about any problems involving my child* ***Parents perceptions of general invitations for involvement from the school*** *C6 The teachers at this school, keep me informed about my child's progress in school*	**76%** **72%**

APPENDIX 6: Links between 5 Perceived Roles and other Data

Survey 1		Survey 2	Survey 3	Diaries	
Role	**Descriptor**	**Constructs / Descriptors**	**Importance / Frequency**	**Topics**	**Insights**
Motivator	Encourage Motivate	**A** Positive feelings; **B** Do well in school; Help my child learn mathematics; Don't know how to help		Linked to Survey 3	Motivation
Resource Provider	Learning environment Related resources Games	**A** Responsibility – role active beliefs		Counting Numerals Games Money Addition Time	Money Real life Time Free Play Independence
Monitor	Homework Talking to child Mathematics requirements	**A,E,F,G** Help with homework; **A** Talk with other parents; **C** Teacher invitations; kept informed; **G** Home-based activities **A, F, G** Talk to my child about school; **F** Time and energy to supervise homework; **G** Help at school.			Model Avoid correcting Rules Taking turns Adaptations
Mathematics Content Advisor	Solving problems Enough knowledge Mathematics in everyday life Child's mathematics	**A** Valence towards school; **B** Know enough to help; **F** Knowledge and skills; Explain things; Communicate effectively;	Counting Comparing Reading numerals Writing numerals	Counting Numerals Games Money Addition Time	
Mathematics Learning Counsellor	Strategies for helping School approaches Helping child Different topics Strengths and weaknesses	**B** Self efficacy; Successful efforts; Make a difference; Getting through to child; Making a significant difference; **E** Homework – Teacher asks; Talk about school day; **F** Time and energy – communicate effectively; Communicate with teacher.			Difficulties Successes Humour

APPENDIX 7: Randomised Revised Parental Involvement Questionnaire – Shellshear (2016)

Pseudonym:	**Date:**
Revised Parental Involvement Questionnaire – Shellshear (2016)	
Responses: 1 = I strongly disagree; 2 = I disagree; 3 = Neutral; 4 = I agree; 5 = I strongly agree	
When my child says he/she is having trouble learning mathematics, I tell him/her to do his/her best.	1 2 3 4 5
I always try to figure out good approaches for helping my child learning different mathematics topics.	1 2 3 4 5
I try to match my expectations with my child's potential.	1 2 3 4 5
I am always aware of my child's mathematics requirements by checking notebooks, emails, or through phone calls to school.	1 2 3 4 5
I make an effort to understand the mathematics my child is studying.	1 2 3 4 5
I know how to motivate my child to do a good job on his/her mathematics assignments.	1 2 3 4 5
I try hard to have a nice learning environment at home for my child to do mathematics.	1 2 3 4 5
I am involved with planning my child's mathematics program.	1 2 3 4 5
I feel I can help my child solve problems from mathematics class.	1 2 3 4 5
I know strategies for helping my child overcome weaknesses in mathematics.	1 2 3 4 5
At home, I encourage my child to work hard on mathematics problems, even though the problems are difficult.	1 2 3 4 5
I provide technology-based tasks to assist my child learn mathematics.	1 2 3 4 5
I often spend time talking with my child about his/her progress in mathematics.	1 2 3 4 5
I think I know enough about mathematics to help my child.	1 2 3 4 5
I am aware of the approaches used to teach mathematics at my child's school.	1 2 3 4 5
I am usually able to motivate my child to learn mathematics well.	1 2 3 4 5
I have access to a variety of home-based activities.	1 2 3 4 5
I often buy mathematics related books for my child.	1 2 3 4 5
At home, it is important for my child to keep a balance between mathematics and his/her other subjects.	1 2 3 4 5

I have attended mathematics workshops for parents.	1 2 3 4 5
Mathematics plays an important role in my child's future.	1 2 3 4 5
At our house, we have a variety of games and puzzles that encourage the development of my child's mathematical skills.	1 2 3 4 5
I always try to monitor the amount of time my child spends on mathematics at home.	1 2 3 4 5
I often discuss with my child how mathematics is used in everyday life.	1 2 3 4 5
I understand my child's strengths and weaknesses in learning mathematics.	1 2 3 4 5
I motivate my child by:	
When doing mathematics tasks my child prefers to use:	
My child completes mathematics homework that involves:	
The aspects of mathematics my child achieves well in are:	
The aspects of mathematics my child is most challenged by are:	
Other comments:	

APPENDIX 8: Demographic Data Submitted by Parent Participants

Code	G	Age	Location	Child – gender -age	Siblings – gender - number	NOTES
MO1	F	>51	Sydney	F-9	M2	Partner - FA1
FA1	M	>51	Sydney	F-9	M2	Partner - MO1
MO2	F	41-50	Sydney	F-5	M1	Partner - FA2
FA2	M	41-50	Sydney	F-5	M1	Partner - MO2
MO3	F	41-50	Sydney	F-9	M1	Partner - FA3
FA3	M	41-50	Sydney	F-9	M1	Partner - MO3
MO4	F	41-50	Sydney	F-8	0	Partner - FA4; special school
FA4	M	41-50	Sydney	F-8	0	Partner - MO4
MO5	F	41-50	Coffs Harbour	F-9	F 3	No partner; home schooling
MO6	F	41-50	Sydney	M-5	F1; M1	Special school; No partner
MO7	M	31-40	Canberra	M-7	F3	Partner - FA7
FA7	M	41-50	Canberra	M-7	F3	Partner - MO7; School teacher
MO8	M	31-40	Canberra	M-7	F1; M1	School teacher; no partner response
MO9	M	>51	Canberra	M-6	F1	Partner - FA9
FA9	M	>51	Canberra	M-6	F1	Partner - MO9
MO10	F	>51	Canberra	F-10	0	Partner - MO10
FA10	M	>51	Canberra	F-10	0	Partner - FA10
FA11	F	>51	South Coast	F-6	F1; M2	Partner - FA11
MO11	F	41-50	South Coast	F-6	F1; M2	Partner - MO11
MO12	F	>51	Canberra	F-5	F1	Partner - FA12; Initial surveys only
FA12	F	>51	Canberra	F-5	F1	Partner - MO12; Initial surveys only
MO13	F	41-50	Canberra	M-6	0	Initial surveys only; No partner
MO14	F	>51	Canberra	F-11	M1	School teacher; No partner
MO15	F	41-50	Canberra	M-5	0	No partner
MO16	F	31-40	Canberra	F-7	0	No partner

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