The Evaluation and Impact of Parent Education in Early Numeracy

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Abstract

This thesis presents the findings of a project which investigated the impact of a parent numeracy education programme on parent understanding of, confidence in, and attitude towards numeracy. Eighteen parents of a year's intake of new entrant children from a rural primary school were participants in the project. Each parent met with the researcher four times over a twenty week period. There were three main aspects to the project. Firstly, parents were provided with information about children's development of number understanding. Secondly, using their child's assessment information, a parent numeracy education programme was implemented. This was aimed at increasing parents' knowledge of children's number understanding and providing them with activities and resources to support their child's learning at home. Lastly, the link between parents' attitude towards mathematics and their confidence towards helping their children in mathematics was explored. Parent evaluation of the effectiveness of the education programme was a major component of the research.

This research gives evidence of the importance of informing parents of the programmes that are implemented in our schools and the value of parent involvement in their child's education. It also highlights the impact of negative experiences on parental attitudes towards learning and achievement, and the confidence that parents have in helping their own children.

There are implications for both school leaders and classroom teachers from this research. It challenges the school sector to explore ways in which they involve and inform parents about the mathematics programmes that are in place in their school, and to review the mathematics achievement information parents receive. Research findings suggest that when parents are provided with learning outcomes linked to home-based activities which are specific to their children, there are benefits for the children, the parents and the school.

Preface

I believe both attitude towards learning and parent involvement in education play a very important role in student achievement. My interest in the links between home and school began very early in my teaching career when I observed both positive and negative changes in attitude towards school and learning as a result of the experiences in the classroom, in the home and in the playground. When parents were involved in a supporting role, children were frequently more focused and positive about the tasks they were working on. If a child was having a problem, this could often be resolved when parents were informed and included in plans to address the situation. If help was needed in a particular curriculum area, parents were usually more than willing to provide additional support at home. All parents want the best for their children. They want to support their child's learning, but often feel powerless to help due to a lack of understanding. When parents are given information about how their child can be helped, it is my experience that they are more than willing to assist at home.

As a parent, open communication between home and school was very important to my husband and myself as we supported our children through times that were challenging to them, both socially and academically. Knowing how we could assist our child, knowing the content of the programme that was being delivered in the classroom, and knowing that support was available to us was particularly useful during these times. When our children displayed a negative attitude towards learning in a particular subject area, it was usually due to either a lack of self belief, caused through failure to understand the concepts that had been introduced, or a negative experience within the class environment. I know my attitude has played a significant role in my children's approach to various tasks. It is only recently that I have been able to reflect on the impact of that, and rationalise the extent to which this has impacted on the choices our children have made.

I would like to thank my husband John, and our sons, Jamie, Craig and Glenn for the interest they have shown in my studies, and their encouragement during the development

of this thesis. Dr. Wendy Bamford, a friend, colleague and mentor, has provided an excellent role model for me, and encouraged me to pursue further tertiary education qualifications. I thank Wendy for the many long hours of discussion we have shared, which has stimulated self-reflection, and challenged my philosophy of teaching and learning.

My teaching qualifications and post-graduate studies have been undertaken through Dunedin College of Education, and I am indebted to the support I have received. Special thanks go to my supervisor Dr. Gill Thomas, for her support, her constructive critiques of my work, and her willingness to share her expertise as a researcher. Thanks also to the additional supervisory support I have received from Chris Linsell, Dunedin College of Education. Geoff Lee has been a pivotal influence in helping me to pursue the journey towards my Masters Degree. Throughout my studies, I have valued Geoff's guidance and critical feedback. I extend my sincerest thanks to Geoff. Without his input this journey would not have begun.

I would also like to acknowledge the support and assistance I have received from Andrew Tagg, who has provided data for me and given me guidance with data analysis.

Finally, but most importantly, I thank the parents, children and teachers with whom I have worked over the past year, for their enthusiasm, commitment and willingness to help with this project. Without their participation and valuable feedback, this research would not have been possible.

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Chapter 1: Introduction

> *Teachers' practices to involve families are as or more important than family background variables such as race or ethnicity, social class, marital status, or mother's work status for determining whether and how parents become involved in their children's education. Family practices of involvement are as or more important than family background variables for determining whether and how students progress and succeed in school.*
> *(Epstein, 2001, p45)*

Parents can make a substantial difference to student achievement (Epstein, 2001; Parents as Teachers, 2000; Tarrant, 2002; Wylie, 2001). Most parents of young children ensure that their child reads the book they bring home from school each day, and are keen to help their child learn to write. However parents do not place the same emphasis on mathematics support at home (Epstein, 2001; Ashlock, 1990; Kliman, 1999). This research investigated the impact of an education programme for parents designed to increase parent knowledge of current numeracy practices, and encourage parents to have greater involvement in supporting their child's mathematics learning at home. Links between parent's mathematical experiences, their attitude and their confidence in mathematics were investigated. The link between the parent's own confidence in mathematics and the confidence they had towards helping their child with mathematics was also investigated.

The research had two key aims:

1. To investigate parent understanding of, confidence in, and attitude towards numeracy.
2. To evaluate the effectiveness of a numeracy education programme for caregivers/parents.

According to Duemer, Benitez, Hurst, Juarez-Torrez, Teague-Smith, Collins, Harrison, Jones & Powers (2002) parents can inspire their children to have a passion for learning. The experiences provided by parents, along with the feedback they give their child, are

critical in developing a desire for education and a positive attitude towards learning. Attitude plays a major role in student achievement. Meaningful, positive experiences promote a positive attitude. Conversely experiences that have negative connotations for the child will have an adverse effect on their attitude and subsequently their achievement. A child's attitude can be changed by relevant, enjoyable, learning experiences at the child's level that increase understanding and knowledge (Kliman, 1999; Wilkins, 2003; Bottle, 1998; Gutbezahl, 1995; Furner & Bergman, 2003).

Many parents and teachers have had negative experiences in mathematics which in turn has had a negative impact on children (Bottle, 1998; Gutbezahl, 1995). This current research focuses on promoting positive mathematical attitudes by fostering an awareness of the role parents can play to increase the mathematical achievement of children. Ashlock (1990) suggests that parents often are unsure about how to help their child. If they are given information about the activities that can be used to support their child's learning at home, and the opportunity to develop their own knowledge and understanding, they will feel more confident to help their child. The Number Framework, developed as part of the New Zealand Numeracy Project was used a basis to provide a pedagogical model for parents to develop their understanding. Activities aimed at increasing their child's number knowledge were based on this framework. The Number Framework, a core element of the project, has two interdependent components: strategy and knowledge. Parents were encouraged to work on activities to increase their child's knowledge of number, which would positively impact on the numeracy strategies they could use (Ministry of Education, 2004b; Davies, 2001; Thomas and Tagg, 2004).

The New Zealand Numeracy Project and the research that is embedded in this project has been pivotal in developing the education programme used with parents. The Numeracy Project was developed to improve student performance in mathematics, by improving the professional capability of teachers and was first introduced into New Zealand schools in 2000. It was the researcher's belief that parents could benefit from the structured, detailed numeracy information developed as part of the projects.

New Zealand research on the impact of mathematics intervention programmes, has found that when parents had been given detailed information about the mathematics programmes operating within the school, introduced to activities to support these programmes at home, and where open lines of communication and feedback were established between parent and teacher, the outcomes were positive for the children (Young-Loveridge, 1993; Carr and Peters, 1995; Peters, 1995). These factors were considered in the design of this current research.

The thesis is organised into seven chapters. Following this introduction is a review of the literature and an outline of the methodology. Chapter Four, reports on the achievements of the student participants over the duration of the project. It also reports on the students' feelings towards mathematics and the activities they enjoy working on. Chapter Five is the first of two results chapters reporting on the impact of the project on parents. It reports on the data gathered from the initial and final written surveys and the interviews with parents. More specifically it reports on the attitudes of parents towards mathematics, the understanding of numeracy development in young children, their confidence in helping their children with mathematics at home, and their beliefs about the success children can have in mathematics. Chapter Six, the second of the results chapters reporting on the impact of the project on parents, evaluates the project from the parents' perspective. The effectiveness of the project is discussed under three topics: numeracy information, feedback on child achievement, and resources and activities. The thesis concludes with a summary of the main findings related to the research questions, a discussion of the implications and limitations of the research and directions for future investigation.

Chapter 2: Literature Review

The first section of this chapter reviews the literature related to the mathematical achievement of New Zealand school students. The poor achievement of New Zealand students in mathematics on international studies was one of the key driving factors behind the implementation of the Numeracy Project from 2000. Findings from research conducted internationally and nationally are included. The second section focuses on numeracy within the New Zealand context and contains an overview of the Numeracy Project. The third section reviews the literature related to the role of parents in supporting the teaching and learning of early mathematics, with a focus on the impact on learning of parental attitudes and expectations.

Mathematical Achievement of New Zealand Students

International and national studies report that in many aspects of mathematics, New Zealand students are not achieving as highly as their international counterparts (Garden, 1997; Chamberlain, 2001; Chamberlain & Walker, 2001; Flockton & Crookes, 2002).

When reporting on the results of the Third International Mathematics and Science Study conducted in 1994/1995 (TIMSS-94/95), Chamberlain & Walker (2001), stated that "the means for [New Zealand] year 4 and 5 students were statistically significantly below the international means for their counterparts from 26 countries" (Chamberlain & Walker, 2001, p.3). In 1998, the New Zealand government participated in a repeat of TIMSS-94/95, which is referred to as TIMSS-98/99, or TIMSS-R. New Zealand included students at both the year five and year nine levels to gather comprehensive comparative data. Although twenty-six countries had middle school students (year five) participating in the TIMSS-94/95 study, no other countries included this group in 1998. Whilst relative international data could not be used for the year five students, the results of this cohort could be compared to the 1994/95 cohort of New Zealand students. Chamberlain (2001) reports that in 1994, New Zealand year four and five students were achieving

significantly below those students from English-speaking countries with similar education systems to ours. TIMSS-94/95 identified that "an area of particular weakness for New Zealand students was *whole numbers*" (Chamberlain, 2001, p.3). The results from the comparative study, TIMSS-98/99, found that there was a small non-significant increase in the mean mathematics achievement of year five students from 1994 to 1998. When compared to thirty-eight other countries, the results from TIMMS-98/99 show that year nine students in New Zealand recorded a decrease in mean mathematics achievement between 1994 and 1998. Whole numbers continued to be the content area with the lowest mean scores for both groups. When tracking the achievement of the cohort, which were tested in 1994/1995 as year 5 students, and again in 1998/1999 as year 9 students, it could be shown that the overall mean scores had decreased slightly during that period.

The Organisation for Economic Co-operation and Development (OECD) conducts an internationally standardised assessment programme that was jointly developed by participating countries and administered to fifteen year olds. This assessment, the Programme for International Student Assessment (PISA) was first implemented in 2000 and involved forty-three countries. Unlike TIMSS, which has a knowledge focus in the mathematics and science areas it tests, the PISA assessment focuses on the application of knowledge and experience to real world issues. "The intention of PISA is to capture learning not only within school curricula, but also learning beyond the school curricula" (Sturrock & May, 2003, p4). The primary goal of PISA is to measure how well fifteen year olds are prepared to meet the challenges of today's knowledge societies, measuring students' mathematical and scientific literacy. Mathematical literacy is defined by the OECD as "an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen" (OECD, 2004, p.2). Although PISA was not specifically a curriculum based study, it was expected that fifteen year old students would have developed a balanced knowledge of the mathematics curriculum during their time at school.

The report from Sturrock and May (2002) on PISA conducted in 2000 (PISA, 2000), placed the mean performance in the mathematical literacy of New Zealand students, third amongst the OECD countries, behind Korea and Japan. Although New Zealand ranked highly, PISA 2000 identified a wide range of abilities within the New Zealand population, particularly in the spread of scores within different socio-economic, gender and ethnic groups. Levels of performance decreased as the socio-economic status of the school (the decile ranking) decreased. "Parental education and patterns of social and cultural communication between parents and children were also associated with higher performance" (Sturrock & May, 2002, p131). Students from single sex schools scored significantly higher than students from co-educational schools. Boys, on average scored higher than girls. There was a greater range of achievement for girls. "The very strong effect of gender alone and of ethnic grouping alone on achievement in PISA 2000 was evident" (Sturrock & May, 2002, p69). Pakeha and Asian students performed significantly better than Māori or Pasifika students, which had a direct link to the socio-economic status difference between these groups. The students in the sample from the Pakeha and Asian groups, generally came from families of higher economic status, and had parents with higher education qualifications.

Sturrock and May (2002) reported that the comparative performance of New Zealand students in terms of motivation and interest in mathematics was slightly above the OECD average. The findings show that a greater interest in mathematics can be associated with higher performance. This was particularly strong in the pakeha cohort's results.

The general outcomes of learning measured in the PISA 2000 study show that New Zealand students, on average, are motivated and engaged in learning. They have the potential to become life-long learners when they leave school. However there is a significant range in attitudes and interests existing within each of the different groups studied. PISA 2000 and TIMSS both reach a similar conclusion in that there is a wide range of mathematical achievement evident amongst New Zealand students.

The National Education Monitoring Project (NEMP) (2001) report, on mathematics achievement for year four and year eight students also highlights the range of academic achievement amongst New Zealand students. The Mathematics Framework assessed by NEMP covers many areas of mathematics: the five strands of mathematical knowledge - number, measurement, geometry, algebra and statistics; mathematical processes and skills; and student attitudes and motivations in mathematics. In particular the results from the section on number understanding are reviewed for this project.

The NEMP (2001) report investigated

> *…students' understandings, processes and skills in the areas of mathematics called number. Number includes the ways numbers are represented, their value, operations on number, accuracy and efficiency in calculating, estimating and making approximations.*
> *(Crooks & Flockton, 2002, p12)*

The NEMP results suggest that New Zealand students are performing poorly in some areas of mathematics.

> *Students at both levels [years 4 and 8] scored poorly in tasks involving estimations and tasks involving fractions…Most [students] relied instead on [using] standard algorithms for these tasks [simplifying or adjusting numbers], indicating a lack of deep understanding of number operations.*
> *(Crooks & Flockton, 2002, p12)*

The comparative results of the NEMP assessments in mathematics carried out in 1997 and 2001, gave evidence of "modest improvement between 1997 and 2001, especially for year 4 students" (Crooks & Flockton, 2002, P3). The report states that a significant number of students were unable to explain the processes and strategies that they used. It also finds that there was a very low rate of success, for both groups, in tasks involving fractions and decimals. Only one of the sixteen tasks involving calculations with fractions were answered correctly by more than half of the year 8 students, and no more than 24% of year 4 students answered the simplest calculation correctly. Approximately 33% of the year 8 students, and 30% of the year 4 students were able to match more than half of the fractional numbers they were given to correct places on a number line. The

tasks given the year 4 students for this assessment were not as difficult as those for the year 8 students.

Estimation and approximation tasks also resulted in low scores. When solving computations such as 36 + 29 or 9 x 98, few students at both levels choose to adjust the numbers to a more easily rounded off number (making 29 into 30, or 98 into 100). The year four students in particular, continued to perform poorly in subtraction and division facts knowledge. Only 53% of year 4 students getting at least 95% of subtraction facts correct and 11% of year 4 students getting at least 95% of the multiplication facts correct. Students from both levels struggled when asked to solve addition and multiplication equations involving two or more digits. Only 40% of year 8 students got the seven addition calculations correct, and 25% of year 8 students got the seven multiplication calculations correct. The year 4 students were only asked 5 of these questions. 36% got all five addition calculations correct, and 6% got all multiplication calculations correct. Place value was another area of concern, particularly for the year four group. "Most year 4 students showed a low level of understanding of place value, and very few succeeded when renaming was required" (Crooks & Flockton, 2002, p17).

The report emphasises New Zealand students' lack of deep understanding of number operations and confirms the findings reached by the PISA 2000 and TIMSS assessments that there is a wide range of ability, particularly within differing socio-economic and ethnic groups.

In 1997, following the findings of the TIMSS 94/95, the Ministry of Education established a Mathematics and Science taskforce to investigate possible solutions for addressing the low achievement of New Zealand students. The taskforce made the following recommendations, as reported in Curriculum Update 45:

> *improving teachers' professional skills, knowledge, and confidence;*
> *providing teacher support material, accompanied by some form of professional development;*
> *support for the teaching of Māori and Pacific students;*
> *greater emphasis on pre-service training;*
> *greater involvement of parents and the community;*

> *raising teachers' and parents' expectations of children's mathematics achievement.*
> *(Ministry of Education, 2001, p3)*

The Ministry responded to a number of recommendations made by the taskforce. In 1998 the New Zealand Government announced a national goal for Literacy and Numeracy, "By 2005, every child turning nine will be able to read, write and do maths for success." The primary sector, in particular, received new and revised resource material for both students and teachers. The Figure it Out Mathematical booklets and the Connected series were initiated as a result of the taskforce, and continue to be developed as key resources to support mathematics programmes. Online assessment material was developed, and could be accessed through Te Kete Ipurangi (TKI), the Ministry of Education's online learning centre which was launched in 1998 as part of the Information and Technology Strategy. Another online initiative, the NZ Maths website was developed to provide resources and support for teachers.

The change in National Administration Guidelines (NAG) in July 2000, demonstrated the Ministry's commitment to give priority to the teaching of literacy and numeracy especially in year one to four.

> *NAG 1b Each Board, through the principal and staff, is required to develop and implement teaching and learning programmes:*
> *giving priority to student achievement in literacy and numeracy, especially in years 1-4.*
> *(Ministry of Education, 2004a, p1)*

Numeracy

Numeracy was one of the areas identified by the TIMSS and NEMP studies as an area of weakness for many New Zealand students. A broad definition of numeracy was published in the New Zealand Ministry of Education's update to schools on curriculum matters. "To be numerate is to have the ability and inclination to use mathematics effectively - at home, at work and in the community" (Ministry of Education, 2001, p1). This definition is consistent with the aims of the New Zealand mathematics curriculum. The concept of numeracy adopted by the New Zealand Ministry of Education is similar to that used by Doig (2001) in a report, commissioned by the Australian Council for

Educational Research (ACER). Doig (2001) defines numeracy as the effective use of mathematics to meet the general demands of life at home, in paid work, and for participation in community and civic life. Many countries (e.g. Australia, the United Kingdom and New Zealand) are placing a strong emphasis on the development of numeracy skills to ensure all students are equipped with skills to fully participate in an ever-changing society.

Numeracy underpins most mathematical contexts. The understanding of number is pivotal to the development of numeracy, as stated by the Ministry in the following quote.

> *Numeracy arises out of effective mathematics teaching. All the strands within Mathematics in the New Zealand Curriculum are important in the pathway to numeracy. Number is central to this pathway, although the relative emphasis on the strand changes with the stages of schooling.*
> *(Ministry of Education, 2004d, pi)*

In the current research, the definition of numeracy is narrowed to suit the context of children in the early years of schooling. Numeracy specifically refers to the development of number understanding.

The Mathematics in the New Zealand Curriculum (MINZC) places emphasis on the acquisition of numeracy skills. MINZC is aimed at ensuring that students develop a sound understanding of number. They should be able to confidently, accurately and efficiently calculate mathematics problems and develop the ability to estimate and make approximations to ensure they are alert to the reasonableness of results. It is expected that students should be able to solve problems within a range of contexts.

Three years following the change in National Administration Guidelines in 2000, the Ministry published a statement about its goals and priorities for the New Zealand education system. The following quote is an extract from these priorities and demonstrates the continued commitment to develop the numeracy skills of all students.

> *All New Zealanders need to master the basic skills of literacy and numeracy … These basic foundations are critical for success in schooling, for coping with the demands of modern society, and for engagement in learning throughout life. The*

foundation skills and attitudes needed include: the ability to read, write and communicate effectively; sound numeracy skills.
(Ministry of Education, 2003, p3)

The New Zealand Numeracy Projects

In addition to legislative changes regarding the emphasis that should be placed on numeracy, especially at the lower levels of primary school, the government demonstrated its commitment to improving teaching and learning in mathematics by implementing the Numeracy Projects. The Numeracy Projects have evolved from two pilot studies implemented in 2000: the Count Me In Too (CMIT) for year zero to three students and the Numeracy Exploratory Study at the year four to six level. The CMIT pilot was a professional development programme for primary teachers, which focused on reflection on mathematical pedagogy and upskilling in content knowledge.

Thomas and Ward (2001), Garden (1997), the New Zealand Ministry of Education (1997a, 1997b) and the Education Review Office (2000) suggest that the responsibility for the poor international standing of our students, can been widely attributed to the lack of quality in our mathematics teaching. The New Zealand Numeracy Development Projects aim to improve "student performance in mathematics through improving the professional capability of teachers." (Ministry of Education, 2004b, pi) There are several components to the Numeracy Projects: The Number Framework, the diagnostic interview, a professional development programme for teachers, supporting online resources and funded evaluations into the effectiveness of the projects. A combination of workshops, in-school support, on-line resource support and training and in class modelling familiarises teachers with the Number Framework and the implementation of the key elements of the numeracy programme.

The Number Framework, developed as part of the Numeracy Project, is based on extensive international and national research. The framework has two interdependent components: Strategy and Knowledge. The strategy component is a sequence of global stages describing the mental processes students use to solve number problems. The knowledge component describes the key items of knowledge that students need to

support strategy development. Knowledge provides the foundation on which strategies are developed. In early number understanding knowledge is a prerequisite for strategy development. As more advanced strategies are used, the student's knowledge also increases (Ministry of Education, 2004b). Davies (2001) and Thomas and Tagg (2004) have made associations between strategy and knowledge, suggesting that the strategies a student uses is indicative of the depth of his/her number knowledge. The stronger the number knowledge the more advanced the strategies used.

The methodology for teaching maths has changed with the implementation of the Numeracy Projects. The Numeracy Projects are based on the assumption that teaching should be more effective if a teacher can identify where a student is on a framework and can then identify the next learning step for the student. Thomas and Ward (2002) suggest that the progressions identified on the number framework should provide a useful pedagogical model for teachers. The current research uses this model with parents. It focused on increasing parent understanding of the links between strategy and knowledge development, particularly at the early stages on the framework, and provided information that supported this development in the home setting.

The strategy section on the framework is divided into eight stages. Progress through the stages indicates an increase in the sophistication and range of strategies used to solve number problems. The Numeracy Project aims to help students develop more sophisticated strategies. However existing strategies are not subsumed. A student frequently reverts to previous strategies when solving an unfamiliar or challenging problem.

The following figure shows the progression of strategy stages. The strategies are broadly categorised as counting and part whole strategies.

Figure 1: The Number Framework 2004 (Adapted from Ministry of Education, 2004b, P1)

	Strategy Stages	
Part-whole Strategies	8. Advanced Proportional 7. Advanced Multiplicative 6. Advanced Additive 5. Early Additive	Expansion of Knowledge →
Counting Strategies	4. Advanced Counting 3. Counting from One by Imaging 2. Counting from One on Materials 1. One-to-one Counting 0. Emergent	

The important items of knowledge students should learn as they progress through the strategy levels are outlined in the knowledge section of the framework. As stated previously, knowledge is a critical component of strategy development. The greater the knowledge, the more proficient students are likely to be in strategy application. The depth of student knowledge varies at each strategy level. The students' application of the knowledge will differ but it is important that more difficult number concepts, for example decimals and fractions, are introduced at the early stages on the framework. For instance, students need to be able to read and write fractions and decimals before they can use these in number operations (Ministry of Education, 2004b). "In the framework, knowledge is categorised under four content domains: Number Identification, Number Sequence and Order, Grouping/Place Value, Basic Facts, and Written Recording" (Ministry of Education, 2004b, P8).

Carr, Peters and Young-Loveridge (1994), Young-Loveridge (1999) and Peters and Jenks (2000) emphasise the importance of counting in the development of early number knowledge. The emphasis is on the development of number knowledge and extends beyond counting in whole numbers by ones, twos and other simple multiples. Forming sets, recognising patterns in number, forwards and backwards number counting sequences and groupings within numbers are important for students developing early

number knowledge. The New Zealand Number Framework uses the students' natural inclination to use groupings of fives, and encourages the use of finger patterns in the early years. Recognising patterns in fractions, decimals and powers of ten becomes increasingly important as students reach the more advanced strategy stages. Basic fact knowledge is another critical component of the knowledge framework (Ministry of Education, 2004b).

> *The Number Framework emphasises that the process of deriving number facts using mental strategies is important in coming to know and apply these facts. It also demands that students come to know a broader range of facts than previously, including groupings of "benchmark" numbers, and that they have knowledge of decimal and fraction conversions at the higher stages.*
> *(Ministry of Education, 2004b, p8)*

Children use strategies to derive number facts, and are expected to know a broad range of facts. This includes knowing about decimals and fraction conversions at the higher strategy stages. (See Appendix C for further detail on the Number Framework, Strategy and Knowledge Stages.)

Another core component of the Numeracy Project is the Diagnostic Interview. This assessment tool, an individual task based interview, was designed to provide quality information to teachers about their students' knowledge and the mental strategies they use to solve number problems (Ministry of Education, 2004c). All students participating in the Numeracy Projects, regardless of age, are assessed at the commencement and the conclusion of the project. Young-Loveridge (1996) suggests that assessing the numeracy skills of new entrant students enables a teacher to identify students who may need additional experiences to support the future learning contexts. Her research showed that differences in students' numeracy skills at age five tended to increase over time. Based on that assumption, it is important that teachers endeavour to bridge any gap in achievement in the early years of schooling. If a teacher can identify the next learning step for each student, and provide activities in support of that learning, the progress on the Number Framework is likely to be facilitated.

Teachers use the numeracy Diagnostic Assessment Tool to determine the student's placement on the Number Framework and determine the future learning needs for that student. All teachers participating in the projects submit their assessment data to a Numeracy Project website. Over the period 2001 to 2003 data from more than 200,000 students was submitted. This data forms the basis for the Numeracy Project's evaluation reports, which have been commissioned since the project's inception (Christensen, 2003; Higgins, 2001, 2002, 2003; Irwin, 2003; Irwin and Niederer, 2002; Thomas & Ward, 2001, 2002; Thomas & Tagg, 2004; Thomas, Tagg & Ward, 2003, 2003).

There are currently five numeracy projects in New Zealand: the Early Numeracy Project (ENP) for year zero to three students, the Advanced Numeracy Project (ANP) for year four to six students, the Intermediate Numeracy Project (INP) for year seven and eight students, the Secondary Numeracy Project (SNP) for year nine and ten students, and Te Poutama Tau (TPT), which is a numeracy project for students taught in Māori medium settings.

The current research is embedded in the ENP. Four evaluation reports have been published, since 2001, on the impact of the ENP on the participating students and their teachers. According to an evaluation of ENP by Thomas and Ward (2002), teachers who have been involved in the Early Numeracy Project have changed their classroom programme, increasing their focus on students' development of number strategies and knowledge and are grouping students and using equipment more effectively.

Thomas and Ward (2002), suggest that the ongoing professional development programme involving all participating teachers, and support provided by the facilitators, have being pivotal in this change of emphasis and the subsequent gains in mathematics achievement for the students involved.

> *The common planning practices underlying the effective teaching of early number included clearly defining objectives for each teaching session, focusing learning, selecting an appropriate learning activity and posing questions to students.*
> *(Thomas & Ward, 2002, p52)*

The most recent ENP evaluation report, by Thomas and Tagg (2004), investigated the impact of the project on 31,423 year 0-3 students and their teachers. It also reports on the longer-term sustainability of the project. A longitudinal study of the performance of year four, five and eight students from fifteen schools, that first participated in the project in 2000 or 2001, was conducted using a selection of items taken from the TIMSS. Thomas and Tagg (2004) concluded that the ENP implemented in 2003 was successful in raising the achievement of students as measured by the Number Framework. This is consistent with the findings from previous years. They state that ethnicity, gender and school decile impact on numeracy achievement, with Māori and Pasifika students performing at a lower level than New Zealand European and Asian students. Another conclusion reached by this report is that the lower the decile of the school, the lower the achievement profile of its students. It also shows that boys tend to make greater progress than girls from the higher stages of the number framework. Young-Loveridge (2004) reported similar findings from her comparative studies of all Numeracy Projects involving students from schools where English was the medium of instruction. These variations in the profiles of achievement replicate findings from TIMSS, NEMP, PISA, as reported earlier in the chapter.

"The results of the TIMSS testing of students in longitudinal schools, show that the year four and five students performed better than New Zealand students in 1995, particularly on questions targeting numeracy concepts. The year eight students performed at least as well as norms from 1995" (Thomas & Tagg, 2004, pv). Interviews and questionnaires with teachers from the longitudinal schools, indicated that they generally believe that the project has had a positive impact on their students. The report states that teachers' believed that involvement in the numeracy project had improved the attitude and the enthusiasm of students towards mathematics and also increased the range of strategies their students used to solve number problems. For many teachers, numeracy continues to form the core of their mathematics programme, even though their direct involvement in the numeracy professional development component has ended.

Young-Loveridge (2004) investigated the trends in the Numeracy Project evaluation data over a three year period, from 2001 to 2003. Although the Numeracy Project results are producing positive outcomes in terms of student achievement on the number framework, Māori and Pasifika students continue to perform at a lower level on the framework than their New Zealand European and Asian cohorts. Students who commenced the project at lower levels on the number framework were able to gain stages more easily than children who commenced at higher levels. This finding reflects the relatively smaller size of the lower stages of the framework. A greater number of Māori and Pasifika students entered the project at lower levels, which should have resulted in higher overall gains on average than their New Zealand European and Asian counterparts. However the project evaluations showed that the gains for both groups were almost identical, relative to the starting point on the framework (Young-Loveridge, 2004). Young-Loveridge (2004) recommends that changes should be made to the Numeracy Projects to address issues concerning the lower achievement of Māori and Pasifika students in particular. These include seeking ways to more effectively cater for meeting students' mathematical learning needs, strengthening home-school partnerships to support students' learning, exploring ways of sustaining the Numeracy Projects over time and considering ethnicity when recruiting and training facilitators.

The home-school partnerships investigated in the current research may have positive applications in a wider context. Although the impact of ENP on the participating facilitators, principals, teachers and students has been evaluated and reported, there is no published research to support the impact of parent involvement in early numeracy education within the New Zealand context.

Role of Parents in Education

The New Zealand Ministry of Education recognises the significant role of parents in raising student achievement.

> *The role that teachers, education managers, education governing bodies, parents, Whanau, hapu, iwi, Māori, communities, employers and other stakeholders play is critical to achieving real change in the education sector.*
> *(Ministry of Education, 2003, p6)*

The Ministry of Education commissioned a report in 2003, designed to strengthen the evidence base that informs education policy and practice in New Zealand, and aimed at improving educational outcomes for students and young people. In this report, Biddulph F., Biddulph J. and Biddulph C. (2003) investigated the impact of community and family influences on student achievement. The following findings from this report have a direct link to the current research and are supported with reviews of research conducted internationally.

One of the findings from Biddulph et al (2003) is that schools should implement programmes which involve parents in addressing the learning needs of their children, especially in the early years of schooling. Biddulph et al (2003) state that students' achievement can significantly improve with this involvement. Young-Loveridge (2004) suggests that one way to close the gap in achievement is to seek ways to foster home-school partnerships. This is supported by international research which shows that there are many benefits for students whose parents play an active part in their child's education, by supporting the child's learning at home (Epstein, 2001; Parents as Teachers, 2000; Tarrant, 2002; Wylie, 2001).

Another of the findings from Biddulph et al (2003) which has relevance to the current research, is that students achieve higher when families have high educational expectations of their performance, a finding which is also supported by Gutbezahl (1995) and Wilkins (2003).

> *Regardless of ethnic or SES [socioeconomic status] background, families with high levels of educational expectations have the most positive effects on their children's achievement…*
> *(Biddulph F., Biddulph, J. & Biddulph C., (2003), p iv)*

A third finding from Biddulph et al (2003) is that students' achievement can be raised by incorporating school-like activities into family activities. The success of this is dependent

on "providing parents with access to both additional pedagogical knowledge and information about finding and using educational resources" (Biddulph et al., 2003, pp v-vi).

Research conducted by Epstein (2001) shows that parents were reluctant to help their children in mathematics because they did not understand the methods that were being taught in schools, and that they were unsure of the ways they could help, and the activities they could use. Parents were worried that they would confuse their children. As a result they chose not to be involved with mathematics at home. Parents involved in a programme designed to inform parents about the skills that were being taught in class, and to provide suggestions for follow-up activities at home, encouraged parents to spend time communicating with their child and the teacher about mathematics. As a result parents felt more empowered to help. Once informed, and equipped with strategies that could benefit their children it was found that parents had a positive influence over their children's achievement and attitude towards maths.

Epstein's research has a direct link to another finding from Biddulph et al (2003) which states that where genuine and meaningful partnerships can be fostered between home and school, and a collaborative approach to improving the learning outcomes for students, achievement can be lifted significantly. Parents need to be fully informed of school programmes and of the activities that they can use to help their children's specific learning needs. The parent role in education is a valued component, and all parties need to be aware the significance of this in fostering student achievement (Epstein, 2001). The following quote supports this view.

> *The vast majority of parents find meaning in activities related to their own children rather than in school- or system-wide endeavors … Parents and teachers should recognize the critical complementary importance of each other in the life of the student. Otherwise, we are placing limitations on the prospects for improvement that may be impossible to overcome.*
> *(Fullan, 1991, p250)*

Students learn from many experiences and in many settings. Education is not limited to school experiences. The skills acquired by students before they begin school can have a

beneficial impact on their future learning. Parents and caregivers have a vital role to play in their child's education. The mathematical experiences students have outside the classroom can provide links that enable students to transfer meaning to the classroom mathematics setting (Epstein, 2001; Strutchens, 2002). A student can achieve early success at school if direct links between existing knowledge, understandings and skills can be made to new learning experiences (Clay, 1993). Introducing a range of mathematical ideas within a variety of contexts, helps to promote student interest, confidence and inventiveness, which underpins successful mathematics achievement (Flockton & Crooks, 2002).

Parents knowledge of their child's social and emotional needs, their experiences and their interests can be a powerful tool in creating the links which are vital, if connections are to be made between past and new learning. Parents play a significant role in the learning process, with the feedback they provide to their child (Haney, 1997). According to Duemer, Benitez, Hurst, Juarez-Torrez, Teague-Smith, Collins, Harrison, Jones & Powers (2002) parents fuel their children with a love and enthusiasm for learning, inspire respect for learning, and a desire for education.

The Impact of Expectations and Attitudes

> *It is important for home and school to join hands. By fostering a positive attitude about math at home we can help our children learn math at school.*
> *(Kenter & Dorfman, 1992, p1)*

Parents and teachers need to be aware of the effect of attitude on children. Many parents and teachers have negative attitudes towards maths and that this has a negative impact on children (Bottle, 1998; Gutbezahl, 1995). This trend can be reversed if positive experiences are provided in the home and in the classroom (Kliman, 1999; Wilkins, 2003; Bottle, 1998; Gutbezahl, 1995; Furner & Bergman, 2003).

Bottle (1998) carried out research on parental attitudes towards early mathematics and the ways in which families initiate and support the development of young children's early mathematical concepts. According to this research, if the parents' awareness of the

importance of mathematical development is greater, more time will be spent on mathematical activities and the activities will be more engaging. Conversely parents' negative mathematics attitudes can negatively affect students' mathematics education (Toliver, 1998).

Gutbezahl (1995) concludes that negative expectancies and attitudes about mathematics lead to lower performance, reinforcing parents' and teachers' negative expectancies, thus perpetuating a cycle of low expectancies. Expectations play an important role in the development of attitudes and beliefs.

Furner and Bergman (2003) stress the importance of the parent's role in fostering mathematical confidence and positive attitudes. They suggest that when parents are positively involved in providing mathematical experiences, a child's attitude can be positively influenced.

Parent Awareness and Involvement in Mathematics Education

Teachers and parents can work together to develop mathematical concepts and to promote numeracy. Parental awareness of the general aims of mathematics education, which include the skills, concepts, understandings and attitudes that promote mathematical achievement, will help enhance the learning outcomes for children.

> *It is important for teachers and school leaders to create opportunities to involve parents in the mathematical community … Those opportunities allow parents to experience with their child first hand what is being taught in the classroom and, through this awareness, to express their support for their child's mathematics learning. Teachers and school leaders have an important role in the creation of intellectually challenging and supportive mathematics communities that raise the expectation of students and create opportunities for interaction among peers and with parents.*
> *(Furner & Berman, 2003, pp. 170.)*

According to Ashlock (1990), all parents want their children to enjoy school and succeed with schoolwork. However many parents are unsure of the way that they can help. Ashlock (1990) suggests that parents should be offered the opportunity to learn about the activities they can use to support their children's mathematics learning, and thereby

develop their child's curiosity about number. He states that parents need information about the questions they can ask, the vocabulary they can use, and the resources that can support learning at home.

The impact of New Zealand mathematics intervention programmes, involving parents have been reported by Young-Loveridge (1993), Young-Loveridge, Carr and Peters (1995), and Peters (1995). Whilst the achievement of students during these programmes was not significantly enhanced by parent involvement, reasons were suggested for this. It was found that when parents had been involved in mathematics information evenings, where the school's mathematics programme was explained and activities introduced which would enhance learning both in the classroom and at home, a more positive outcome was experienced. Also when there had been regular communication and feedback with the teacher, the outcomes were more positive. The inability of parents to be involved because of work commitments, and a low level of commitment from many of the parents to the programmes were other factors that contributed to the lack of gain in these studies.

The current research has considered these factors when designing the parent education programme to ensure that parents are fully informed about the school's mathematics programme, the achievement of their children and the activities they can use to promote a greater understanding of number. There was regular communication with each parent and meeting times were arranged to suit parents to eliminate the problems caused by the timing of work and family commitments.

Suggestions by Kliman (1999) were also taken into consideration when designing the parent education programme. Kliman (1999) suggested the following ways to involve parents in their child's home-based mathematics education. A connection could be made between the parent's role in mathematics to their role in literacy. This could promote a greater awareness of the importance of spending time to support mathematics. Many parents ensure that time is set aside to support their young children's literacy development, but seldom spend an equivalent time on the development of numeracy

skills. Anecdotes could be shared which spark an awareness of mathematics in everyday situations. Activity ideas could be suggested for application in the home or in other family contexts such as travelling in a car. Ideas for optional resources that could be easily sourced for home use would be welcomed by parents. The provision of ongoing support, open communication and information about teaching and learning programmes operating in the school could encourage parents to find approaches suited to their family and experiences. Kliman (1999) concludes that the most important message to parents is that they can make a difference to their child's learning and that their child's skills, interest, confidence and attitude towards mathematics will improve with positive parental input.

According to research by Cai (2003) parents who are involved in their children's education contribute not only to higher academic achievement, but also to positive behaviours and emotional development. Educators need to consider ways they can build bridges that will involve parents, and build strong foundations for students' learning (Price, 1997). The intention of the current research is to explore a possible template which may be used as a foundation on which to base future home/school links in numeracy.

Key focus areas for the current study are to investigate parent understanding about the teaching and learning of numeracy; to investigate the link between parent attitudes towards maths and parent confidence in number calculations; to investigate links between parent beliefs in their confidence and their competence in working with their own children on maths activities; and to evaluate the effectiveness of a numeracy education programme for caregivers/parents. According to the literature reviewed all these areas contribute substantially to student achievement.

Chapter Summary

Three themes have been covered in this literature review. The first theme provided a background to this project and focused on literature related to the relatively poor mathematics achievement of New Zealand students compared with their international

counterparts. The review included information from National research which identified numeracy skills as an area in which there was a wide range of ability. This research showed that there had been minimal progress in achievement over the four year monitoring period.

The second theme of the review focused on the initiatives taken by the New Zealand Ministry of Education to improve the numeracy skills amongst students. It reviewed the findings of the taskforce set up to investigate ways of addressing the achievement concerns, which led to the establishment of the Numeracy Projects. Detail about the Numeracy Projects, including the Number Framework which underpins these projects and the ongoing evaluation of the impact of the projects, was discussed.

The third theme of the literature review, centred around parents. Literature focused on the role of parents in supporting the teaching and learning of mathematics. Also discussed was the impact of parental attitude on child achievement. Themes two and three have particular relevance to this project, as the project involves parents in the teaching of numeracy and investigates parent attitude towards mathematics and the impact this can have on their children.

Chapter 3: Methodology

Purposes of the Research

This research provides data about parent attitude towards mathematics, their understanding of the stages of mathematical concept development in young students and the impact on parent attitudes of a parent numeracy education programme. This research complements the extensive research that has been undertaken in New Zealand involving students and teachers who have participated in the Numeracy Projects.

There is very limited current New Zealand research available on the impact of parent attitude on student learning, particularly in mathematics, and of parent understanding of the key mathematical concepts which underpin numeracy development.

Although most parents have the opportunity to be involved in their child's mathematics education through information evenings held at schools, and as parent helpers in the classroom, it is the researcher's belief that parents could have more impact on their child's mathematics if they had a greater understanding of the key numeracy knowledge areas and the strategy stages. This research investigated whether the confidence parents have in supporting their children in mathematics could be increased through a greater understanding of mathematical concepts and of the activities which could be used in the home setting. Also examined was the parental attitude towards mathematics and the impact this can have on students' learning.

The research had two key aims:
To investigate parent understanding of, confidence in, and attitude towards numeracy.
To evaluate the effectiveness of a numeracy education programme for caregivers/ parents.

The aims were investigated through the following research questions:

How is parent attitude and confidence linked to their mathematical experiences at school and their achievement in mathematics?

Has parent knowledge of the development of number understanding and their attitude to mathematics changed as a result of participation in this project?

Has parent confidence towards helping their child at mathematics changed as a result of participation in this project?

What elements of the project do parents consider to be the most effective in helping develop their child's number knowledge and what aspects would parents like to be applied to a classroom context?

Participants

Parents

This research has been conducted with the parents/caregivers of the eighteen new entrant students who commenced at Aotea School from 1 December 2002 until 30 November 2003. At least one parent/caregiver from every family, agreed to participate in the research. Although this parent filled in the written surveys, where there was more than one parent/caregiver in the home, both parents were involved with the implementation of the mathematics activities.

One parent was unable to attend the introductory seminar and first interview due to family illness. This parent had also indicated a reluctance to become involved in the first instance, due to her perception that lengthy written statements would be required from the participants. After the project had been underway for four weeks, she decided to participate fully. Positive feedback from other participants had convinced this parent that both her and her child would benefit by her involvement. A revised timeline was developed with this participant.

At the time of the data gathering phase for the research, February 2004 until June 2004, there were a total of eighteen students. This included nine year one students, five girls, and four boys, and nine year two students, six girls, and three boys. One of the year 2 students was an Ongoing Resource Support, (ORS) funded student.

This purposive sample was selected, to represent one chronological year's intake of new entrant students. The students had settled into school routines and were following the numeracy programme within their classroom. The researcher was familiar to all students, which was important as the researcher met with each student individually, at least three times during the data gathering phase to assess the student's numeracy knowledge and strategy stages.

The researcher had a close working relationship with the two teachers of the students involved in the research and had a significant understanding of their teaching methods and their classroom numeracy programmes as they had been colleagues for ten years.

Researcher

The researcher can identify with the research participants through the discourses of being a teacher, a parent and a student of mathematics. She is the Deputy Principal at the school where the research is based and she has been teaching in this school, a decile 8, full primary school, for twelve years.

Over the twenty years that she has taught in primary schools, she has taught all year levels. The researcher participated in the Early Numeracy Contract in 2000 and has been teaching the numeracy programme since that time. She is very familiar with the programme, and has an in depth knowledge of activities which promote students' number understanding.

During the data gathering phase of the research the researcher was on study leave. She was able to reflect on the achievement of the students from the position of an observer. She did not have the responsibility or bias of being the class teacher for the students of

the participant group. All members of the participant group knew the researcher, either as a teacher of their older students or as the acting principal, when their children were enrolled at school.

The researcher is the mother of three adult sons, and was fully involved in their education as a parent, supporting them with homework, and as a parent helper in a variety of school settings. Her children all had differing abilities in mathematics. One son achieved highly in mathematics and gained tertiary qualifications in mathematics. The other sons needed greater support and discontinued mathematics, as a subject, after at the end of year 12. They had negative attitudes and perceptions of mathematics, which were very difficult to overcome. The researcher believes that all her children were given the same opportunity and encouragement in mathematics, but the differences in both their ability and their attitudes were quite pronounced.

Whilst the researcher achieved highly in mathematics throughout her schooling, she had a negative experience of mathematics at university. This highlighted the importance for her of developing an in depth knowledge of number and understanding of strategies, rather than developing a reliance on the rote learning of formulae, to solve problems.

Methodological Rationale and Research Approach

The qualitative research design applied to this research follows a constructivist paradigm. Denzin and Lincoln (1994) define qualitative research as being multi-method in focus, involving an interpretative, naturalistic approach.

> *The constructivist paradigm assumes a relativist ontology (there are multiple realities), a subjectivist epistemology (knower and respondent cocreate understandings), and a naturalistic (in the natural world) set of methodological procedures. Findings are usually presented in terms of the criteria of grounded theory or pattern theories.*
> *(Denzin and Lincoln, 2000, p21)*

Denzin (1994) lists credibility, transferability, dependability, and confirmability as the necessary requirements to ensure qualitative research is trustworthy. The researcher has considered these elements to maintain the trustworthiness of her research.

Credibility

Lincoln and Guba (1985) suggest that there are five major techniques to ensure that the research is credible.

> *…activities that make credible findings and interpretations will be produced (prolonged engagement, persistent observation, and triangulation); and activity that provides an external check on the inquiry process (peer debriefing); an activity aimed at refining working hypothesis as more and more information becomes available (negative case analysis); and activity that makes possible checking preliminary findings and interpretations against archived "raw data" (referential adequacy) and an activity providing for the direct test of findings and interpretations with the human sources from which that have come – the constructors of the multiple realities being studied (member checking).*
> *(Lincoln & Guba, 1985, p301)*

Credibility has been achieved by engaging with the participant group over an extended period of time. The researcher gathered data over a six month period and had contact with each participant: at the introductory seminar; during three hour long interviews; and informally during meetings at school and through phone conversations.

The researcher was well known to the participants as a teacher, deputy principal and acting principal. The researcher had developed a positive rapport with all the student participants, prior to the research commencing. Developing trust and mutual respect between the researcher and the participants was vital to this research.

> *(Trust) is a developmental process to be engaged in daily; to demonstrate to the respondents that their anonymity will be honoured; that hidden agendas, whether those of the investigator of or other local figures to whom the investigator may be beholden, are not served; that the interests of the respondents will be honoured as much as those of the investigator; and that the respondents will have input into, and actually influence the inquiry process.*
> *(Lincoln & Guba, 1985, p303.)*

The parents could have felt threatened by meeting so frequently with a teacher/leader from their student's school, if they did not feel that the process would benefit both them and their students.

> *Prolonged engagement also requires the investigator be involved with a site sufficiently long to detect and take account of distortions that might otherwise creep into the data.*
> *(Lincoln & Guba, 1985, p302.)*

Knowledge of family circumstances helped the researcher target suitable activities for each family. For instance, when the researcher was compiling resources to support the activities she was suggesting that participants could work on with their child, all the resources could be easily made from 'recyclable' materials available in every home: cardboard cereal or biscuit boxes, a pack of cards etc. Some resources were offered to participants to reduce the cost and any time factor involved in making these.

The participant group was selected from the school the researcher had worked in for the past twelve years. She had an in depth knowledge of the cultures that existed within the school communities, of the programmes that were operating to support teaching and learning and of community expectations. This was particularly relevant when developing activities for parents to support the development of number understanding for their child.

There was an extended period of contact with both parents and students throughout the research. This ongoing contact related both to the numeracy achievement of each student within the participant group and also to the ongoing contact with each parent. Each student was assessed by the researcher three times during the data gathering phase of the research, with the results of these assessments used to develop activities for parents to use to increase the number understanding of their student. Results of all assessments were shared with parents and they were able to confirm these assessments. Parent participants were also asked for their feedback regarding their child's number development which supported the evidence gained by the researcher. At all stages the participants were given the opportunity to seek clarification of questions asked. The researcher checked for understanding by clarifying that she had understood and interpreted the respondent's comments correctly.

Denzin (1978) introduced a metaphor, lines of action, which is characterised by the use of multiple data-collection technologies, multiple theories, multiple researchers, and multiple methodologies. Whilst in this research there is only one researcher, triangulation of data was achieved through various data-collection tools. Different modes

of collecting data have been used: interviews, written surveys and standardised assessment formats.

> *A good constructionist interpretation (text) is based on purposive (theoretical) sampling, a grounded theory, inductive data analysis, and idiographic (contextual) interpretations. The foundation for interpretation rests on triangulated empirical materials that are trustworthy.*
> *(Denzin, N. 1994, p508)*

The research processes adopted give credibility to this inquiry, subsequent data analysis and the conclusions reached. The processes described by both Lincoln & Guba (1985), and Gerdes & Conn (2001), summarise the key elements employed in this research.

> *In summary, we believe it to be the case that the probability that findings (and interpretations based upon them) will be found to be more credible if the inquirer is able to demonstrate a prolonged period of engagement (to learn the context, to minimise distortion, and to build trust), to provide evidence of persistent observation (for the sake of identifying and assessing salient factors and crucial atypical happenings), and to triangulate, by using different sources, different methods….*
> *(Lincoln & Guba, 1985, p307.)*

> *The analytical process involves an interactive, creative, and intuitive examination of the data, all in the search for patterns, themes, or emerging insights, each unfolding from the research process and grounded in the data …The data is analyzed and synthesized through a developmental process, continually evolving and emerging through constant comparison of newly acquired data with previously acquired materials.*
> *(Gerdes & Conn, 2001, p186-187)*

Transferability

A transparent process has been employed to carry out the research. Transferability is achieved by the inclusion of a detailed account of the research process. All surveys, interview questions, examples of written material used by the researcher during the parent education component of the research, are included in the appendix of this report. The research, by providing a rich description of the processes involved, could be replicated by other researchers.

Dependability and Confirmability

Guba (1981) suggests that there can be no credibility without dependability and that a demonstration of the former is sufficient to establish the latter. Dependability in this research has a strong link to the factors outlined in the section on credibility. The research process is fully supervised to ensure that the data within is dependable and can be justified. All tape recordings, transcripts, and written evidence have been submitted with the research documentation. This provides supervisors with records which provide a full audit trial.

> *Thus, a single audit, properly managed, can be used to determine dependability and confirmability simultaneously.*
> (Lincoln & Guba, 1985, p318.)

Data Collection Methods

Consistent with a research design based on a qualitative paradigm, various forms of data collection have been employed in this research: Interviews, written surveys, anecdotal evidence, field notes and transcripts from tape recordings. The measurement of attitudinal change was a key factor in determining the research methodology and the data collection tools that would be employed.

> *The task of measuring attitudes is not a simple one. What's more, attempting to demonstrate attitude change, as some evaluations require, is probably to most difficult of all evaluation tasks.*
> *(Heneron, Morris & Fitz-Gibbon, 1987, p11)*

Heneron et al (1987) suggest that although complex attitudes are difficult to measure, it is possible if the following precautions are noted and considered. Inference must be relied on, since it is impossible to measure attitudes directly. The focus needs to be on a range of behaviours, beliefs, and feelings, because to focus only on one manifestation of an attitude could distort the reality of a situation. Information needs to gathered on more than one occasion. The meaning of the term 'attitude' needs to be defined. In this research 'attitude' is used broadly to describe all the objectives that have to do with affect, feelings, values and beliefs.

According to Heneron et al (1987) interviews and oral surveys have advantages that make them popular attitude evaluation tools.

> *Interviews, in particular permit flexibility in several ways:*
> *Interviewers can clarify the questions and ensure that the respondent understands them. They make judgements as to whether or not the respondent has sufficient knowledge to answer the questions. New lines of inquiry can be pursued based on the comments of the respondent.*
> *They allow for an estimation of the strength of an attitude…*
> *(Heneron, Morris & Fitz-Gibbon, 1987, p25)*

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Interviews

As the researcher was acquainted with all the parents through her teaching role at Aotea School, an amiable relationship existed between the researcher and the parent participants prior to the commencement of the research.

> *Interviews are a crucial source of data for many research questions. The quality of the research interpretation and analysis depends upon the quality of the text generated in the interview. The text generated in an interview depends upon the relationship between the interviewer and the interviewee.*
> *(Limerick, Burgess-Limerick & Grace, 1996, p459)*

Care was taken to "devise questions whose meaning is bounded and stable…The researcher can deliver those questions so that the interviewee is not influenced by the delivery…" (Scheurich, 1995, p240).

All interviews were arranged at a time and place agreed by the participant, and care was taken to ensure that the participant felt as relaxed as possible prior to the interview commencing. Dexter (1970) suggested that an interview is a conversation with a purpose. The positive rapport that existed between the participants and the interviewer helped to promote the interview as a purposeful conservation between the researcher and the participant.

> *The purposes for doing an interview included, among others, obtaining here-and-now constructions of persons, events, activities, organizations, feelings motivations, claims, concerns, and other entities; reconstructions of such entities as experienced in the past; projections of such entities as they are experienced in the future…*
> *(Lincoln & Guba, 1985, p268)*

Written Questionnaires

Written questionnaires with rating scales were used as a tool to provide data on the understandings and attitudes of the participants. The information collated from the questionnaires was analysed and used to support data collected from the interviews. Combining the two data collection tools provided the researcher with more credible data.

The questionnaires were trialled on two parents, not directly involved in the study, to ensure that the questions could be understood and that they were able to be completed in a relatively short time frame. Several questions were reworded at this stage prior to giving these to the participants. A five point rating scale was used.

Figure 2: Sample Rating Scale

Sample Rating Scale

Excellent None at all

1_____2_____3_____4_____5

Note: Various descriptors were used on the scale depending on the context of the question:

Very Important – Not important

Very Confident – Not Confident

Very High – Very Low

Highly Agree – Strongly Disagree

As respondents rated themselves between these points for many of the questions, the data from the rating scales was analysed on the following basis:

1.0 - 2.4 Above average

2.5 - 3.5 Average

3.6 - 5.0 Below Average

Many of the questions from the first questionnaire were replicated in the second questionnaire to gather comparative data.

Anecdotal evidence

All parents were given a notebook to record any observations regarding the activities they were using, concerns or queries they may have, and milestones in their student's number understanding. They were asked to date all entries.

There was no compulsion on parents to use these, and many did not record any information in them. Parents who used these recorded a range of responses in the notebooks. They referred to their notes during the interviews with the researcher. Notes pertaining to the participant's student's progress that were recorded in the notebooks were used to substantiate the researcher's assessment of the student's number knowledge. Evaluative comments on the activities that were trailed by the participants were used when additional activities were suggested.

Field Notes and Transcripts

The researcher made field notes during parent interviews and numeracy assessment sessions with the students. Interviews were also recorded on audio tape, which were transcribed. The researcher had problems with the tape recorder during one day of interviews, which resulted in some recordings stopping prior to the completion of the interview. Field notes were used for these occasions.

Data Collection Procedures

In February 2004, all participants were sent a letter, requesting their participation; an information sheet about the research; and a consent form (see Appendix A). The researcher contacted parents to arrange a suitable time to attend an introductory seminar, at which the research process was outlined, queries regarding the research were answered, the research project timeline was highlighted and the expected commitment from each participant was explained in detail. Parents were reminded that they could withdraw from the project at any time.

Parents were asked to complete a written survey (see Appendix B) to gather data about their understanding of the role of parents in developing their student's number

knowledge, their ideas about the key activities for helping students gain number knowledge and the attitudes and mathematical achievement of the parent participant group. This information provided baseline data which was used as a comparison at the end of the research, when parents completed a second written survey (See Appendix B). At the completion of the initial survey, parents shared their mathematics experiences at school and reflected on their attitudes and the impact this could have on their students. This discussion was not prompted by the researcher. Field notes were taken by the researcher to record this discussion.

At the conclusion of the introductory seminar, when all surveys had been collected, background information to the numeracy project was outlined, and a brief summary of the numeracy knowledge and strategy stages was presented. Activities parents could use to foster number skill development were suggested as an introduction to the types of activities that would be explained in detail to parents during subsequent interviews with the researcher.

All meetings with parents were arranged at a time and venue that was suitable for them. Childcare arrangements were also offered, but not requested by the parents. Two alternative meeting times were arranged for the introductory seminar, one in the evening and one in the afternoon. The researcher also met with five parents individually for the introductory session.

Parents met with the researcher for individual interviews, three times during the data gathering process. The first interview was held mid-February, following the initial seminar. The second interview was held at the end of March and the final interview was held at the end of May. There were six to eight weeks between each interview.

The first interview was to clarify any comments from the survey, to ensure that the parent's intent was correctly reported. These comments were added to the survey responses with the agreement of the parents involved. Other focuses for the interview were to reinforce numeracy knowledge and strategy stages as applicable for their child

and to suggest activities and to provide resources that could be used at home to help develop their student's understanding of number.

The second interview was to clarify any queries that had arisen since the previous interview, to update the parent on the progress their student was making and to discuss activities that would be useful to support their student's skill level development. Numeracy assessments were undertaken with each student by the researcher prior to each interview, to provide the parent with accurate feedback concerning the student's number knowledge and to identify the future learning needs for each student. During the assessment prior to the second interview, the student was asked about their attitude towards mathematics and the activities they worked on at home and at school. The tape recording of this was played for each parent and the student's responses were discussed. Comments regarding the effectiveness of certain elements of the parent education programme were recorded and transcribed by the researcher.

The third interview, held at the end of the data gathering phase, was to give the researcher evaluative feedback on the programme and the activities used. This interview provided additional data to the second written survey, which was also completed during this time. All students were tested using the Numeracy Project Assessment Diagnostic Interview format and the results of this were discussed with parents in detail. Comparisons were made to show the progress that each student had made during the data gathering period. Parents were given further suggestions for activities to use to help support their student mathematically at the conclusion of the project.

Data Analysis

The rich data gathered during this project was analysed, using the constant comparative method of grounded theory as referred to by Glaser (1992). Comparisons have been made between the parents' attitudes, experiences, and understandings, and the same individuals at different points in time. Responses to written surveys, have been compared with data from oral questioning, conversation and comments made during interviews. Data has been compared within categories and with other categories. For example, a

comparison was made between the parents' personal mathematical experiences and the expectations they had for their student's mathematics. A comparison was also made between parents' experiences of mathematics at differing stages in their schooling.

Survey data from parents was recorded on summary sheets, analysed and reported using a table format. Due to the small sample, numbers rather than percentages of parents within each category were reported.

Comments to illustrate the parents' responses from audio taped interviews and field notes were used to illustrate patterns appearing in the data analysis. The comments recorded, covered the range of opinions expressed.

The data from the student's numeracy assessments was collated in a similar format to the national early numeracy research reports, in order for comparisons to be drawn. Although the validity of these comparisons could be questioned because of the small sample of students from which the data was drawn, the different demographics that are represented in the national data and the different timeframe for testing, it was useful to compare this group of year 0-2 students, with the national sample of year 0-2 students. The comparisons between the gains in numeracy knowledge and strategy levels provided data for further analysis. Comparative percentages have been used to discuss similar and differing trends between the national and the project data. The progress made by students on the number framework, was attributed to both the programme implemented by parents and the classroom mathematics programme. The student's numeracy assessment data over the duration of the project was a useful analysis tool to identify the future learning needs for each student. The activities suggested to parents were based on this.

Support Materials for Parents

At the first interview all parents were given a reference sheet summarising the numeracy knowledge and strategy stages, written information outlining activities that could be used at home which were suited to their student's level and a 1-100 number line. They were shown resources that could be made from 'recyclable material' i.e. cereal box cardboard,

or from very inexpensive items easily obtained from local shops, which would be useful in developing number understanding. All activities were demonstrated and details for using these were recorded on activity sheets for future reference (See Appendix D). Parents were also given a sheet outlining specific learning focuses, aimed at moving their student to the next numeracy strategy level. (See Appendix D)

At the second interview the parents were given additional activities to support the development of number knowledge at their student's level, website links to on-line maths games and a CD containing several maths games the researcher had sourced from the internet. An assessment of their student's achievement against the learning focuses that had been identified previously was recorded and the new learning focuses listed.

At the third interview the parents were given an updated record of their student's achievement against previous learning focuses, and a list of future learning focuses was included. All resource material that had been offered to parents was reviewed at this stage.

Ethical Considerations

Approval to conduct the research was first obtained from the Dunedin College of Education's research and ethic's committee.

The researcher obtained permission from participating parents for their involvement in the project; the Principal, the Board of Trustees, and the teachers from whose classes the students were drawn. A copy of the information sheets and consent forms are included as Appendix A.

Child care considerations were offered, to assist parent participation in the project. Interview times and venues were arranged to suit parents. It was intended that all participants in the research should benefit from the project – students, parents and teachers. Survey results and trends were given to the parents, principal, Board of Trustees and the teachers at the end of the study, prior to the publication of results.

Participating parents, Principal and Aotea School Board of Trustees will be given a copy of the completed research. Participants are not identified by name in any reported data. Substitute names are used, where names are included in any transcript of data or in narratives. Confidentiality was upheld throughout the project.

Parents were informed of their right to withdraw from the research at any stage, and they were told that at no stage was it compulsory to answer either written or interview questions.

Chapter 4: Student Outcomes

This chapter reports on the achievement of the student participants over the duration of the project. Data was gathered from three assessments; at the commencement of the project, mid way through the project, and at the end of the project. It also reports on the students' feelings towards mathematics and the activities they enjoy working on. The results reported in this chapter exclude the student with special needs because of her communication difficulties and her low emergent level of mathematics.

The first section reports on students' achievement data. The second section discusses the students' feelings and attitudes towards mathematics, and the third section provides a summary of the impact of the project on the students.

Student Achievement Data

In this section comparisons have been made between the numeracy assessment results of the participant group of year 0-2 students and national results accessed from the Numeracy Project database in January 2004, for the year 0-2 students involved in the ENP in 2003.[1]

Although the difference in sample sizes and demographics affects the validity of these comparisons, the cohorts were from a similar age range and the same numeracy assessment was administered. The researcher acknowledges that the national sample consists of 32748 students, attending schools from regions throughout New Zealand and

[1] Andrew Tagg, co-author of the report, 'An Evaluation of the Early Numeracy Project 2003, accessed this data on the researcher's behalf. The information was conveyed by personal communication via e-mails on October 15, 2004 and October 18, 2004. The data relates to 2003 ENP results, downloaded on January 19, 2004. The data included in the ENP 2003 report came from an earlier download. Not all teachers had inputted their results in time for this report. Hence the sample number of year 0 to 2 children is higher in the data quoted in this research.

with different decile rankings[2], whereas the seventeen Aotea School children are from a decile eight rural school with less than one hundred and fifty pupils. The national data has been included to provide a reference against which to compare achievement levels and also to compare gains made by the project group. These gain comparisons were made by comparing the progress of students at the same starting points on the number framework. Comparing the progress of students with the same starting stage increases the validity of the comparative data (Thomas and Tagg, 2003). The participant group of students from Aotea School will be referred to as the project group and the ENP students will be referred to as the national group during this chapter.

Student Achievement on the Additive Strategy Domain

At the start of the project six children from the project group were assessed at Stage 0 or Stage 1 on the number framework which indicates they were unable to add two sets of objects. All of these students were able to at least count from one to add two sets of objects (Stage 2) by the end of the project. Ten of the seventeen students started the project at Stage 2. All but two of these students increased the stage they were working on by at least one level. By the end of the project eleven students were able to either count forwards and backwards to solve addition and subtraction problems (Stage 4), or use basic facts or place value knowledge to calculate the answer by reasoning (Stage 5).

The starting points for the students from the national group were similar, with the majority of year 0-2 students assessed at Stage 2. The final assessments show that the project group made greater gains on the additive domain, with 65% of this group assessed at Stage 4 or higher compared with 41% of the national group. Table 1 shows the percentages of both groups at each stage of the additive domain at the initial and final assessments.

[2] A school's decile indicates the extent to which a school draws its students from low socio-economic communities. Decile 1 schools are the 10% of schools with the highest proportion of students from low socio-economic communities, whereas decile 10 schools are the 10% of schools with the lowest proportion of these students. A school's decile does not indicate the overall socio-economic mix of the school. (Ministry of Education, 2004e)

Table 1: National / Project Comparison: Additive Stage for Year 0- 2 Students

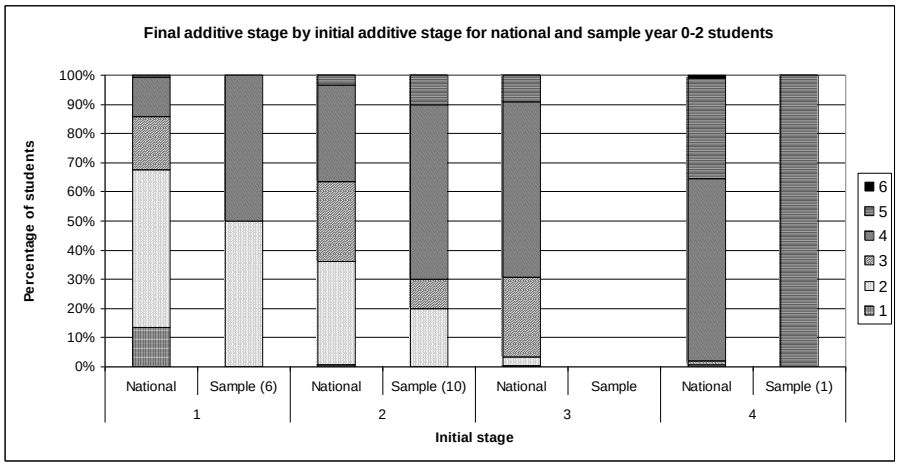
National/Project Additive Comparison Y0-2				
Stage	Initial		Final	
	ENP %	Project	ENP %	Project
0	10%	0%	2%	0%
1	19%	35%	6%	0%
2	45%	59%	31%	29%
3	12%	0%	20%	6%
4	13%	6%	33%	53%
5	1%	0%	8%	12%
6	0%	0%	0%	0%
N=	32748	17	32748	17

Of the project group, only two (12%) of the seventeen students remained at the same strategy level, five (30%) moved up one strategy level, six (35%) moved up two strategy levels and four (24%) moved up three strategy levels. Three of the six students who were unable to add two numbers together (Stage 2), at the commencement of the project, were able to count on or back to solve addition and subtraction problems (Stage 4), by the end of the project. Only one student was able to use advanced counting initially. This student applied his knowledge of basic facts and place value to solve addition and subtraction problems by the end of the project. The majority of the project group, ten children (59%), moved up two or more levels compared with 29% of the national group.

Figure 1 provides graphical representation of the comparative data between the national sample and the project sample. It shows percentages of students, from both samples, at each stage of the framework at the final assessment in relation to their starting stage. The numbers of students in the project group, starting at each stage are given in brackets. Figure 3 illustrates that the project group made greater gains from each of the strategy levels where comparisons were possible. There were no children from the project group

starting at Stage 3, which is represented by a blank on the bar graph. Stage 0 has not been included on the graph as there were no project group students at this level.

Figure 3: Final additive stage by initial additive stage for national and sample year 0-2 students



Student Achievement on the Forward Number Word Sequence (FNWS) Domain

Initial assessment results show that thirteen students (77%) of the project group were at least able to produce the number just after a number in the range of one to twenty (Stage 3). All but two of these students had increased their FNWS knowledge by the end of the project, and were able to produce the number just after a given number in the range one to one hundred (Stage 4). The three students who were assessed as being unable to produce the number just after a given number in the range one to ten (Stage 2), had moved to Stage 3 by the end of the project. Many activities worked on at home were related to numeral sequence and order. FNWS was an area of focus for every student, with the goal of increasing their number knowledge and moving them to the next stage on all domains. Table 2 shows the percentages of both the national and the project groups at each stage of the FNWS domain based on the initial and final assessments.

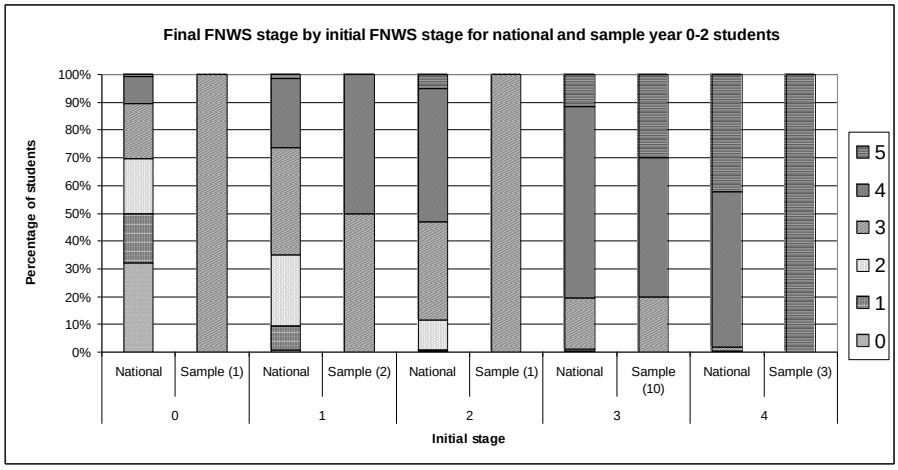
Table 2: National / Project Comparison: FNWS Stage for Year 0-2 Students

National/Project FNWS Comparison Y0-2				
Stage	Initial		Final	
	ENP %	Project	ENP %	Project
0	7%	6%	3%	0%
1	16%	12%	3%	0%
2	27%	6%	9%	6%
3	24%	59%	22%	24%
4	23%	18%	47%	41%
5	3%	0%	16%	29%
6	0%	0%	1%	0%
N=	32748	17	32748	17

All but two students in the project group moved up at least one stage. Of the ten students in the project group who were at Stage 3 at the beginning of the project, two remained at the same level, five moved up one stage and three moved up two stages. The two students who remained at Stage 3 were developing knowledge of numbers to one hundred, and although they hadn't mastered this, they could give the number just after a number to fifty by the final assessment.

Whilst similar patterns emerged from the national data, a greater percentage of national students remained at the same level, 22% compared with 12% from the project group. A smaller percentage of national students gained two or more levels, 29% compared to 36%. Figure 4 shows the percentage of students, from both samples, at each stage of the FNWS domain at the final assessment in relation to their starting point.

Figure 4: Final FNWS stage by initial FNWS stage for national and sample year 0-2 students



Student Achievement on the Backward Number Word Sequence (BNWS) Domain

Comparisons between the initial and final assessment on the BNWS domain show that this was the area of highest gain overall for the project group. At the beginning of the project thirteen out of seventeen of the students (77%) could not give the number before a number beyond ten without dropping back. At the end of the project only three students (18%) could not achieve this. The final assessment shows that twelve of the students (71%) could give the number before any number to 100 at least (Stage 4 and above).

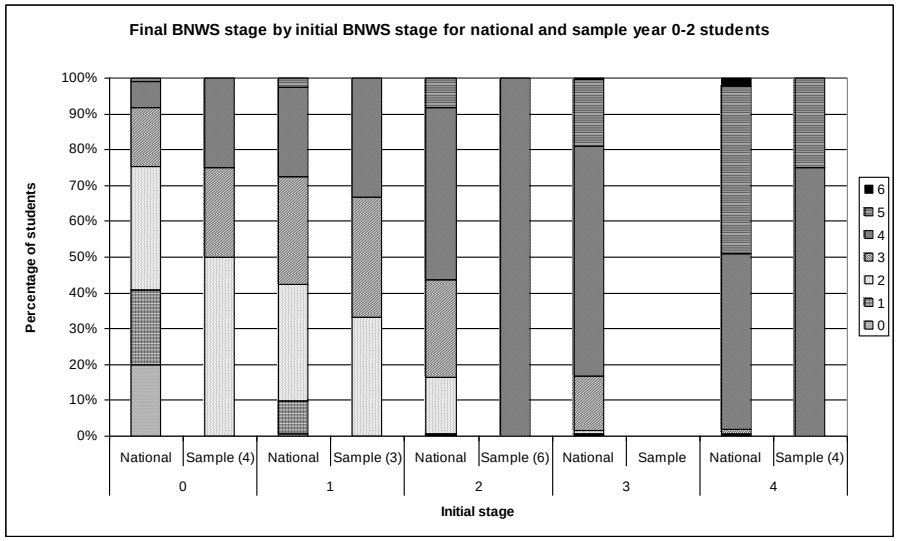
Although the starting points for the national group were similar, in terms of percentages of students at each level, the gains on the BNWS domain were not as high for the national group, with the 51% of the national sample able to give the number before any number to 100 at least (Stage 4 and above) compared to 71% of the project sample. Table 3 shows the percentages of both the national and the project groups on each stage of the BNWS domain based on the initial and final assessments.

Table 3: National / Project Year 0-2 Comparison: BNWS Stage

National/Project BNWS Comparison Y0-2				
Stage	Initial		Final	
	ENP %	Project	ENP %	Project
0	21%	24%	5%	0%
1	18%	18%	6%	0%
2	31%	35%	18%	18%
3	13%	0%	20%	12%
4	14%	24%	36%	65%
5	3%	0%	14%	6%
6	0%	0%	1%	0%
N=	32748	17	32748	17

Seventy-one percent of the project group have gained at least two stages on the BNWS domain at the end of the project compared with 59% of the national group. The greatest gains have been made on the lower stages of the domain, which support Thomas and Tagg's (2003) findings. The gains for the project group at the lower stages of this domain (Stages 0 - 2) are higher than the gains shown for the national group. Three of the four students from the project group who were initially assessed at Stage 4 of BNWS remained at this stage throughout the project. It was suggested by the researcher that the parents of these children should use activities to support the instant recall of groupings to twenty, place value knowledge and advanced counting strategies. These were the areas identified by the researcher as the key areas of learning need as the students had a sound knowledge of number sequences and order to one hundred, but had limited knowledge in other areas. Figure 5 shows the percentage of students, from both samples, at each stage of the BNWS domain at the final assessment in relation to their starting point.

Figure 5: Final BNWS stage by initial BNWS stage for national and sample year 0-2 students



Student Achievement on the Numeral Identification Domain

Numeral identification was a knowledge area that parents found easy to target with their children. Parents tended to seek out a variety of activities to support the development of numeral identification. For instance, one parent used the numerals from old calendars, and another used the page numbers of books. All parents received a handout outlining a range of activities that they could apply to increase knowledge on this domain.

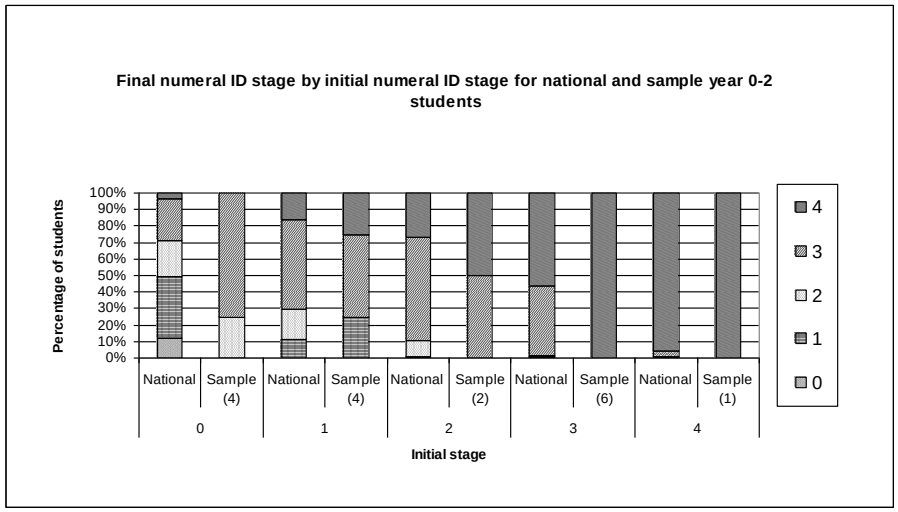
At the end of the project only two of the seventeen students from the project group could not recognise numbers to 100, compared with eight students at the beginning. Both the national and project groups made similar progress on this domain. Eighty eight percent of students from the project sample and 82% of students from the national sample could recognise numbers to 100 at the final assessment. Table 4 shows the percentages of both the national and the project groups at each stage of the Numeral Identification domain based on the initial and final assessments. It is clear from Table 4 that there is very little difference between the gains made by both groups at all stages of the Numeral Identification domain.

Table 4: National / Project Year 0-2 Comparison: Numeral Identification Stage

National/Project Num ID Comparison Y0-2				
Stage	Initial		Final	
	ENP %	Project	ENP %	Project
0	12%	24%	2%	0%
1	25%	24%	7%	6%
2	16%	12%	9%	6%
3	29%	35%	35%	35%
4	8%	6%	26%	53%
Not Assessed	9%	0%	21%	0%
N=	32748	17	32748	17

The greatest differences between the national and project groups are the higher gains achieved by the project group at Stage 0 and Stage 3 of this domain. Of the four students from the project group initially assessed as being unable to identify most of the numerals to ten, three (18%) could recognise numbers to hundred by the end of the project, compared with 3% of the national group. The six students (35%) from the project group who were initially assessed as recognising numerals to one hundred were all able to recognise the numerals to 1000 by the final assessment, compared to 13% of the national group. Figure 6 shows the percentage of students, from both samples, at each stage of the Numeral Identification domain at the final assessment in relation to their starting point.

Figure 6: Final Numeral ID Stage by Initial Numeral ID Stage for National and Sample Year 0-2 Students



The interdependence between numeracy strategies and number knowledge has been reported consistently in the research (Young-Loveridge and Wright, 2002; Thomas and Tagg, 2003). This correlation between knowledge and strategy was highlighted during the parent education sessions to ensure that parents understood the importance of establishing a strong understanding of number knowledge. The assessment results from this research show that all students have made substantial gains on the knowledge domains, which are reflected by the gains also made on the additive strategy domain. This replicates the findings of Thomas and Tagg (2003). There also appears to be a link between the activities worked on at home and the gains made by the project students.

Just as the ENP focused teachers' attention on the number knowledge required to support each strategy stage, the parent education programme focused parents on the importance of developing students' number knowledge. In the numeracy evaluations Higgins (2001, 2002) and Thomas and Ward (2001, 2002) reported on the impact of focusing teachers' professional development on pedagogical content and knowledge in mathematics. Teachers who participated in the numeracy projects have reported that this knowledge

has increased their confidence in, and enthusiasm for the teaching of mathematics. The teachers believe that this has resulted in higher expectations for students and increased mathematics achievement. This project has applied the same philosophy to the parent participants through the parent education programme. Although the student gains can be attributed both to the classroom mathematics programme and parent involvement, the greatest gains are on the knowledge domains which have been major focus areas for the work with parents. These gains may be reasonably attributed to parent involvement. As resources for parents included many activities which were based on number order and sequence, it seems that the parents' role was a vital one in fostering these gains.

Student Perspective – Feelings and Attitudes

Prior to the second student assessment, each student was asked to share their feelings about mathematics, their perception of the areas of mathematics that they were good at, the activities they enjoyed, and the areas that they considered they would like to get better at. The audio taped interviews were played for parents, and used as a stimulus to promote further discussion on the students' achievement. The researcher did not clarify the meaning of mathematics with the students prior to asking them questions about the feelings about mathematics. However the responses from most students showed that they linked 'mathematics' to activities based on the use of number.

Enjoyment of Mathematics

All but three of the students were positive about mathematics. The reasons they gave varied but were all based on activities in which they felt successful. These included counting, adding, using mathematics equipment, being challenged, and learning new things. Of the three students who disliked mathematics, one felt it was boring, one did not like to write numbers, and one did not like having to solve problems independently. The following parent comments, made after listening to an audio tape of their child's responses to the researcher's question, "Do you enjoy mathematics?" show that parents have a depth of understanding about their children's attitudes and feelings.

Student 1: Not really, because you always have to like, figure it out and sometimes you don't know and you have to, just do it.

Parent 1: *She likes to be correct and if she is not sure she worries. She tends to give up when she finds things difficult. She usually grasps things quickly, but sometimes it needs to be explained in a different way. Sometimes I have to spend a lot of time on her homework to encourage her and help her understand. She is just like me.*

Student 2: *Yes. Cause it's hard really. I like hard things. You know there's counting back from stuff like 100. I like doing that.*

Parent 2: *[Student] likes to be challenged. She can do more things than I thought she could. She loves that. She thinks in a maths way, quite logically. She wants to work out answers herself.*

The following student had a very limited knowledge of maths concepts when he was first assessed. He could count from one to ten, but he could not count forwards or backwards from any other given number, nor could he read or write numbers to ten. When choosing activities in the classroom he would select games that did not require numeral identification. He did not appear interested in numbers. A variety of activities were suggested to his mother to trial at home, using equipment that the student would not normally relate to maths: pipe cleaners, counting objects like leaves, shells etc, and dice and board games. His increased confidence and enthusiasm for maths was evident in his response and the subsequent response from his mother. This comment was made mid-way through the project.

Student 3 : *Yes. I like how you can do numbers. I like counting.*

Parent 3: *I am surprised that he said he likes maths. He refused to do any of the activities you gave us at first, but now he is starting to use the things in his maths box. I never forced him, I would just leave it when he got annoyed or angry. But every now or then I would say would you like to play this [student] and he would play it for a little while.*

Researcher: *Why do you think he has changed his attitude?*

Parent 3: *Perhaps now he knows he can count better and recognise most of the numbers to ten. He wasn't interested before. Perhaps it was just too hard for him and he wasn't ready. It helped that [sibling] would get some of the things out. He would watch and want to join in.*

The researcher used the student's comments to target activities that would cater for their learning needs. She took particular care when the student showed disinterest or a negative attitude, to ensure that a variety of activities were suggested, in order for parents to find an activity that would 'hook' the student into learning. Games and equipment that were appropriately challenging for the student were pivotal to this. This is supported by Peters' (1993) research which showed that students disliked maths games that were too easy, too hard or boring. The research by Peters (1993) also stressed the importance of regularly changing the games and activities students are working on to maintain their interest and enthusiasm. The researcher stressed to parents the importance of selecting a variety of activities that were at the student's level. For instance, students who could not count backwards from a given number would have difficulty with subtraction. They were given activities focused on increasing their backwards number word sequence knowledge, first to ten, then twenty, then beyond. The following comment was made by a student who enjoyed maths but who struggled with subtraction. Her mother had contacted the researcher to seek out additional activities to help her child with this concept because she was concerned about the lack of progress being made in this area. The mother worked with her child on a daily basis, using games and activities that her child enjoyed. She explained that she only introduced new concepts when her child seemed to be confident with the previous ones. She used sequential activities from a handout sheet, suited to the student's strategy level. When the student was interviewed and asked the same question, "Do you enjoy mathematics?" her enthusiasm towards the maths activities she was doing at home, was not only evident in her responses, but also in the exuberance of her answers and her body language.

Student 4: *Yes, but I don't know how to do take-aways. I like doing 7+14, adding things together … It is fun trying to count back from forty.*

Parent 4: *Yes [Student] really has enjoyed the activities. She likes doing maths things at home. She likes adding. She can do these without her hands now [imaging]. I know she doesn't like take-aways but it hasn't put her off maths. She can take away numbers to ten but she can't do it from bigger numbers. She enjoys counting back using the number line and can do these past twenty now.*

The mother stated that she was committed to respond positively during these mathematics sessions at home. She could see a direct link between her student's ability to count backwards and subtraction. She now understood that once her student could visualise numbers and count backwards from any number to hundred, she could use this knowledge to count back from a number to solve subtraction problems. The parent's positive attitude and enthusiasm towards the activities appeared to be having a positive impact on the student.

The students were asked about the activities that they liked working on at home and school. When comparing their responses about school and home based activities, eleven of the seventeen students responded in greater detail when asked about the activities they enjoyed working on at home. Three children responded in greater detail about activities at school and three children responded similarly. The home activities mentioned were closely connected to the number activities that had been shared with their parents as part of this project. A selection of their responses is contained in Table 5.

Table 5: Activities Students Enjoy – Comparison Between Home and School

Student	Activities enjoyed at school	Activities enjoyed at home
Student 5	*Games like bingo*	*I like doing counting with dots [dot-to-dot books]. I like counting to 100 with it.*
Student 6	*Doing the activities, the Dalmatian puzzles [matching – same and different puzzle]*	*Lots of things. Playing cards. I play all sorts of [counting and adding] games. I like playing fish. I have got my own cards. [Mother would ask the child to add the pairs together to reinforce doubles.]*
Student 1	*Playing bingo. We have got maths bingo. People call out numbers and you have to think and put them on the board.*	*Mum has got all this maths stuff and she will say to me, "Well, Laura went to the pet shop and she got three kittens," and stuff [solving number stories]. She bought me this number thing [number line]. It goes from one up to one hundred and she says to me, "Where is this number?" [find the number of the number line]*
Student 2	*Counting forwards and stuff.*	*I get my Mum to write down some **hard** maths things that I have to work out what the answer is. She does things like 20+20 and that [patterns with doubles, instant groupings to 20].*
Student 7	*I like playing with the rods … playing games with counters.*	*A counting thing. It counts right up to 100. It is a yellow thing that has numbers on it [number line]. I like finding numbers on it.*

Students' Learning Focus

At the commencement of the second assessment session, the students were asked to identify the areas of mathematics in which that they would like to improve. All but one response could be linked to the students' learning focus which was outlined with parents during the first interview session. The ability of the students to articulate their own learning goals, and talk about the activities they were using to achieve these, appears to be influenced by the activities they have been working on at home. The following

students' comments are illustrative of this. These students were learning to count with numbers to 100 and beyond, backwards and forwards.

Learning stuff like up to high. I would like to count up to a thillion [trillion].

Counting more, like counting backwards and stuff.

Counting forwards up to 100

Counting. Bigger numbers than 100.

The following comments are from students who were learning to count on and back to solve addition and subtraction problems with numbers greater than twenty.

Adding things from 100.
Taking away [subtraction] with big numbers [more than 20].
Doing pluses with numbers far away from one and two.
Sub-traps [subtracting] with big numbers.

During the individual sessions with parents, the researcher focused on their understanding of why it was important to develop strategies and number knowledge. The number framework information given to parents highlighted the need to consider learning progressions and to target activities that would cater for the learning needs specific to their child. Parents were asked to ensure that their children understood the reason for practising a skill in order to make the learning more meaningful and relevant to them. Identifying the learning focus for the child follows the approach by Clarke (2003) who suggests that students who understand why they are focusing on an aspect of learning, and what they expect to achieve as a result of this, will achieve better results. Clarke (2003) also states that if students are directly involved in this process the gains will be greater. The researcher explained this philosophy to the parents, to ensure that they had a clear understanding of the learning needs for their child. The future learning focus was identified following each assessment.

The researcher gave feedback to each child, at the time of the assessment, on the achievement of the previous learning focuses and involved the child in identifying the

next step for their learning. The following comment is illustrative of a child who has developed an understanding of numbers to 100.

Researcher: *I am really impressed. You can now count read all these numbers and you know all the numbers before and after [numbers to 100]. What do you think you could practice now?*

Student 5 : *I could try to say bigger numbers. I can count to 300. I could practice the big hundreds numbers.*

At the initial assessment the following student was unable to instantly give answers to addition problems with numbers to ten. One of the learning focuses for this student was to develop instant recall of doubles to five. The following conversation is an extract from the dialogue between the researcher and the student, showing how the student is encouraged to identify his next learning step.

Researcher: *You gave me the answers to those doubles really fast. [Doubles to 5]. What could you work on now?*

Student 2: *I nearly know 6 + 6. I just have to think about it a bit.*

Researcher: *Yes, I know you do.*

Student 2: *I will know it next time I see you. I will try to know the harder ones too, like 9 + 9. That will help me get better at maths. I will be able to play those games better. [Bingo and Double Trouble] … I am getting better now. I just know the answer to lots of pluses.*

Some of the students were focused on moving to the next strategy level. The following conversation is between the researcher and a student, who at the initial assessment could join sets together by counting on his fingers. His focus was to practice activities that would help him to visualise the sets when adding them together.

Researcher: *You can work out that problem really quickly now. You only looked at your fingers a little bit.*

Student 8: *Yes. I can even put my hands behind my back and think about the answer now. I have been brain counting sometimes.*

Researcher: *Show me.*

The researcher asked the student to solve five and three, which the student solved with his hands behind his back.

Student 8: *That was easy.*

Researcher: *What could you practice now?*

Student 8: *Not using my hands at all. I can just think of the numbers in my brain.*

When reporting to parents about their child's assessment, relevant information regarding the learning focuses that had been discussed between the researcher and the student was passed on. During chapter five, parent feedback regarding the value of the learning focus sheets is discussed.

Following every assessment session, copies of all information given to parents and a copy of the assessment results were passed to their class teachers. The researcher met with the teachers to discuss the progress of each child and the areas on which the parents were asked to focus. This ensured that there was ongoing feedback regarding the students' achievement throughout the project. The teachers' classroom programme, during the project period, whilst primarily based on the number framework, also included the topic teaching of other mathematics strands; statistics, geometry and measurement.

Summary of the Impact of the Project on the Students.

The achievement data clearly shows that all students have made gains on the number framework over the duration of the project. The enthusiasm shown by the children towards their growing knowledge, their ability to identify their own learning needs and their keenness to share their new skills, appeared to increase with each assessment. The project students would often informally approach the researcher, both in and out of school-time, to share the increased knowledge that they had acquired. One child very excitedly approached the researcher, out of school hours, to tell her that she could count backwards from one hundred and insisted that these skills were demonstrated. Another group of children targeted the researcher in the school playground to demonstrate their instant responses to doubles.

Higgins (2002) and Thomas and Ward (2002), in their evaluations of the numeracy projects, found that teachers' believed that their improved content knowledge of mathematics had a positive impact of their students. It seems that there are similarities

in the findings of the ENP research and this research. Parents' improved content knowledge appeared to have a positive impact on their children, as demonstrated by the feedback from the children, and the gains they have made on the number framework. The increased confidence shown by parents, as reported in chapter five, towards helping their child with mathematics appears to have had a direct impact on student achievement.

Parents reported that their children were more enthusiastic about mathematics as a result of the extra emphasis placed on numeracy activities in the home. The majority of children regularly sought out mathematics activities and games to work on at home over the duration of the project. The researcher believes that the challenge is to maintain this involvement. Young-Loveridge (2004) supports this view. She states that students would benefit from family/whanau support and suggests that this is a dimension that educators need to explore further.

Chapter 5: Impact of Participation on Parent Attitudes

This is the first of two results chapters reporting on the impact of the project on parents. It reports on the data gathered from the initial and final written surveys and the interviews with parents. The surveys and interviews were designed to investigate parent understanding of, confidence in, and attitude towards numeracy. More specifically this chapter addressed the following research questions:

How is parent attitude and confidence linked to their mathematical experiences at school and their achievement in mathematics?

Has parent knowledge of the development of number understanding and their attitude to mathematics changed as a result of participation in this project?

Has parent confidence towards helping their child in mathematics changed as a result of participation in this project?

Mathematics Experiences of Parents

At the commencement of the research, the eighteen parents were asked to complete a written survey about their mathematical experiences, their achievement in mathematics and their attitude towards mathematics. There is no comparative end of project data for this section as the attitudes parents have towards their own learning and ability were not considered likely to change as a result of participation in this project.

When they had completed this survey, parents were keen to share their experiences of mathematics with the group. For all but two parents, negative experiences, particularly at secondary school, were the ones that were related. There appeared to be a connection between these and their feelings of inadequacies when helping their children with maths.

The following comments are a selection of the negative experiences expressed by parents during the introductory seminar.

> *I was never any good at maths and [child] is just like me.*
>
> *My children haven't got a chance. I am hopeless [at maths]..*
>
> *I got the strap for making mistakes with my times tables in standard four.*
>
> *I enjoyed maths at primary school but when I got to secondary school I was useless. I hated maths.*
>
> *I can't help my children with maths because I can't do a lot of things. I don't how to help them. [Husband)] always has to help with maths.*
>
> *I don't understand the way you do things at school. It is so different to the way I learnt. I have tried to teach [child] my way but they just seem to get mixed up and then we argue.*

When asked by the researcher if they lacked confidence to help their child with literacy subjects, all parents stated that they felt more confident when helping with reading and writing and that most homework activities were focused on literacy activities. This evoked a period of discussion. There was a general agreement that they had not considered the importance of spending an equal amount of time on numeracy activities. They felt that there needed to be a greater emphasis on providing positive mathematics experiences in the home, if the negative attitudes parents held, were going to be overcome. The following comments from parents illustrate the greater emphasis given to literacy in the homes at the beginning of the project.

> *I always listen to [child] reading and help him with his spelling. I sometimes get him to count but not very often.*
>
> *We have alphabet friezes on the wall. I should put number ones up there too. I will get a counting chart.*
>
> *I just don't think about maths at home. We play eye spy to help (child) learn her alphabet. I should be thinking of games to play like asking her to find numbers in books and things, and practising counting and adding. She can write her name but she can't write numbers.*

Although fourteen out of eighteen parents had been regular helpers within the classroom and had some understanding of the junior school numeracy programme, they had minimal knowledge of the numeracy stages. [3]These stages were introduced with examples in order to enable parents to link the achievement of their child with the numeracy stages of the number framework. A summary of knowledge and strategy stages was given to parents at the conclusion of the session for future reference (see Appendix B). Parents were keen to learn more about the activities that they could use to support their child's learning in the home.

The following sections summarise the results from the initial written survey for parents. These results provide information on the parents' qualifications in mathematics, their mathematics experiences at school, and their feelings and attitudes towards mathematics.

Mathematics Achievement

Fifteen out of eighteen parents had gained mathematics qualifications at school certificate level or higher. For six of the participants school certificate was the highest qualification gained. Five of the participants had gained a sixth form qualification and four of the participants had gained tertiary qualifications in mathematics. One of these participants, although not gaining school certificate at school, now has a diploma in accounting. One has qualifications in mathematics from a polytechnic, one an accounting degree and one a pharmaceutical degree.

Only three parents have not attained any mathematics qualifications. This is a noteworthy fact, because although half of the group holds a sixth form qualification or tertiary qualification in mathematics, the initial survey indicated that they lacked confidence in helping their children with mathematics, even in the first three years of schooling. When asked how confident they felt about helping their child with mathematics throughout their schooling, only three parents rated themselves as being very confident in helping their junior school child, two parents rated themselves as being

[3]Diagrams and extracts from the Ministry of Education (2004). Book 1. The Number Framework. (pp 3, 4) were transferred onto charts to use at the seminars.

very confident to help their primary school child, and no parents rated themselves as being very confident to help their secondary child. In the researcher's opinion, at the commencement of the research, this group of parents had a low perception of their ability to help their children with mathematics throughout their schooling, compared to their level of mathematical achievement and ability. This project had a major impact on the level of parent confidence in helping their children with maths. These results are fully discussed later in the chapter.

Parent Attitudes Towards Mathematics

Parent responses to the initial survey, about their feelings and attitude towards mathematics is analysed in this section. Table 6 shows the numbers of the parent responses in each category, their feelings towards mathematics, their experiences during primary and secondary school, attitude towards and confidence in mathematics.

Table 6: Mathematics Experiences of Parents

N=18	Above Average	Average	Below Average
Feeling towards maths	6	8	4
Rating - maths experiences at primary school	9	4	5
Rating- maths experiences at secondary school	5	4	9
Confidence in maths	4	7	7
Ability in maths	4	8	6

One third of parents rated their enjoyment in mathematics as above average. All these parents gained at least a sixth form qualification in mathematics. Of the four parents who did not like mathematics at all, two have not gained any formal mathematics

qualification, and two have school certificate maths. When asked about their reasons for the dislike of mathematics, all four of these parents told stories connected with failing in class and feeling ostracised by their teachers. A common thread to their stories was that they felt their teachers were not able to explain how to work out the maths problems with which they were having difficulty. All four became very reluctant to seek help for fear of being put down in front of their classmates. They agreed that they did not have a sound understanding of numbers, and that they would have been at the lower end of the of the number knowledge and strategy levels as outlined during the first parents' seminar. They could now understand why the rules and shortcuts they had been expected to learn, did not help them with problem solving.

The following stories from two of these parents illustrate how inadequate they felt. They also highlight the importance of learning mathematics with understanding.

> *I learnt my times tables but I never understood until now that times meant groups of things. I found long multiplication hard, and division even harder. My teacher used to shout at me, and tell me that I wasn't listening when he showed the class the rules for long multiplication. I felt really dumb. I got it in the end, but I could only work out problems that were set out as a multiplication sums. I couldn't work out the ones with words. I managed to pass school certificate, but only just, I got 51%, by learning rules. I hated my teachers at secondary school. I can now see that if I understood things about adding and multiplication better at primary school, I might have been able to understand the harder maths.*

> *I could never do maths. I was useless. I would try but I just couldn't get it. My mum would say, "You will be alright. You can read really well, write neatly and spell things well. You don't need maths anyway. I couldn't do maths either." This sort of made me think that it was okay to be bad at maths, but my teachers didn't think so. They would go on and on. I felt like they blamed me. I now realise that perhaps they should have taught me differently. I was always in the group of dummies. We either got real easy work, or given other things to do when the maths was too hard for us. That didn't help us get better. I never really understood anything. I had to sit school certificate maths and that was embarrassing. I won't tell you what I got.*

When parents talked about their own experiences it made them realise the importance of being positive about maths for their children and providing as much support as they could. The researcher was able to relate her experiences to parents also. As a learner, the researcher had positive and successful experiences in mathematics until university. She

was able to rote learn rules and apply formulae, but when she went to university she realised that she lacked an in depth understanding of many basic concepts. Family and teachers had high expectations of her success, and she had not met these. Although this bad experience had been detrimental to her self esteem, her interest in mathematics was resumed during her teacher training. Learning how to help children develop an understanding of number had helped broaden her understanding, discovering better ways for applying this mathematics knowledge to problems.

The informal discussions amongst parents appeared to be a catalyst to help parents reflect on the impact of their attitudes on their children. Their view that parents' and teachers' negative attitudes towards mathematics could have a detrimental effect on children, is consistent with the research of Wilkins (2003), Bottle (1998) and Gutbezahl (1995). Parents acknowledged that they had conveyed their feelings about mathematics to their children through their responses during mathematics homework and the interest and enthusiasm they showed towards number activities. Three parents who enjoyed mathematics, talked about the activities they worked on with their children; playing number games, talking about mathematics in a range of meaningful contexts with their child, and seeking out opportunities to explore mathematics concepts. Parents with negative attitudes, explained that although they had spent time counting with their children they did not consciously seek out activities that would promote mathematical understanding. Parents expressed their support of this project, as it was making them more aware of the importance of fostering positive attitudes towards maths.

Parent Experiences in Mathematics - Primary and Secondary School

There was a significant difference between the rankings of mathematics experiences at primary and secondary school. Nine parents, half of the participant group, rated their enjoyment of mathematics at primary school as above average. Conversely, nine parents rated their enjoyment of secondary mathematics as below average.

The following comments from parents give examples of the reasons given for the change in enjoyment between primary and secondary mathematics.

Maths got too hard. I couldn't understand it. I just gave up.

I was alright with basic maths but when I had to learn about formula and things I couldn't do it any more. Logarithms and trigonometry meant nothing to me.

The teachers couldn't explain things so that I would understand.

Apart from one instant, parents rated their level of confidence identically to their ability in mathematics. On the other hand, sixteen parents, rated their feelings about mathematics at least one level higher than their ability in mathematics. From this data it appears that there is a more direct link between ability and confidence than between ability and feelings of enjoyment.

Parent Understanding: Children's Numeracy Development.

During the initial survey parents were asked to define numeracy. This question was not included in the final survey because the purpose of the question was to ensure all parents had a common understanding of numeracy, as defined in this project from the outset. After answering this question parents had time to compare their definitions and clarify their understanding.

Although there were a range of responses most parents had similar understandings of numeracy as used within the Numeracy Project. Their understandings included developing an understanding of number; calculating accurately, efficiently and confidently; and to develop the ability and the inclination to use mathematics to solve problems in a range of contexts.

The following parent responses are illustrative of the definitions from parents who define numeracy in a broad sense, relating numeracy to any activity using numbers.

Being number literate i.e. number literacy; any activity relating to numbers.

The way we use numbers and our comprehension of them – addition subtraction, statistics, patterns

Numbers, methods of working with numbers and application of these methods to reach accurate conclusions – it is a language

The way we use numbers, working with numbers in various ways.

Understanding and working with numbers

The following responses define numeracy more narrowly as an understanding of number and the ability to use the operations of addition, subtraction, multiplication and division.

The relationship of numbers to each other, their order, addition, subtraction etc.

Numbers and all the ways they can be used i.e. multiply, subtract.

Adding and subtracting, anything basically to do with numbers.

Maths – numbers, adding, counting.

Knowledge of numbers and how they are used/function.

Parent Role: Developing Children's Understanding of Number

This section compares data obtained at the commencement of the project with data obtained from the written survey at the project's conclusion.

Parent responses could be grouped into different themes. Fifteen of the eighteen parents, considered that their role in developing children's numeracy was to support and encourage their child to develop mathematics skills, and to help reinforce skills learnt at school. Research shows that parents who play an active part in their child's education, by supporting the child at home will benefit the child's learning. (Parents as Teachers, 2000; Tarrant, 2002; Wylie, 2001; Biddulph et al, 2003)

The following quotes are illustrative of the supporting and encouraging role these parents identified as being the prime role for parents in developing children's numeracy.

Parents need to encourage and participate in the development of children's numeracy.

A supporting role in line with what they are learning at school and can extend at home through repetition.

To support teachers and reinforce school learning/ homework.

To encourage, support and supervise their number literacy; to assist in its application.

Support and understanding, encouraging. To assist the child in learning through games, activities.

I think it's important for the parents to assist from school age in furthering/ continuing what they are learning at school.

The following comments demonstrate a different role, which was identified by four parents. They considered that their role was to help children develop mathematics knowledge through everyday activities.

Pointing out the use of maths in everyday life; using as many opportunities as possible to reinforce maths e.g. counting, adding etc;

First teacher – helping with awareness of numeracy, showing how useful it is in everyday life and reinforcing what they are learning in everyday situations.

Using situations at home, supermarket or public places to help your children learn about and use numbers.

One parent linked the focus for the education component of this project to her role.

Being aware of your child's current knowledge/understanding and knowing the next step to encourage them to achieve

Parents were asked about their role, at the conclusion of the project, to evaluate any changes in parent opinion. Supporting and encouraging their child to develop mathematics skills was the major role identified by fifteen out of eighteen parents, the same number of responses for this theme as for the initial survey. Two parents identified their role as fostering positive attitudes and the enjoyment of mathematics. The following comment is illustrative of this theme.

To foster enjoyment and a positive attitude towards maths through having fun, together with games and activities.

Six parents considered that a prime role was directly related to their understanding of numeracy development. The importance of allocating time to work on mathematics activities with their child was mentioned by two parents. The following comments illustrate these roles.

We need comprehension to motivate and assist. We need time and to be aware of the learning outcomes expected for our children.

I think it is important for parents to have an understanding of number so they can help practice and reinforce children's school learning.

I feel every parent needs to spend time with their child to show that numbers and their application is a basic life skill.

Be aware of your child's current knowledge and stage of development so you can encourage and support them to move on to the next stage.

The different roles identified in the final survey can be linked to the parent education programme which promoted a greater understanding of numeracy stages and the importance of building on the child's current knowledge in incremental stages, using activities which are enjoyable and meaningful to the child. Research conducted by Wilkins (2003), Bottle (1998) and Gutbezahl (1995) shows that by providing positive experiences in the home and in the school, negative attitudes towards mathematics can be reversed. Furner & Berman (2003) have stated that parent involvement can change children's attitudes towards mathematics. This group of parents have become more aware of the importance of their role in promoting positive mathematics experiences for their children by providing enjoyable activities to support their child's stage of learning.

Parent Understanding Of How Children Learn To Be Numerate

Parents were asked about their understanding of how children learn to be numerate and their views about the resources and equipment that could be used to help children develop an understanding of number. Baseline data was obtained during the first written survey and the same questions were asked at the conclusion of the project. This data is summarized in Table 7.

Table 7: Parent Understanding of How Children Learn to be Numerate

N=18	Above Average	Average	Below Average
Understanding Of Numeracy			
Feb: Project commencement	2	15	1
May: Project conclusion	13	5	0
Importance Of Counting			
Feb: Project commencement	18	0	0
May: Project conclusion	17	1	0
Importance Of Reading And Writing Numbers			
Feb: Project commencement	18	0	0
May: Project conclusion	16	1	1
Importance Of Maths Games			
Feb: Project commencement	17	1	0
May: Project conclusion	15	3	0
Importance Of Working With Other Children			
Feb: Project commencement	14	4	0
May: Project conclusion	16	1	1
Importance Of Recording Maths Problems			
Feb: Project commencement	14	4	0
May: Project conclusion	12	5	1
Importance Of Homework			
Feb: Project commencement	16	2	0
May: Project conclusion	11	6	1
Importance Of Working With Equipment			
Feb: Project commencement	16	1	1
May: Project conclusion	15	3	0

In the initial survey fifteen parents out of eighteen indicated that they had an average understanding of how children learn to be numerate. Two parents considered that they

had an above average understanding. There was a noticeable difference in response to this question in the second survey. At the end of the project thirteen parents had an above average understanding of how children learn to be numerate, compared with two parents in the initial survey. No-one rated themselves as having a below average knowledge. According to Bottle (1998) this gain in understanding, will have positive impacts on the ways in which parents initiate and support their child's numeracy development. He suggests that as awareness increases more time will be spent on mathematical activities and the activities will be more engaging. This in turn should result in enhanced learning opportunities for the child.

During the project the parents were keen to ask questions about the numeracy stages. All parents used the numeracy stages to identify where their child was positioned, and what the child's next learning steps would be. The researcher constantly referred to these stages when giving feedback on the child's achievement. The parents used language that related to the stages when they reported on activities and outcomes for their child, during interviews.

The following parent's comment is an example of the numeracy language and knowledge gained during the project. It illustrates her understanding of the importance of visualising number, spending time talking about numbers, helping her child to identify number patterns, and using a variety of contexts to explore number. It shows that she is applying her knowledge of numeracy stages to the activities she is working on with her child. This comment was typical of parent feedback during the interview sessions.

> *We have used that yellow chart thing [the number line]. I don't think she could count in tens but she can do that really easily now –10, 20 .., not looking at the chart now but in her head. I did the blank number line 0 – 100. I turned it [number line] over and said well this is zero and this is 100, where was fifty. She struggled with that, but about the third time she got it. She can do it in her head 5,10,15… but couldn't see the numbers on a blank number line. After about three times she could get it. I laminated the hundreds board. She is just starting to see patterns – there's the ones, twos, threes. We have doing the other things like - Bob went to shop and bought three chickens, then he bought four more, how many did he have…[Number stories] She can do these easily in her head for easy numbers but if I go past the ten she can not.*

In both written surveys parents were asked what activities they considered to be important in helping their child to develop numeracy skills. One of the parents responded to the questions in the first survey from the perspective of any child, but in the second survey, responded from the position of parent of a special needs child who has very different needs in respect to her numeracy development. This parent's expectations were consistently lower, in the second survey, and the parent acknowledged the reasons for this. Priorities for her child's learning became clearer, during the project, and the parent's focus turned from rote learning to providing literacy and numeracy experiences in context. Oral language and social skills were the priority for this child.

All parents recognised the importance of counting as a core skill underpinning number understanding. In the first survey all rated this as above average. The results were mirrored except for the parent mentioned in the previous paragraph who changed her rating from very important in the initial survey to average importance in the final survey. Counting was only important for her child if it was meaningful.

During the first survey, reading and writing numbers were rated as above average by all eighteen parents. Sixteen parents rated this as above average in the final survey. For the children working at the lower stages of the number framework, emphasis had been placed on developing number knowledge, counting forwards and backwards, and number recognition, through the activities suggested to parents as important to practice at home. There was an expectation that children should be able to read numbers but there was not as great an expectation for them to write numbers. This is reflected by these results.

During the initial survey, all but one parent rated playing maths games as being of above average importance. In the second survey, fifteen parents rated this as above average while three parents rated this as average importance. The parents who reduced their ratings from the initial survey, agreed that games are a valuable activity to reinforce numeracy understanding, but considered that their children responded better to activities using the number line, ten frames and counting activities. They used a variety of activities which their children enjoyed. It needs to be mentioned however that the

definition of a game is open to interpretation and other parents in the group, may have considered some of these activities to be games.

The following comment is an example of a number line activity that may have been termed a game by other parents.

> *We used the number line to guess a number. What number am I thinking of? We would include both children [siblings] in this. It helped [child] to see where the numbers were on the number line.*

Working with other children, using equipment, recording maths problems, and homework were considered by all parents, in the initial survey to be of at least average importance, The only below average rating in this section was given to working with equipment. One parent considered this to be of no importance. The second survey had similar results. Working with equipment was rated by all parents to be of at least average importance. A below average rating was given to each of homework, working with other children and recording mathematics problems.

The following parent comment explains why she rated homework as of below average importance, with respect to developing number knowledge. She considers the activities suggested to parents during the project were more beneficial in developing numeracy skills.

> *I don't necessarily see [homework] as being important in developing number knowledge. But things like playing maths games, opportunistic counting etc at home is very important.*

The following parent comment explains why she felt that working with other children was of below average importance. She also considered the activities that were suggested during the project were of greater benefit for her child.

> *I don't think it is necessarily important that they can work with other children as often some children lack confidence and 'smart' kids can have the wrong effect on them. Make them feel inadequate. I've found the games and physical learning of maths has really helped [child].*

The following comments, recorded in the initial survey, are examples of other activities considered by parents to be important in the development of children's number understanding.

> *Incorporating numeracy into their favourite activities, whatever that may be; baking, craftwork etc.*
>
> *Working with money (playing shopkeepers is a child's favourite); number games.*
>
> *Bring maths questions into everyday activities e.g. How many eggs did the hen lay today? How many yesterday? How many altogether?*
>
> *Seizing the moment – using everyday opportunities. E.g. How many petals on the flower? I wonder how many will be left if I pluck 3?*

Eleven parents suggested that everyday, easily available objects such as counters, buttons, walnuts, apples, tape measure, dominoes, and scales were resources to use to assist with the development of mathematical understanding. Other useful resources identified were: games (eight parents); abacus (five parents); number and counting lines, and books (two parents each); songs and homework sheets (one parent each).

In the second survey parents were asked to comment generally on the activities they considered to be important in helping their child to develop numeracy skills. The following parent comments have been selected as examples to illustrate the realistic perception that this group of parents have of activities that work well for children.

> *All the aspects are important. Some ways may work better than others for different children. But ultimately it has got to work in the individuals own head.*
>
> *I think equipment or resources only need to be basic, recording problems must be age appropriate.*
>
> *All of the above activities contribute to a total attitude and suitable learning environment. I realize that working with other children is important but can be difficult for some children.*
>
> *Challenging them [children] – a bit of competition so they are striving to improve.*

Consistent with the report from Biddulph & Biddulph & Bidduph (2003), this project has resulted in positive impacts on children's achievement, by providing parents with pedagogical knowledge, and by showing them a variety of activities and resources that could be used in the home to develop number understanding. Incorporating school-like activities into family activities, as referred to in the report by Biddulph et al (2003) has increased parents' awareness of the resources that can be used to support numeracy development. Parents commented that knowing about the stages of numeracy is very helpful because they could target activities at home to suit their child.

Parent Confidence: Helping Children with Mathematics

This section discusses parent responses to questions regarding the confidence they have in helping their child with mathematics throughout their schooling. It compares data gathered during the initial survey with data from the second written survey. Parent comments, recorded during interview sessions, have also been used to illustrate some of the generalizations made.

The initial survey showed that eleven parents out of eighteen, rated themselves as having above average confidence, in helping their junior school child[4] with mathematics. Parents rating themselves as having below average confidence also rated their ability in mathematics as below average. Parents generally rated their confidence in helping their junior school child higher than the ratings given for their own confidence in mathematics. An exception to this was the three parents who rated themselves at the low end of the scale. Two of these parents had no formal mathematics qualification.

Reasons parents gave for rating themselves as having above average confidence in helping their junior child, rather than a rating at the very confident end of the scale are listed as follows:

Some of the terminology I am not familiar with (number array).

I would appreciate help as I want [name] to enjoy maths.

[4] A junior school child, in this instance, is a child who has been at school for less than three years – five to seven year olds.

I need to brush up on some of my maths.

Parents want the best for their children, and were keen to gain support to help their children at home. The following parent comments illustrate this.

> *I don't think I will discourage her. I believe I could help with support, simply because of her level. If you'd asked me to work with a teenager, I'd have to decline.*

> *I don't want my kids to fall through the system because of my lack of knowledge.*

These parents were particularly responsive during the parent education sessions, as they were committed to gaining the knowledge that would increase their confidence and help their child. When asked about the confidence parents had in helping their child with mathematics throughout the primary school[5], only two parents rated themselves as very confident. Neither of these parents had tertiary mathematics qualifications. One had gained mathematics at university entrance level, and one at school certificate level.

When comparing the ratings between the confidence parents had in helping their junior school child and their older primary school child, a lower level of confidence was evident. Seven parents rated themselves in the above average range, four parents less than the number of parents in the above range for helping their junior child; two parents rated themselves higher; nine parents rated themselves the same. Seven parents rated themselves as having less confidence.

It appeared that the parents' confidence levels decreased with the increase of the child's age. Parents were concerned that they didn't have current knowledge of mathematics practices in the school and they did not want to teach their children methods of calculating problems that might differ to the ways the child was being taught at school. The following comments highlight the diminishing confidence felt by parents.

> *I am a bit more apprehensive when the maths becomes more complicated.*

> *Things change very quickly and I may need to relearn some things I've forgotten.*

[5] A primary school child, in this instance, refers to a child in year 4 to year 8.

I'll be able to help to certain point.

When asked about the confidence parents had in helping their child with mathematics throughout their secondary schooling[6], no parents responded in the above average range. Seven parents out of eighteen, indicated that they have average confidence, and the majority, eleven parents, rated themselves in the below average range. Six parents within this range indicated that they were not confident at all. Parents supplied few comments to support their rating, but the following comments are typical of the negative comments from parents towards helping children at secondary level.

Things have changed a lot and I've forgotten a lot!

I'm useless at maths.

Table 8 compares findings from the initial survey with findings from the survey conducted at the research conclusion. The numbers of parents who responded in each category is recorded.

[6] Secondary schooling, in this instance, refers to a child from year nine, until the child leaves school.

Table 8: Parent Confidence: Helping Child during Schooling

N=18	Above Average	Average	Below Average
Confidence In Helping Child With Maths – Junior School			
Feb: Project commencement	11	4	3
May: Project Conclusion	18	0	0
Confidence In Helping Child With Maths – Primary School			
Feb: Project commencement	7	8	3
May: Project Conclusion	15	3	0
Confidence In Helping Child With Maths – Secondary School			
Feb: Project commencement	0	7	11
May: Project Conclusion	6	6	6

The results from the second survey support the positive impact of the project on parent's confidence in helping their children with maths. At all levels of schooling, there was an increase in confidence levels. All parents indicated that they now felt of above average confidence in helping their junior child with maths. An increased understanding of numeracy stages and of the activities parents can use to help move their child from one stage to the next were reasons cited by parents as having the most impact on their confidence level. The following parent comments are examples of the increased understanding parents have as a result of participation in this project.

> *I do feel more confident than before this project, armed with more tools and understanding.*
>
> *Now I understand numeracy more I feel confident to support my child in this area of learning.*
>
> *After reading the information on the different stages of [numeracy] development I'm more aware of what to do and work on.*

There was also an improved level of confidence in helping their child with mathematics throughout primary school. Fifteen out of eighteen parents have increased by at least one level of confidence, with the remaining three parents rating themselves at the same level.

No parents rated themselves as having below average confidence in the second survey. The following comments illustrate the gain in the confidence of parents as a result of increased knowledge about numeracy stages.

> *As long as I am making the effort to learn what she is doing then I will be confident to help her.*
>
> *I think now I will be more aware of the stages they are at and how to help*

Parents increased confidence in helping their child throughout their secondary schooling also improved significantly by the end of the project. In the initial survey, eleven out of eighteen parents rated themselves as having below average confidence. In the final survey only six parents rated themselves in the below average category. Twelve parents ranked themselves as having average or above average confidence at the end of the project.

According to Ashlock (1990) all parents are eager to help children learn mathematics, but many are not sure what activities to use to support this learning. By increasing the parents' awareness of the stages of numeracy development and by offering suggestions of activities that can be used in the home to support their child's learning, parents have become more confident in providing this support.

Parent Attitudes Towards Children's Mathematics

Parents were asked whether they thought that children could be successful in mathematics, children should enjoy mathematics and whether it was important for children to have a positive attitude towards mathematics. Table 9 shows the parent responses in each category.

Table 9: Parent Attitudes Towards Children's Mathematics

N=18	Above Average	Average	Below Average
Agree That Children Can Be Successful In Maths			
Feb: Project commencement	11	3	3
May: Project Conclusion	13	4	1
Importance Of Child Enjoying Maths			
Feb: Project commencement	16	1	1
May: Project Conclusion	18	0	1
Importance Of Child Developing Positive Attitude To Maths			
Feb: Project commencement	17	0	1
May: Project Conclusion	18	0	0

The importance parents have given to children's feelings about their mathematics experiences is highlighted by the increased ratings given to all three questions at the end of the survey. Although the responses were also rated highly in the initial survey, the increased ratings from the second survey appear to indicate an increased awareness of the impact of attitudes on mathematical achievement.

The initial data rated children's ability to be successful in mathematics as average or above for fourteen out of eighteen parents, whereas seventeen parents rated it as average or above average in the final survey. Parents supplied a variety of comments to support their ratings, in both surveys. One common theme of the comments was the importance of establishing a partnership between home and school if children are to be successful. The following comments illustrate this theme.

> *As long as the partnerships between child, parent and teacher are working most children should be able to succeed in maths.*
>
> *They must have the backing from home and as well as school, to reinforce their learning.*

The second theme focuses on the way children are taught in schools today, with the focus on developing numeracy knowledge and strategies progressively.

> *Maths that is taught in the classroom today is at a level of understanding to the child and is not too hard for them.*
>
> *They need to understand basics and comprehend not only the 'rules' but why they are applied.*

The following parent comments are illustrative of the third theme that teachers and parents need to be aware that children respond differently to different activities. They need to be treated as individuals, have their differing needs catered for and feel positive about mathematics if they are to be successful.

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> *If children have the opportunity and the confidence. Also if their learning style is understood and the child is taught accordingly.*
>
> *I believe that some children are right brained or left and as a consequence are mathematically more in tune as opposed to others who maybe are more language orientated.*
>
> *They can be successful at different levels according to their ability. An enjoyment of maths can be fostered from positive learning experiences during their schooling. Sometimes it's the method of teaching which doesn't connect with the child's understanding.*

Parents were asked to rate how important it was for their child to enjoy mathematics. In the first survey, sixteen parents rated this as of above average importance. All parents rated this as of above average importance in the final survey. This shows the increased emphasis parents have placed on positive mathematics experiences, by the conclusion of this project.

In the first survey, all but one parent rated the importance of their child having a positive attitude as above average. In the final survey all parents have rated this as above average. This is evidence that parents are aware of the impact of attitudes on their child's mathematics achievement.

Parent Expectations of Child Achievement

Parents were asked to comment on the expectations they had for their child's mathematics achievement after two years of schooling. The parents held a variety of expectations which appeared to relate to the ability of their child. Their comments usually included a range of areas in which they considered their child should be proficient.

In the first survey, eleven parents stated that they expected their child to be able count proficiently. The level attained in counting ranged from counting to 50 to counting to 1000. Sixteen parents considered that children should be able to add and subtract numbers. Eleven parents expected their child to know simple times tables, such as the two's, fives or tens times tables and to be able to count in groups of twos, fives and tens. Other responses included (one parent for each response): to be able to measure; to understand and use some maths terminology – heavier, lighter than, bigger, biggest ; to start to read clocks; have an understanding about the concept of money; and to know some shapes.

In the second survey, the comments were less general, with the majority linked to the specific learning outcomes on which their children had been working. Twelve parents linked their comments directly to numeracy knowledge and strategy stages. Through their comments, parents showed a greater awareness of the knowledge their child needed before they could move to a more advanced numeracy strategy stage. The following comments show this increased parent awareness of the numeracy stages and the specific expectations they have for their child.

> *To be able to work on addition, subtraction multiplication and division competently and move onto the advanced additive part-whole thinking stage. Recognise numbers up to 1 000 000.*
>
> *Easy additions and subtractions [with numbers] up to 10. Multiplication 2,5,10. Count in 10s to 100 backwards, Count in 100s to 1000 backwards.*
>
> *Have a good knowledge of number, be able to image mentally, understand some sequences and groupings (e.g. counting in 2's, 5's, and 10's), odd and even numbers.*

Simple adding, subtracting. Confidence in counting forwards and backwards, and finger counting. Adding on [Advanced Counting].

Parents had higher expectations for their children at the conclusion of the project. Biddulph et al (2003) suggest that there are positive benefits on children's achievements if families have high levels of educational expectations. Through their involvement in the parent education programme, parents have been able to articulate their expectations more clearly and work towards achieving higher learning outcomes in number understanding which should raise their child's achievement.

Chapter Summary

The results from this research have shown a link between parent's mathematics experiences at school, their confidence in mathematics and their attitude towards mathematics. Parents who had been more successful in mathematics had more positive attitudes and displayed higher levels of confidence. Conversely negative mathematics experiences resulted in more negative attitudes and generally lower levels of confidence.

At the conclusion of the project there was an increased parental awareness of the development of number understanding for junior school children. The improved knowledge about the stages of numeracy and a comprehension of the activities that could be used in the home to support their child's learning needs, have contributed towards parent's confidence in their ability to help support and encourage their child's mathematics. There was a noticeable increase in levels of confidence shown by parents in helping their child throughout their schooling with mathematics. At the conclusion of the project all parents felt very confident in supporting their junior child, which was the area targeted during the parent education sessions.

During interview and feedback sessions, the researcher reinforced the belief that parents can make a difference to their children's learning. Kliman (1999) states that this is the most important message parents can be given to promote positive parent input, which she suggests will improve children's skills, interest, confidence and attitude towards

mathematics. The roles identified by parents as important in fostering numeracy understanding, show that they believe they can make a difference to their child's learning.

According to Toliver (1998), it is important that parents are aware of the detrimental impact that negative attitudes towards mathematics can have on children. Results from the survey showed that parents were more aware of the importance of fostering a positive attitude and enjoyment of mathematics with their children. This research illustrates that how parents can be supported to provide positive mathematics experiences in the home to support their child's numeracy learning.

Chapter 6: Evaluation of the Parent Education Programme

This chapter is the second results chapter reporting on the impact of project on the parents. Gaining feedback regarding the effectiveness of the parent education programme was a key purpose of the second and third interview sessions, and the second written survey. The discussion in this chapter is focused on the following research question.

What elements of the project do parents consider to be the most effective in helping develop their child's number knowledge and what aspects would parents like to be applied to a classroom context?

The effectiveness of the project is discussed under three topics: numeracy information, feedback on child achievement, and resources and activities. The final section of the chapter reports on the components of the project that the parents identified for future implementation by the class teacher.

Effectiveness of Information about the Number Framework

Increasing parents' understanding of the number framework was pivotal to the project. When parents have an increased awareness of how they can help their child, and of the needs specific to their child, they have greater confidence to support their child's learning (Ashlock, 1990; Epstein, 2001.) The Teachers Involve Parents in Schoolwork (TIPS) programme referred to by Epstein (2001) was developed to give parents more confidence in supporting their children's learning at home, by increasing parent awareness of the skills children need and the process through which this skill development takes place.

At the conclusion of this project parents were asked to evaluate the effectiveness of the verbal and written information they received, on their understanding about the numeracy stages.

All parents responded that they had a greater understanding of the numeracy knowledge and strategy stages. Sixteen out of eighteen parents indicated that their understanding had increased substantially. The following parent comments illustrate the increased awareness of the numeracy stages as a result of the parents' participation in the project.

> *I am now more aware of the different stages and levels, and ways of progressing through each stage. I am also more focused.*
>
> *Previously I had no understanding of the stages of developing number knowledge. Now I do feel like I understand – interesting looking back on older children's past development.*
>
> *Before participating in this research I had an idea of knowledge but now I feel the gaps are filled in.*
>
> *Understanding the stage where my child is at and how he is progressing and knowing what to work on before he can progress to the next level.*

Parents' increased knowledge of the numeracy stages was also evident during the interviews when the achievement of the child was discussed. All parents had been given the option of recording activities they used and comments about their child's mathematics achievement in a notebook supplied during the first interview. Three parents had recorded detailed notes on their child's progress and activities used, and shared these with the researcher. Two other parents had recorded brief notes, about the activities they used, and some general comments regarding their child. The remaining parents shared their observations about their child's achievement and the activities they had used to support their child's numeracy stage, without reference to notes.

All parents were able to talk about the activities that had been successful for their child, and identify the key areas of improvement they had noted since the first interview. Through their comments it was apparent that parents were developing an increased awareness of numeracy stages and the activities to support these. The following

comments illustrate the understanding parents had of their child's achievements. Their reference to key knowledge areas from the number framework demonstrates their increased awareness of the stages of numeracy development as applicable to their child.

> *[Child] is more confident. Some groupings to five are now instant.*
>
> *Prior to our initial interview she couldn't skip count and she can now skip count forwards in 2's, 5's and 10's and she now knows her odd and even numbers.*
>
> *I heard her count 5,10,15,20 recently. She knew what 37 was – she could count in groups of ten and then put the seven with them. (using coloured sticks)*
>
> *[Child] was able to count up to 100 using the number line and seeing the numbers **3**0 **4**0 **5**0 **6**0 **7**0 **8**0 **9**0 **10**0 as prompts. He stumbled once on 50 and called it thirty. He counted in 10's, up to 100, using the number line and pointing to each number.*
>
> *[Child] has been counting backwards and forwards much better. She seems a lot more confident.*
>
> *He can do 2's up to 20 now, like the other day he was going 2,4,6,8 up to 20 and 5's. He can count up to 100 quite easily. We have just been practising with the wee counters [tens frame] to see the numbers to ten.*

All parents considered the handouts and information regarding the stages of numeracy knowledge and strategy development to be very useful and considered that was a vital component of the project that should be continued in the future. The following parent comment summarises parents' feelings about the usefulness of these handouts.

> *We are all better equipped to help our child when we have knowledge like this.*

This comment is consistent with the views of Ashlock (1990) and Epstein (2001), who suggest that when the process for helping their child is clear, parents feel more confident and empowered to help.

Effectiveness of Feedback on Child Achievement

Parents were asked to evaluate the effectiveness of the feedback given to them by the researcher regarding their child's achievement. This feedback included a summary of the child's progress using numeracy assessment data and achievement information on the targeted learning needs of each child.

The researcher reported on each child's assessment data in full during the interview sessions. All parents agreed that this was very valuable in helping to increase their understanding of their child's achievement level in mathematics. Parents felt it was useful to have written information for future reference. They also found that the tracking of the child's progress against the numeracy stages was helpful as it gave them a measure of the progress the child had made. They were able to compare the current achievements of the child with the baseline data gathered at the start of the research. Of particular benefit was the information on the future learning needs for each child. The following comments are illustrative of the positive feedback from parents about the achievement data they received.

> *Giving me specific information of my son's development has meant being able to plan for his individual needs.*
>
> *I appreciate the understanding of where my child is at and what strategies I can use to help him along.*
>
> *The focused feedback to parents has been wonderful. To get that feedback and to know which stage she would be going to next.*
>
> *Knowing where she is at and where to go next – go to the next level. Absolutely beneficial …*
>
> *Knowing where [child] is at. Knowing what to work with her on. Knowing that they are capable. I wouldn't have given her as much credit for her capabilities if I hadn't known that.*

Feedback about each child's individual needs was another area identified by all parents as something they would like to be continued at the conclusion of the research. Knowing about their child's achievement and the next learning focus for their child was regarded

by all parents as very useful. This feedback influenced the activities parents worked on with their children. This finding is consistent with the research of Ausubel, Novak and Hanesian (1978), which emphasises the importance of knowing what the learner already knows, as the most important factor in influencing learning. Parents suggested that feedback on their child's achievement could be given through a check list in the homework book, in a classroom context.

Effectiveness of Activity and Resource Suggestions

Parents were asked to evaluate the effectiveness of the handouts and the information about resources and activities they were given to help foster the numeracy understanding for their child. From this information, parents selected suitable activities for their child's stage of number understanding. All parents rated the handouts on activities, which covered different areas of numeracy knowledge, as very useful. The following parent comments highlight this.

> *Gave me practical activities to do at home to assist [child's] learning.*
>
> *Without them I would not have used the resources like a pack of cards for teaching addition/subtraction.*
>
> *Anything that helps [child] I appreciate. Also gave me the opportunity to be doing activities with her that I knew would help her.*

Parents appreciated that the resources needed to implement these activities were readily available in the home or could be purchased at minimal cost. They adapted activities to suit the resources they had available. One parent collected old calendar sheets for a range of purposes. She used them for activities based on number sequence, number patterns and numeral identification. Another parent set up a maths box with numeral cards and tens frames made from cardboard, number games, bundles of coloured sticks, cards with dots to represent different number patterns and a variety of counting objects such as buttons and pebbles. The following comment is illustrative of resources parents would seek out to interest and motivate their child.

> *I tried to include a lot of activities that you showed us … lots of fun things, like the pipe cleaners [for numeral identification]. She was more keen, rather than just working with cards and that, if you can use more fun things, more colourful things, it made it more enjoyable.*

I was reading my book when [child] asked what page I was on. We then looked at all the page numbers and I would ask, "What is the next number?" She was fascinated by the hundred's numbers. We spent a long time looking at numbers.

All parents rated the number line and suggestions for using this as very useful. The following parents' comments show the value of this.

[Child] had a better idea with grouping and counting

Great for number recognition and counting forwards and backwards.

Visually seeing the numbers – helped [child] to remember them.

It's right beside his bed so he is looking a it everyday.

I have a number line by the bed and often count instead of reading a book [at bedtime] … This is helping her 'see' the numbers on the line and has her progress in counting.

The number line has been valuable for imaging – halfway between and things like that.

I started off with the number line so he could actually see the number.

At interview sessions, activities to develop the instant recall of addition and subtraction facts were a key focus. A range of resources and activities were suggested to parents. All parents rated this information, in the written survey, as very useful.

Parents were offered computer games on a CD and a handout which included links to web sites all of which were based on reinforcing number understanding and recall of basic facts. Of the thirteen parents that had access to a computer at home, all but one rated these resources as at least average, in terms of usefulness. Overall parents rated the computer CD more highly than the website links information. The main reasons for this were parents' lack of confidence in using the internet, and internet connection difficulties. The following comment, made by a parent who felt very confident surfing the internet, endorsed the value of the website link resource.

There are such a terrific array [of mathematics sites] on the net, for all ages.

Parents felt that the computer games were useful, but the programmes had to be at the child's level in order to maintain interest. Some games were considered too hard for some of the children. The children were reported to respond differently to computer use. Parents suggested that they needed to ensure games were selected carefully to suit the level of the child. Games that were too difficult were believed to have a negative impact on the child. It was also noted that children loose interest in games that do not provide enough challenge. The following comments show the diverse range of parent opinion on the usefulness of computer games.

> *In their place they can be useful but not all the time.*
>
> *Haven't had a chance to use the disk yet [computer has broken down] but I can see they will be extremely useful and will add another dimension.*
>
> *The computer games keep them interested.*
>
> *The computer CD has been very valuable.*
>
> *Not very useful, possibly because there was a time frame for answering and [Child] found this [one of the computer games trialled too difficult.*

Application of Project

Parents commented that they would appreciate a similar support and guidance programme to help them target mathematics at home, after their involvement in the project was completed. They had suggestions for ways that this might be implemented by a class teacher.

All parents agreed that the resources and support they had received during the project were very useful in helping them understand more about the activities they could use with their child. They suggested that a condensed version of the numeracy framework and activity handouts, specifically suited to the child's stage of numeracy development, would be beneficial to all parents. These resources could be developed in a kit and given to parents at differing numeracy stages. All parents felt that a 1-100 number line, a tens frame and an hundred's board should be included in this kit. Four parents considered that a computer game CD, with links to websites, would also be valuable.

Eleven parents thought it would be beneficial for small groups of parents, whose children are at a similar stage of numeracy development, to meet with the class teacher either once or twice a term, to talk about the activities and resources parents could use to support their child's learning. One of these parents felt it was beneficial to meet with other parents, as ideas are generated by parents as well as the teacher.

Three parents indicated they would prefer to meet with the teacher individually because they felt the information would be more specific to their child. One parent added that as she lacked confidence to express herself in front of others, she would rather meet individually with the teacher.

All parents considered that communication via the homework book was a suitable way of receiving information about the specific learning needs for their child. This could be updated once or twice a term.

Chapter Summary

This chapter has reported on the elements of the project that parents consider have been most effective in helping them to develop their child's number knowledge. It has identified aspects of the project that parents would like to be applied to a classroom context. The increased awareness and understanding of the numeracy stages, the knowledge of activities that can be used at home to support their child's learning, the feedback on their child's progress and the areas of focus to move the child to the next numeracy stage were rated highly by all parents as areas that they would like see continued.

The parents' opinions are echoed in research by Epstein (2001), who highlights the importance of informing families about the work children do in class, and involving them in their child's education. Her research also highlights the importance of organising family-friendly partnerships, which are aimed at raising children's achievement. There is strong correlation between this project, and two models of school and family partnerships

in America: the work of Epstein (2001) based on the TIPS programme, and the Parents as Teachers (2000) programme. Research from these programmes has concluded that there is a strong link between family involvement and student achievement. In both programmes there was an emphasis on the content of the learning as well as the processes which foster this.

The researcher's next project will be to investigate the manageability of implementing a condensed version of this project within her classroom and within the junior syndicate of her school.

Chapter 7: Conclusion

The aims of this research were to investigate the parent understanding of, confidence in and attitude towards numeracy, and to evaluate the effectiveness of a numeracy education programme for parents. This chapter provides a summary of the research findings as they relate to the research questions. The possible implications for teachers and school leaders in terms of the numeracy education programme and its application in the wider school setting is discussed. The chapter concludes with suggestions for future research.

Key Findings Related to Research Questions

How is parent attitude linked to their mathematical experiences at school and their achievement in mathematics?

This research illustrated that there is a direct link between attitude to mathematics and achievement in mathematics. Parents who have had success in mathematics during their schooling have a more positive attitude and displays a higher level of confidence. Research results also illustrate that the enjoyment of mathematics at secondary school level was directly linked to achievement. However there was no obvious link between achievement and enjoyment of mathematics at primary level.

All but three of the eighteen parents participating in this project had gained a secondary school mathematics qualification or higher. Half of the parents had achieved either a sixth form or tertiary mathematics qualification.

Six parents, one third of the group, rated their enjoyment of mathematics as above average. All these parents had gained at least a six form qualification in mathematics. All three parents with no formal mathematics qualification rated their feelings towards mathematics as below average. All parents who gained a fifth form mathematics

qualification or less rated their enjoyment as average or below. All parents who gained a sixth form qualification or higher, rated their enjoyment as average or above.

There was a significant difference between the rankings of mathematics experiences at primary and secondary school. Half of the parents rated their enjoyment of mathematics at primary school as above average, but their mathematics experiences at secondary school were rated as below average. There was no direct link between achievement in mathematics and the rating of primary school mathematics experiences. However there was link between achievement and rating of secondary school mathematics experiences. Eight of the nine parents who rated their experiences at secondary school as below average had achieved fifth form mathematics or less. The five parents who rated their enjoyment of mathematics at secondary school as of above average all had achieved a sixth form qualification or higher.

A link could also be established between parent confidence in mathematics and achievement. In all but one instance, the lower the achievement in mathematics, the lower the confidence rating. All but one parent with a sixth form qualification or higher rated their confidence in mathematics as average or above.

With the exception of one parent, parents rated their level of confidence identically to their ability in mathematics. Sixteen of the eighteen parents rated their feelings about mathematics at least one level higher that their ability in mathematics. From this research it appears that there is a more direct link between ability and confidence and ability and feelings of enjoyment.

Has parent knowledge of the development of number understanding and their attitude to mathematics changed as a result of participation in this project?

Research results illustrate the difference between the level of understanding of numeracy development in junior school students from the commencement until the conclusion of the research. Thirteen parents indicated that they had an above average understanding of

numeracy development at the conclusion of the research compared with two parents at the start.

It appears that a direct link can be made to the parent education programme which informed parents about the stages of numeracy knowledge and strategy development and equipped them with a range of resources and activities that could be applied in the home setting to support the numeracy development of their children. These findings support the report by Biddulph F., Biddulph J. and Biddulph C. (2003) which suggests that by providing parents with pedagogical knowledge and encouraging them to use school-like activities in the home setting, a positive impact on student achievement would result. Parents reported that knowing about the stages of numeracy was very important for them in assisting them to target relevant activities at home to support their child's learning.

Has parent confidence towards helping their child at mathematics changed as a result of particaption in this project?

Findings from the research demonstrate that when parents are informed and are supported with the help they can offer their children, there is a dramatic increase in the level of confidence have in supporting their child's mathematics learning.

At the commencement of the research, parents generally rated their confidence in helping their junior child higher than the ratings given for their own confidence in mathematics. Three parents who rated themselves as having no confidence in mathematics, also rated themselves as having below average confidence in helping their children with mathematics. At the conclusion of the research all parents rated their confidence in helping their junior school child as above average, compared with eleven at the research commencement.

The results indicate that the parents' level of confidence decreased with the increase of age of their child. When asked to rate their confidence in helping their older primary school child and their secondary school child the confidence level dropped significantly. The main concern for parents was their perception that didn't have current knowledge of

mathematical practices. They didn't want to teach their child to calculate problems using a method that might differ to the one being taught at school.

Even though the parent education programme focused on the numeracy development of junior school age children it appears to have a positive impact on the general confidence level parents have in helping the children at all stages of the schooling. At the conclusion of the research, fifteen of the eighteen parents rated their confidence in helping the older primary age child with mathematics as above average compared with only seven at the commencement of the research. At the beginning no parents rated themselves as being of above average confidence in helping their secondary child. At the end of the research six parents rated themselves in the above average category.

These results have a direct link to findings of Ashlock (1990), who states that all parents are eager to help to help their children, but many are not sure what activities to use to support this learning. The information given to parents, the feedback about the stage of numeracy development of their child and the activities that can be used to move their child to the next step of learning appear to be instrumental in developing parents confidence in helping their child. Parents awareness of the stages of numeracy development and the key knowledge areas needed to support strategy development appears to be integral in fostering their confidence.

<u>What elements of the project do parents consider to be the most effective in helping develop their student's number knowledge and what aspects would parents like to be applied to a classroom context?</u>

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Appendices

Appendix A

Information Sheet For Board of Trustees and Principal

Consent Form for Board of Trustees

Consent Form For Teachers of Junior Children

Letter To Parents: Inviting Them To Participate In The Project.

Information Sheet for Parents.

Consent Form for Parent Participants

Information Sheet for Board of Trustees and Principal

The Evaluation and Impact of Parent Education in Early Numeracy

Thank you for showing an interest in this research project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate I thank you. If you decide not to take part there will be no disadvantage to you of any kind and I thank you for considering my request.

This project is being undertaken as part of the requirements for the Masters of Education (Teaching) degree that I am currently studying. It will form the basis for my Masters thesis.

This research will provide data about parent attitude towards mathematics, their understanding of the stages of mathematical concept development in young children and the impact of direct involvement in their child's mathematics education on their understanding and attitudes.

It is intended that this research will complement the extensive research that has been undertaken in New Zealand involving students and teachers who have participated in the Numeracy Projects. There is very limited current New Zealand research available on the impact of parent attitude on student learning, particularly in mathematics, and of parent understanding of the key mathematical concepts which underpin numeracy development.

What are the aims of this project?

To investigate parent understanding of, confidence in, and attitude towards numeracy.

To evaluate the effectiveness of a numeracy education programme for caregivers/parents.

What type of participants are being sought?

The research will be conducted with parents of Aotea School junior children.

All parents/caregivers of the new entrant children that commenced at Aotea School from 1 December 2002 until 30 November 2003 will be invited to participate in the research.

What is the involvement of the Aotea School Board of Trustees?

Approval is being sought to allow this research project to be undertaken at Aotea School. I would be observing and assessing the numeracy achievement and progress of junior school children during the project and working with the parents to increase their understanding of ENP. I will be encouraging them to support their child in numeracy at home.

Detail regarding the data collection, timeframe and parent involvement in the project is included in the information sheet.

Who are the participants in the project?

The research will be conducted with parents of Aotea School junior children.

All parents/caregivers of the new entrant children that commenced at Aotea School from 1 December 2002 until 30 November 2003 will be invited to participate in the research.

What will the participants be asked to do?

Parents who agree to take part in this project will be asked to:

Complete 2 written surveys, one at the commencement of the research and one at the conclusion of the research, which will include questions about parent knowledge of the teaching and learning in maths for junior school children.

Undertake three interviews with the researcher, one at the commencement of the research, one during the research, and one at the conclusion of the research, to gather data about parent attitude towards maths. These interviews would be arranged at a time and venue that would be mutually acceptable.

Attend a parent education seminar at Clyde School (1 ½ hours maximum) to outline the key elements of the Early Numeracy Programme, which is taught at Clyde School, and to introduce activities which parents could use at home to assist your child's development of numeracy skills. This seminar will be held on Wednesday February the 4th at Clyde School. Parents will be asked to choose a time that is suitable to you, either 1:30pm-3pm or 7:30pm-9pm.

Meet two times, at the beginning of **Feb,** one **mid-March**, with the researcher to talk about additional activities you could use at home to support your child's learning, based on your child's stage of numeracy development, assessed by the researcher prior to each interview. Interviews will be audio taped. **(Parents will have the opportunity to talk to the researcher at other times during the research period if you wish.)**

Meet at the beginning of May to evaluate parent involvement in the research process and give feedback to the researcher.

Invite you to observe or help with the classroom maths programme on a regular (once per week/fortnight) or irregular basis.

Agree to your child being audiotaped/videotaped in the classroom (if required), and during assessment sessions, in order to provide information that would assist you to understand the stage your child is working at in numeracy.

All meetings would be arranged at times that were suitable for you. Child care arrangements would be made if required.

The data collection for the research will be conducted in two phases.

Phase 1: Data to be collected from parents at the commencement of the research:
Written Survey

Interviews (audiotape): With all participating parents (on a 1-1 basis) prior to the research commencing, to gain information about their attitude and experience of maths at school, and of the importance that they place on maths for their children, and during the research period to gather anecdotal information during the period when specific activities will be trailed with children. A second interview will be held 6 weeks following, to answer any queries parents may have, discuss their child's progress and talk about additional activities they could use.

Phase 2: Evaluative data to be collected in May 2004, at the conclusion of the research:

Written Survey
Interview (audiotape): With all participating parents (on 1-1 basis) to evaluate the project in terms of change in attitude or confidence noted by the parent, of themselves and of their children.

The questions asked in the written survey and interview have been approved by the Dunedin Teachers College Ethics committee.

There may be additional questions, that evolve during the interview (open-questioning technique) where the precise nature of the questions which will be asked have not been determined in advance, but will depend on the way in which the interview develops. Consequently, although the Ethics Committee is aware of the general areas to be explored in the interview, the Committee has not been able to review the precise question to be used.

In the event that the line of questioning does develop in such a way that parents feel hesitant or uncomfortable they are reminded of their right to decline to answer any particular question(s) and also that they may withdraw from the project at any stage without any disadvantage to themselves of any kind.

They will be asked to record milestones they have noted in your child's numeracy knowledge (in the form of brief notes) to refer to during feedback sessions with the researcher.

The researcher seeks parents' permission to discuss their child's progress in numeracy with the class teacher, to communicate regularly with the class teacher about the child's achievement in numeracy and to observe their child for several numeracy sessions within the class to identify the future learning needs for your child. (If required)

What use will be made of the data collected?

The results of this project may be published but any data included will in no way be linked to any specific participant or to Aotea School.

Copies of the final research thesis will be filed with the Bill Robertson Library, Dunedin College of Education. It will be available through interlibrary loan, and may be quoted in future research articles.

The lecturers supervising and examining this project will have full access to all data.

Results of all data gathering surveys etc will be made available to participants.
A full copy of the thesis will be available to all participants on request.

The data collected will be securely stored in such a way that only those mentioned above will be able to gain access to it. At the end of the project any personal information will be destroyed immediately except that, as required by the College's research policy, any raw data on which the results of the project may depend will be retained in secure storage for five years, after which it will be destroyed.

How will confidentiality be upheld?

Substitute names will be given to participants, their children and the school involved in the project, where names are included in any transcript of data or in narratives. Participants will not be identified by name in any reported data. Confidentiality will be upheld throughout the project.

What if participants have any questions?

If you have any questions about my project, either now or in the future, please feel free to contact me:

Sharon Booth
(phone number supplied)

or my supervisor:

Dr Gill Thomas, Dunedin College of Education.
(phone number supplied)

This project has been reviewed and approved by the Research and Ethics Committee of the Dunedin College of Education.

Consent Form for Board of Trustees and Principal

The Evaluation and Impact of Parent Education in Early Numeracy

We have read the Information Sheet concerning this project and understand what it is about. All our questions have been answered to our satisfaction. I understand that we are free to request further information at any stage.

We know that:
Our participation in the project is entirely voluntary.
We are free to withdraw from the project at any time without any disadvantage.
The data (Video tapes / audio tapes / written surveys) will be destroyed at the conclusion of the project but any results on which the project depend will be retained in secure storage for five years, after which it will be destroyed.
This project may involve parents in an open-questioning technique where the precise nature of the questions which will be asked have not been determined in advance, but will depend on the way in which the interview develops and that in the event that the line of questioning develops in such a way that they feel hesitant or uncomfortable they may decline to answer any particular question(s) and/or may withdraw without any disadvantage of any kind.
The results of the project may be published but the anonymity of all participants and the school will be preserved.

We fully support this project and agree to Aotea School's involvement in the project.

…….
(Signature of Principal, Aotea School.)

…….

(Signature of Chairperson, Aotea School Board of Trustees)

……

(Date)

This project has been reviewed and approved by the Research and Ethics Committee of the Dunedin College of Education.

Consent form for the Teachers of Junior Children

The Evaluation and Impact of Parent Education in Early Numeracy

I have read the Information Sheet concerning this project and understand what it is about. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage.

I agree to audio and video recorders being used in my class, during mathematics lessons, if required by the researcher. I agree to being involved in this project as the teacher of junior children involved in this project. I am willing for the parents identified through this project, to observe and/or help during mathematics lessons. I am prepared to meet with the researcher, as required, to discuss the learning needs of the new entrant children. I am aware that I may be recorded during these meetings.

I know that:
My participation in the project is entirely voluntary.
I am free to withdraw my consent from the project at any time without any disadvantage.
The data (video and audio tapes) will be destroyed at the conclusion of the project but any results on which the project depend will be retained in secure storage for five years, after which it will be destroyed.
The results of the project may be published but participants' anonymity will be preserved.

…… ……

(Signature of teacher) (Date)

This project has been reviewed and approved by the Research and Ethics Committee of the Dunedin College of Education.

Letter To Parents: Inviting Them To Participate In The Project.

Dear

As you are aware I have been granted six months study leave to complete the research thesis for my Masters of Education degree, 'The Evaluation and Impact of Parent Education in Early Numeracy.'

I would like you to be a participant in the research I am undertaking. I would like one parent from each of the target group of children (the new entrant intake from 1 December 2002 until 30 November 2003) to be specifically involved in the project. The other parent would be involved indirectly through the activities the child is working on at home. I hope this research will benefit the children, parents and teachers involved.

Please find enclosed an information sheet and consent form. I would appreciate a response from you as soon as possible as I have a strict timeline to follow to complete the data gathering phase of my research. I will phone you on Monday the 2nd of February to ask if you are prepared to participate in the research.

A meeting will be held for participants on Wednesday the 4th February at Aotea School to outline the key elements of the Early Numeracy Programme taught at Aotea School, and to introduce activities which you could use at home to assist your child's development of numeracy skills. You are asked to choose a time that is suitable to you, either 1:30pm-3pm (room 6) or 7:30pm-9pm (school library). I will ask you your preferred time when I contact you on Monday. If you are unable to come on Wednesday I can make alternative arrangements. I will appreciate it if you could bring the consent form to this meeting. If you have any queries at all please do not hesitate to ring or e-mail me.

Yours sincerely

Information Sheet for Parent Participants

The Evaluation and Impact of Parent Education in Early Numeracy

Thank you for showing an interest in this research project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate I thank you. If you decide not to take part there will be no disadvantage to you of any kind and I thank you for considering my request.

This project is being undertaken as part of the requirements for the Masters of Education (Teaching) degree that I am currently studying. It will form the basis for my Masters thesis.

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All parents/caregivers of the new entrant children that commenced at Aotea School from 1 December 2002 until 30 November 2003 will be invited to participate in the research.

What will the participants be asked to do?

Should you agree to take part in this project you will be asked to:

Complete 2 written surveys, one at the commencement of the research and one at the conclusion of the research, which will include questions about your knowledge of the teaching and learning in maths for junior school children.

Undertake three interviews with the researcher, one at the commencement of the research, one during the research, and one at the conclusion of the research, to gather data about your attitude towards maths. These interviews would be arranged at a time and venue that would be mutually acceptable.

Attend a parent education seminar at Clyde School (1 ½ hours maximum) to outline the key elements of the Early Numeracy Programme, which is taught at Clyde School, and to introduce activities which you could use at home to assist your child's development of numeracy skills. This seminar will be held on Wednesday February the 4th at Clyde School. You will be asked to choose a time that is suitable to you, either 1:30pm-3pm or 7:30pm-9pm.

Meet two times, at the beginning of **Feb,** one **mid-March**, with the researcher to talk about additional activities you could use at home to support your child's learning, based on your child's stage of numeracy development, assessed by the researcher prior to each interview. Interviews will be audio taped. **(You will have the opportunity to talk to the researcher at other times during the research period if you wish.)**

Meet at the beginning of May to evaluate your involvement in the research process and give feedback to the researcher.

Invite you to observe or help with the classroom maths programme on a regular (once per week/fortnight) or irregular basis.
Agree to your child being audiotaped/videotaped in the classroom (if required), and during assessment sessions, in order to provide information that would assist you to understand the stage your child is working at in numeracy.

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There may be additional questions, that evolve during the interview (open-questioning technique) where the precise nature of the questions which will be asked have not been determined in advance, but will depend on the way in which the interview develops. Consequently, although the Ethics Committee is aware of the general areas to be explored in the interview, the Committee has not been able to review the precise question to be used.

In the event that the line of questioning does develop in such a way that you feel hesitant or uncomfortable you are reminded of your right to decline to answer any particular

question(s) and also that you may withdraw from the project at any stage without any disadvantage to yourself of any kind.

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The researcher seeks your permission to discuss your child's progress in numeracy with the class teacher, to communicate regularly with the class teacher about the child's achievement in numeracy and to observe your child for several numeracy sessions within the class to identify the future learning needs for your child. (If required)

What use will be made of the data collected?

The results of this project may be published but any data included will in no way be linked to any specific participant or to Aotea School.

Copies of the final research thesis will be filed with the Bill Robertson Library, Dunedin College of Education. It will be available through interlibrary loan, and may be quoted in future research articles.

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What if participants have any questions?

If you have any questions about my project, either now or in the future, please feel free to contact me:

Sharon Booth
(phone number supplied)

or my supervisor:

Dr Gill Thomas, Dunedin College of Education.
(phone number supplied)

This project has been reviewed and approved by the Research and Ethics Committee of the Dunedin College of Education.

Consent Form for Parent Participants

The Evaluation and Impact of Parent Education in Early Numeracy

I have read the Information Sheet concerning this project and understand what it is about. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage.

I know that:
My participation in the project is entirely voluntary.
I am free to withdraw from the project at any time without any disadvantage.
The data (Audio tapes / written surveys) will be destroyed at the conclusion of the project but any results on which the project depend will be retained in secure storage for five years, after which it will be destroyed.
This project may involve an open-questioning technique where the precise nature of the questions which will be asked have not been determined in advance, but will depend on the way in which the interview develops and that in the event that the line of questioning develops in such a way that I feel hesitant or uncomfortable I may decline to answer any particular question(s) and/or may withdraw without any disadvantage of any kind.
The results of the project may be published but my anonymity will be preserved.

I agree to take part in this project.

…… ……

(Signature of participant) (Date)

This project has been reviewed and approved by the Research and Ethics Committee of the Dunedin College of Education.

Appendix B

Survey for Parents: (Research commencement)

Survey for Parents: (Research Conclusion)

Survey for Parents: (Research commencement)

Name: Date:

Background Information

1. What do you think is meant by numeracy?

Parents were asked to complete this question and then a discussion was held to clarify the definition of numeracy, before any additional questions were answered. 'Numeracy' in the following questions was defined as developing an understanding of number – knowledge of number and the application of this to solve problems.

2. What do you think is the role of parents in developing children's numeracy?

3. What qualifications do you have in mathematics? Please tick

Maths course at Secondary School

School Certificate

University Entrance

Bursary

Other: (Tertiary)

Section A

4. What is your understanding of how children develop number understanding?

Excellent None at all

1_____2_____3_____4_____5

5. How important are the following activities for children to develop their numeracy/number knowledge? (please comment if you wish)

Counting

Very important Not important

1_____2_____3_____4_____5

Reading and Writing numbers

Very Not important

1_____2_____3_____4_____5

Maths Games

Very important Not important

1_____2_____3_____4_____5

Working with other children

Very important Not important

1_____2_____3_____4_____5

Recording maths problems – written maths

Very important Not important

1_____2_____3_____4_____5

Homework

Very important Not important

1_____2_____3_____4_____5

Working with equipment

Very important Not important

1_____2_____3_____4_____5

7. Are there any other activities that you think are important to develop your child's numeracy/number knowledge?

8. What resources or equipment do you think should be used to help children learn to be numerate?

Section B

How do you feel about maths?

Highly enjoyable Don't like at all

1_____2_____3_____4_____5

How would rate your maths experiences at primary school?

Highly enjoyable Don't like at all

1_____2_____3_____4_____5

11. How would rate your maths experiences at secondary school?

Highly enjoyable Don't like at all

1_____2_____3_____4_____5

12. How would you rate your confidence in maths?

Very Confident Not confident at all

1_____2_____3_____4_____5

13. How would you rate your ability in maths?

Very high Very Low

1_____2_____3_____4_____5

Section C:

14. Do you think that all children can be successful in maths?

Highly agree Strongly Disagree

1_____2_____3_____4_____5

Why or why not?

15. Do you feel confident to help your junior child with Maths?

Very Confident Not confident at all

1_____2_____3_____4_____5

Comment?

16. Do you feel confident that you will be able to help your child throughout his/her primary schooling in Maths?

Very Confident Not confident at all

1_____2_____3_____4_____5

Comment?

17. Do you feel confident that you will be able to help your child throughout his/her secondary schooling in Maths?

Very Confident Not confident at all

1_____2_____3_____4_____5

Comment?

18. What do you expect your child to be able to achieve in maths by the end of the two years at primary school?

19. How important is it for your child to enjoy maths?

Very Important Not important

1_____2_____3_____4_____5

20. How important is it for your child to develop a positive attitude towards maths?

Very Important Not important

1_____2_____3_____4_____5

Survey for Parents: (Research conclusion)

Name: Date:

Section 1: These questions are selected from the questions that were asked at the commencement of the research

1. What do you think is the role of parents in developing children's number understanding?

2. What is your understanding of how children develop number understanding?

Excellent None at all

1_____2_____3_____4_____5

3. How important are the following activities for children to develop their numeracy/number knowledge?

a. Counting

Very important Not important

1_____2_____3_____4_____5

b. Reading and Writing numbers

Very important Not important

1_____2_____3_____4_____5

c. Maths Games

Very important Not important

1_____2_____3_____4_____5

d. Working with other children

Very important Not important

1_____2_____3_____4_____5

e. Recording maths problems – written maths

Very important Not important

1_____2_____3_____4_____5

f. Homework

Very important Not important

1_____2_____3_____4_____5

g. Working with equipment

Very important Not important

1_____2_____3_____4_____5

Please make a general comment about your choices:

4. Are there any other activities that you think are important to develop your child's numeracy/number knowledge?

5. Do you think that all children can be successful in maths?

Highly agree Strongly Disagree

1_____2_____3_____4_____5

Why or why not?

6. Do you feel confident to help your **junior** child with Maths?

Very Confident Not confident at all

1_____2_____3_____4_____5

Comment?

7. Do you feel confident that you will be able to help your child throughout his/her **primary schooling** in Maths?

Very Confident Not confident at all

1_____2_____3_____4_____5

Comment?

8. Do you feel confident that you will be able to help your child throughout his/her **secondary schooling** in Maths?

Very Confident Not confident at all

1_____2_____3_____4_____5

Comment?

9. What do you expect **your** child to be able to achieve in maths by the end of the two years at primary school?

10. How important is it for your child to enjoy maths?

Very Important Not important

1_____2_____3_____4_____5

11. How important is it for your child to develop a positive attitude towards maths?

Very Important Not important

1_____2_____3_____4_____5

Section 2: Effectiveness of the Parent Education Programme

12. Has your understanding of the stages and levels of number knowledge and strategy use, increased as a result of your involvement in this research?

A lot None at all

1_____2_____3_____4_____5

If it has, in what ways?

13. How valuable have the 1-1 sessions been in helping to increase the understanding of your child's achievement level in maths?

Very Valuable Not valuable at all

1_____2_____3_____4_____5

Comment:

14. How useful were the handouts you were given?

a. Stages of numeracy knowledge and strategy development

Very Useful Not useful at all

1_____2_____3_____4_____5

Comment:

b.Activity sheets to help move your child to the next strategy/knowledge stage

Very Useful Not useful at all

1_____2_____3_____4_____5

Comment:

c. Numberline

Very Useful Not useful at all

1_____2_____3_____4_____5

Comment:

d. Ideas for activities that help to develop basic fact knowledge

Very Useful Not useful at all

1_____2_____3_____4_____5

Comment:

e. CD – Computer games

Very Useful Not useful at all

1_____2_____3_____4_____5

Comment:

f. Website links

Very Useful Not useful at all

1_____2_____3_____4_____5

Comment:

g. Learning focus for your child

Very Useful Not useful at all

1_____2_____3_____4_____5

Comment:

Any other comments you would like to make about this project.

Thankyou very much for your helping me with this research. ☺

Appendix C

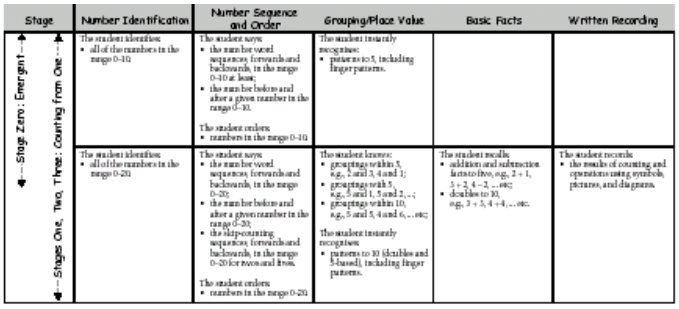
The Number Framework - Strategies and Knowledge

The Number Framework - Strategies

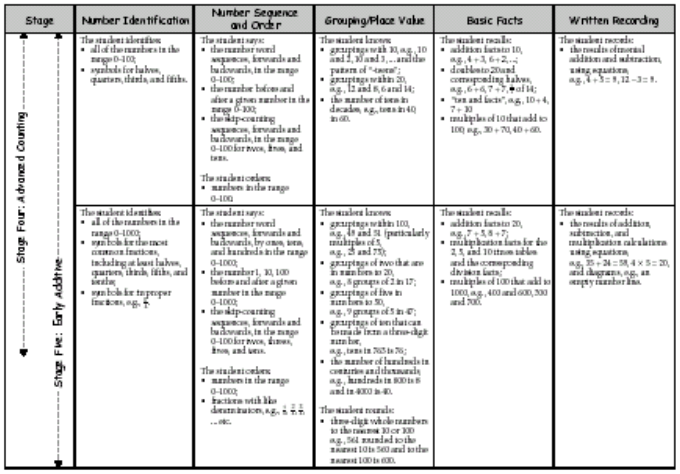
		Operational Domains		
Global Stage		Addition and Subtraction	Multiplication and Division	Proportions and Ratios
Counting	Zero: Emergent	**Emergent** The student is unable to count a given set or form a set of up to ten objects.		
	One: One-to-one Counting	**One-to-one Counting** The student is unable to count a set of objects but is unable to form sets of objects to solve simple addition and subtraction problems.	**One-to-one Counting** The student is able to count a set of objects but is unable to form sets of objects to solve simple multiplication and division problems.	**Unequal Sharing** The student is unable to divide a region or set into two or four equal parts.
	Two: Counting from One on Materials	**Counting - from One** The student solves simple addition and subtraction problems by counting all the objects, e.g., 5 + 4 as 1, 2, 3, 4, 5, 6, 7, 8, 9. The student needs supporting **materials**, like fingers.	**Counting - from One** The student solves multiplication and division problems by counting one-to-one with the aid of **materials**.	**Equal Sharing** The student is able to divide a region or set into two or more equal parts using **materials**.
	Three: Counting from One by Imaging	**Counting - from One** The student **images** all of the objects and counts them. The student does not see ten as a unit of any kind and solves multi-digit addition and subtraction problems by counting all the objects.	**Counting - from One** The student **images** the objects in simple multiplication and division problems, e.g., 4 × 2 as 1, 2, 3, 4, 5, 6, 7, 8.	**Equal Sharing** The student is able to share a region or set into two or more equal parts by using **materials** or by **imaging** the materials for simple problems, e.g., ½ of 8.
	Four: Advanced Counting	**Counting On** The student uses counting on or counting back to solve simple addition or subtraction tasks, e.g., 8 + 5 by 8, 9, 10, 11, 12, 13 or 52 – 4 as 52, 51, 50, 49, 48. Initially, the student needs supporting **materials** but later **images** the objects and counts them. The student sees 10 as a completed count composed of 10 ones. The student solves addition and subtraction tasks by incrementing in ones (38, 39, 40, ...), tens-ones (13, 23, 33, ...), and/or a combination of tens and ones counts (27, 37, 47, 48, 49, 50, 51).	**Skip-counting** On multiplication tasks, the student uses skip-counting (often in conjunction with one-to-one counting), e.g., 4 × 5 as 5, 10, 15, 20.	

		Operational Domains		
Global Stage		Addition and Subtraction	Multiplication and Division	Proportions and Ratios
Part-Whole	Five: Early Additive Part-Whole	**Early Addition and Subtraction** The student uses a limited range of mental strategies to estimate answers and solve addition or subtraction problems. These strategies involve deriving the answer from known basic facts, e.g., 8 + 7 is 8 + 8 – 1 (doubles) or 5 + 3 + 3 + 2 (10s) or 30 + 5 (making tens). Their strategies with multi-digit numbers involve using tens and hundreds as abstract units that can be partitioned, e.g., 43 + 25 = (40 + 20) + (3 + 5) = 60 + 8 = 68 (standard partitioning) or 39 + 26 = 40 + 25 = 65 (rounding and compensation).	**Multiplication by Repeated Addition** On multiplication tasks, the student uses a combination of known multiplication facts and derivation from addition fact knowledge, e.g., 4 × 6 as (5 + 6) + (5 + 6) = 12 + 12 = 24. The student uses known multiplication and repeated addition facts to anticipate the result of division, e.g., 20 ÷ 4 = 5 because 5 + 5 = 10 and 10 + 10 = 20.	**Fraction of a Number by Addition** The student finds a fraction of a number and solves division problems with remainders mentally using, halving, or deriving from known addition facts, e.g., ¼ of 12 is 4 because 3 + 3 + 3 = 9, so 4 + 4 + 4 = 12; e.g., 7 pies shared among 4 people (7 ÷ 4) by giving each person 1 pie, and ¼ pie, then ¼ pie. The student estimates answers and solves proportion and ratio problems by replicating the proportion or ratio repeatedly with the support of materials.
	Six: Advanced Additive (Early Multiplicative) Part-Whole	**Advanced Addition and Subtraction of Whole Numbers** The student can estimate answers and solve addition and subtraction tasks involving whole numbers mentally by choosing appropriately from a broad range of advanced mental strategies, e.g., 65 – 39 = 63 – 40 + 1 = 24 (rounding and compensating) or 39 + 20 + 4 = 65, so 65 – 39 = 24 (reversibility) or 64 – 40 = 24 (equal additions) e.g., 324 – 86 = 328 – 24 – 62 = 300 – 62 = 238 (standard place value partitioning) or 324 – 100 + 14 = 238 (rounding and compensating).	**Derived Multiplication** The student uses a combination of known facts and a limited range of mental strategies to derive answers to multiplication and division problems, e.g., 4 × 8 = 2 × 16 = 32 (doubling and halving) e.g., 8 × 6 is (10 × 6) – 6 = 54 (rounding). e.g., 63 ÷ 7 = 9 because 9 × 7 = 63 (reversibility)	**Fraction of a Number by Addition and Multiplication** The student uses repeated halving or known multiplication and division facts to solve problems that involve finding fractions of a set or region, renaming improper fractions, and division with remainders, e.g., ⅜ of 36, 3 × 10 = 30 36 – 30 = 6, 6 ÷ 3 = 2, 10 + 2 = 12 eg., ⅜ = 5/8 (using 5 × 3 = 15) e.g., 8 pies shared among 3 people (8 ÷ 3) by giving each person 2 pies and dividing the remaining 2 pies into thirds (answer: 2 + ⅓ + ⅓ = 2⅔). The student uses repeated replication to solve simple problems involving ratios and rates.

The Number Framework – Knowledge



Stage	Number Identification	Number Sequence and Order	Grouping/Place Value	Basic Facts	Written Recording
← Stage Zero : Emergent →	The student identifies: • all of the numbers in the range 0-10.	The student says: • the sum for word sequences, forwards and backwards, in the range 0-10 at least; • the sum for before and after a given number in the range 0–10. The student orders: • numbers in the range 0-10.	The student instantly recognises: • patterns to 5, including finger patterns.		
← Stages One, Two, Three : Counting from One →	The student identifies: • all of the numbers in the range 0-20.	The student says: • the sum for word sequences, forwards and backwards, in the range 0-20; • the sum for before and after a given number in the range 0-20; • the skip-counting sequences, forwards and backwards, in the range 0-20 for twos and tens. The student orders: • numbers in the range 0-20.	The student knows: • groupings within 5, e.g., 2 and 3, 4 and 1; • groupings with 5, e.g., 5 and 1, 5 and 2, ...; • groupings within 10, e.g., 5 and 5, 4 and 6, ... etc; The student instantly recognises: • patterns to 10 (dctables and 5-based), including finger patterns.	The student recalls: • addition and subtraction facts to five, e.g., 2 + 1, 3 + 2, 4 – 2, ... etc; • doubles to 10, e.g., 3 + 3, 4 +4, ... etc.	The student records: • the results of counting and operations using symbols, pictures, and diagrams.



Stage	Number Identification	Number Sequence and Order	Grouping/Place Value	Basic Facts	Written Recording
← Stage Four: Advanced Counting →	The student identifies: • all of the numbers in the range 0-100; • symbols for halves, quarters, thirds, and fifths.	The student says: • the number word sequences, forwards and backwards, in the range 0-100; • the number before and after a given number in the range 0-100; • the skip-counting sequences, forwards and backwards, in the range 0-100 for twos, fives, and tens. The student orders: • numbers in the range 0-100.	The student knows: • groupings with 10, e.g., 10 and 2, 30 and 3, ... and the pattern of "-teens"; • groupings within 20, e.g., 12 and 8, 6 and 14; • the number of tens in decades, e.g., tens in 40 in 60.	The student recalls: • addition facts to 10, e.g., 4 + 3, 6 + 2, ...; • doubles to 20 and corresponding halves, e.g., 6 + 6, 7 + 7, ½ of 14; • "ten and facts", e.g., 10 + 4, 7 + 10; • multiples of 10 that add to 100, e.g., 30 + 70, 40 + 60.	The student records: • the results of mental addition and subtraction, using equations, e.g., 4 + 3 = 8, 12 – 3 = 8.
← Stage Five: Early Additive →	The student identifies: • all of the numbers in the range 0-1000; • symbols for the most common fractions, including at least halves, quarters, thirds, fifths, and tenths; • symbols for improper fractions, e.g., $\frac{7}{5}$.	The student says: • the number word sequences, forwards and backwards, by ones, tens, and hundreds in the range 0-1000; • the number 1, 10, 100 before and after a given number in the range 0-1000; • the skip-counting sequences, forwards and backwards, in the range 0-100 for twos, fives, tens, and tens. The student orders: • numbers in the range 0-1000; • fractions with like denominators, e.g., $\frac{1}{5}, \frac{2}{5}, \frac{3}{5}$, ... etc.	The student knows: • groupings within 100, e.g., 45 and 55 (particularly multiples of 5, e.g., 25 and 75); • groupings of two that are in sum form to 20, e.g., 6 groups of 2 in 17; • groupings of five in sum form to 50, e.g., 9 groups of 5 in 47; • groupings of ten that can be made from a three-digit number, e.g., tens in 765 is 76; • the number of hundreds in centuries and thousands, e.g., hundreds in 800 is 8 and in 4000 is 40. The student rounds: • three-digit whole numbers to the nearest 10 or 100 e.g., 564 rounded to the nearest 10 is 560 and to the nearest 100 is 600.	The student recalls: • addition facts to 20, e.g., 7 + 5, 8 + 7; • multiplication facts for the 2, 5, and 10 times tables and the corresponding division facts; • multiples of 100 that add to 1000, e.g., 400 and 600, 300 and 700.	The student records: • the results of addition, subtraction, and multiplication calculations using equations, e.g., 25 + 24 = 58, 4 × 5 = 20, and diagrams, e.g., an empty number line.

(Ministry of Education, 2004b, pp9-10, 12-13)

Appendix D

Activities to Support the Development of Number Knowledge

Games to Reinforce Basic Facts of Addition and Subtraction

Samples of Learning Focus Tables

Activities to Support the Development of Number Knowledge

Knowledge Stages

Stage 0: Emergent Stage

The student says:
•the number word sequences, forwards and backwards, in the range0–10 at least;
•the number before and after a given number in the range 0–10.

The student orders:
•numbers in the range 0–10.

The student instantly recognises:
•patterns to 5, including finger patterns.

The student identifies:
•all of the numbers in the range 0–10.

Stage 1, 2, 3: One-to-one counting, Counting from one on materials, Counting from one by imaging.

The student says:
• the number word sequences, forwards and backwards, in the range 0–20;
• the number before and after a given number in the range 0–20;
• the skip-counting sequences, forwards and backwards, in the range0–20 for twos and fives.

The student orders:
•numbers in the range 0–20.

The student knows:
•groupings within 5,e.g., 2 and 3, 4 and 1;
•groupings with 5,e.g., 5 and 1, 5 and 2, ...;
•groupings within 10,e.g., 5 and 5, 4 and 6, ... etc;

The student instantly recognises:
•patterns to 10 (doubles and 5-based), including finger patterns.

The student identifies:
•all of the numbers in the range 0–20.

The student recalls:
•addition and subtractionfacts to five, e.g., 2 + 1,3 + 2, 4 – 2, ... etc;
•doubles to 10,e.g., 3 + 3, 4 + 4, ... etc.

The student records:
•the results of counting and operations using symbols, pictures, and diagrams.

Activities to Develop Number Knowledge

Counting

Learning to say the forwards and backwards number words sequences, from random numbers to 10… to 20… to 50… to 100.
Skip-counting by two fives and tens, forwards and backwards. (when child can count to 50 at least)
Ask the child to clap as they count in ones
Clap on different parts of the body, if skip counting in 2's, 3's etc. e.g the child touches their knees and silently thinks "one" and then clap and say "two, touch their knees and silently think "three" clap and say "four"…
Point to the numbers on the number line as they count forwards and backwards, or skip count.
Use a beadline or abacus when counting or skip counting

Number Mat

Draw numbers 0 to 9, in random order on a large piece of fabric, plastic, vinyl or using chalk on concrete.
e.g.

5	8	9	3
2	7	5	0
0	1	4	6
7	9	2	8

Use this mat for the following number games. (Numbers from 0-20 can also be used)

Call out a number and the child stands on the number.
The child steps from 0-9 (forwards and backwards)
Hold up fingers – the child goes to the number
Make up cards using dots, stamps, stickers, cut out pictures of objects. Ten cards, 0-9. Turn over a card and the child counts how many and then stands on the number. The also can stand on the number after or the number before.
Play "Twister". Call out 3-4 numbers. The child must use their hands, feet or head to touch each new number. Two children could play at once. Note: A twister mat can be used – write digits 0-9 randomly on the mat. Can use cards to select the numbers that the child stands on.

Dot-to-dot Pictures
Use dot-to-dot pictures to help to reinforce number identification. The can be made up by tracing over simple pictures from children's books, or purchased from Warehouse, Paper plus etc.

Dice
Throw one or two dice. The children count the number of dots.

Pipe Cleaner / Dough models
Make up the number using pipe cleaners, plasticine, clay, playdough etc. Count out come objects to sit beside the model number. Use buttons, pegs, small toys, stones, shells etc for this.

Number Booklets
Using scrap paper, make up small booklets based on a single number. (Six posters could be created in a similar way. The backs of old calendar sheets are ideal for this.
e.g. "6" Decorate the pages in the booklets in different ways. Cut out number 6 from advertising brochures. Make a spider with six legs. Make a monster – 6 eyes, hands etc.
The child sticks six objects on each page and copies over the number six on each page.
Using adhesive dots the child makes patterns for six. The child decorates inside an outline six.

Number Cards
Write the numbers 0-9 (0-20) on cardboard. These are useful for all sorts of games. The inside of Snax, Muesli, Cereal boxes etc are ideal for these.
Children order the cards
Children count objects to match the number

Number Lines
It is really important that children "see" where a number is placed sequentially on a number line.

Make up a number line 0-20 and display on childs bedroom wall, the fridge, or attach to a ruler or cardboard for use at the table, on the floor etc.
Use to help rote counting from 1
Ask child to count from a random number forwards and backwards.
What number comes after … What number comes before …
Cover a number. Ask what number is this?
Child covers every second number and then counts in two's starting at 0…1…5…etc
Use a peg to point to the number and the child counts that number of objects. What is the next number, two more numbers, three numbers before etc.

Bead Lines
Make up a bead line usingbeads string, or shirring elastic. Group the beads in lots of fives (colour or type). Use pegs to separate each group of ten. Great for counting and helping to visualise number groups.

Abacus
An abacus can be used to reinforce counting. Beads on the abacus are grouped in 5's by colour which reinforces counting in groups of fives and tens.

Board Games
Snakes and Ladders, Ludo etc are great for reinforcing one-to-one counting.

Dominoes
Excellent for visually representing number. Count the dots as they match them. Use as the game or as counting blocks.

Fingers
The most useful tool for reinforcing counting to five and ten.
How many? Hold up hand showing 3, 2, 5, 1… 6, 9, 8 ….(Fill up one hand first when showing numbers greater than five.)
Show me 2. How many more to make 5. Show me 8. How many more to make 10?
Good for reinforcing doubles. Can use both hands to show 3+3,4+4 etc. Can use your hands and their own to show doubles beyond 5.
Can use your hands to show 10, and then their hands to show "teen" numbers.
Ask the child to show you numbers to ten whilst holding their hands on their head. They can't see their fingers. This helps them to visualise the number.

Tens Frames

Use counters, buttons etc to fill the tens frames. This can be drawn on a piece of paper and the objects placed on top.
For numbers greater than five, fill up one row of five first. This helps to reinforce grouping within five and ten.
Also useful for showing doubles. 3+3, 4+4, 1+1.
Ask How many? How many more to make five? How many more to make ten?
Can use two of these to show '"teen" numbers. 10+4, 10+6 … How many more to make 20?
Can use more sets to show 5 groups of ten = 50 etc.

Games to reinforce basic facts of addition and subtraction

Number Mat
Throw two counters on the mat. Add the numbers together.
Throw one counter. Add or subtract that number to/from 10, 20 (The number you are adding/ subtracting to/from could be written on a piece of paper)
Throw one counter. Add/Subtract that number to/from 12, 18, 24, 37….
Throw three counters. Add all numbers. Look for the numbers that you can add easily first.

Card Games: Remove the picture cards. Ace is 1.
Memory doubles
Snap, but you must give the answer to the double you are snapping
Add two cards together.
Add three cards together. Select two cards to start with developing part-whole thinking.
E.g 6, 8, 4 6+4=10+8=18; 4, 4, 2 4+4=8+2=10
Turn over a 10. Turn over another card. Add to/Subtract from the 10…
Turn over two 10 cards = 20. Turn over another card. Add to/ Subtract this from 20.
Use other numbers in this way. eg. Turn over a 2, add to this card.

Ten Pin Bowls
Great if you have a plastic bowling set. Practice with subtraction from 10. Bowl. Record the result as 10-4= 6, Record the second bowl 6-1=5. You don't need to record, but ask the child to say the number sentence.

Play money
Practice adding notes, coins. $1+$2 =$3; $10+$5=$15
5 cents coins - counting forwards and backwards in 5s
10 cent coins – counting forwards and backwards in 10s
20 cent coins – counting forwards and backwards in 20s
50 cent coins - counting forwards and backwards in 50s
Use notes in a similar way.

Samples of Specific Learning Focus Table

Sample 1

Materials given to parents	Numberline 1-100	Hundreds Board	Sheet A: Number Identification and Sequence	Sheet B: Emergent – 1-1 counting	Sheet C: 1-1 Counting – 1-1Count on Mats	Sheet D: Count from one by imaging	Sheet E: Advanced Counting	Sheet F: Developing Part-whole thinking	Basic Facts Games/Internet Links
18.2.04	√		√	√		√			
31.3.04									√
Learning Focus: Note: √ indicates this outcome has been achieved.	18.2.04 Check teen/ty confusion Numeral identification to 20 and then beyond. Play lots of games etc – perhaps dot to dot books etc Random forwards number counting to 50 and then beyond. Emphasis needs to be on backwards number counting to 10, then to 20… include random numbers Needs to develop instant knowledge of groupings within five and ten- lots of practice using hands, then developing imaging. Introduce addition and subtraction concurrently 31.3.04 Practice (+,-) Groups within 10 Learn doubles: 2+2, 3+3, 4+4, 5+5, 10+10 Continue working on random counting backwards and forwards to 50, to100 Count backwards from 25, 22 etc – crossing backwards over 20 and in teens Say number before, after – especially in teens Check [child] knows 12 – not "twenteen" Skip Counting 10's to 100, 5's to 50. 31.5.04 Develop instant knowledge of addition and subtraction facts with numbers to 5 and to 10 – use fingers and tens frames to reinforce these visually. *It takes lots of practice to develop instant recall* Ask [child] to put her hands behind her back when adding or subtracting, or to "see" the dots on the tens frames, to develop imaging. Count on or back from a number for adding and subtracting numbers with numbers totaling more than 10. (Advanced Counting) Doubles: 6+6, 7+7, 8+8, 9+9. Using her knowledge of doubles: What is ½ of 10, ½ of 8, , ½ of 6… Tell me:5+ _ =10, 3+ _ =6 … 12-6=, 10-5= … Skip Counting in 2's to 20, 5's to 50, 10's to 100. Forwards and when she knows this backwards. Try skip counting from random numbers eg. 4,6,8,10…15,20,25,30…90,80,70,60….14,16,18…12,10,8,6…45,40,35 When she can skip count introduce X10 tables as groups of 10. She can use her fingers at first to skip count. 3x10 … 3 groups of ten, 3 lots of 10 = 10,20,30. Practice writing down the addition and subtraction facts she is learning.									

Sample 2

Materials given to parents	Numberline 1-100	Hundreds Board	Sheet A: Number Identification and Sequence	Sheet B: Emergent – 1-1 counting	Sheet C: 1-1 Counting – 1-1Count on Mats	Sheet D: Count from one by imaging	Sheet E: Advanced Counting	Sheet F: Developing Part-whole thinking	Basic Facts Games/Internet Links
18.2.04	√	√				√			
31.3.04									√

Learning Focus:

Note:
√ indicates this outcome has been achieved.

18.2.04
Developing imaging – importance of knowing groupings within 5 and 10. (using fingers at first)
Developing groupings within 5 and 10 using ten frames.
Developing groups with tens using tens frames and other materials - bags of 10 beans etc. e.g 10 + 4 = 14

Random counting - backwards and forwards to 100, and then beyond 100
Needs to practice crossing decade: 80-90
Numeral Identification – excellent to 100, could develop this further to numbers beyond 100. (not important at this stage)
Introduce addition and subtraction concurrently

31.3.04
Continue to practice goals above. [Child] knows instantly that 10+4=14 10+6=16… and has instant recall of groupings within 5 and some within 10 and can random count to 100 forwards and backwards.
Move to advanced counting using numbers greater than 10.
Continue to practice basic facts of + and -. Numbers within 10 and 20.
Random counting beyond 100 – forwards and backwards

31.5.04
Continue to practice basic facts of addition and subtraction to develop instant recall of groups within 10 then within 20.
Develop part whole thinking strategies from facts he knows. using doubles + or – 1, 10=4+14 so 9+4=13.. 20+6=26 so 21+6=27…10-4=6 so 11-4=7 etc
Using her knowledge of doubles: What is ½ of 10, ½ of 8, , ½ of 6… Tell me: 5+ _ =10, 3+ _=6 … 12-6=, 10-5=
Times Tables; x2,x5,x10,x1,x0 "x" means groups of, sets of
÷ 10, ÷5, ÷2. "÷" means how many … in? 18÷2= (How many 2's in 18?)
Skip counting in 2s,5s,10s from random numbers forwards and backwards