Professional Development in Mathematics for Primary Teachers

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Abstract

The purpose of this study was to describe teachers and principal perceptions about professional development in primary schools, and in particular mathematics professional development. A survey of primary teachers examined teachers' recent professional development experiences and related issues of access, needs assessment, effective and sustainable professional development, and accountability. These issues were further explored in relation to four case study schools in which both teachers and principals were interviewed.

The study identified that there are a number of issues to confront when developing professional development programmes if individual and school needs are to be addressed. In particular, the need to obtain a balance between individual needs and school needs, the ideal and the reality, short-term and long-term needs, and curriculum demands and subject needs of individual teachers was an ever present challenge. The questionnaire results showed that mathematics professional development was not accessed regularly by all teachers, and in a few cases teachers reported purposely avoiding mathematics professional development because of a lack of confidence or entrenched beliefs. Issues of time for professional development and competing curriculum demands for primary teachers was a common concern of both principals and teachers.

Professional development should be valued as an integral part of teaching and learning. In the case of mathematics this integration could well include the need to address teacher attitudes and beliefs about mathematics. Case studies suggest that school culture impacts on the value and integration of professional development and that the success or otherwise of any professional development initiatives is strongly related to the leadership and support structures within a school.

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Chapter One: Introduction

1.1 Background to the Study

Since 1993 primary teachers in New Zealand have experienced a significant amount of change across a range of curricula. Curriculum reviews during the 1990s concluded that there was a "need for a curriculum framework to provide a more coherent and integrated structure, for a school curriculum designed in consultation with all interested parties, and for assessment procedures which focused on improving the quality of learning" (Ministry of Education, 1993, p. 27). The result was the publication of *The New Zealand Curriculum Framework* (Ministry of Education, 1993), followed by new curriculum documents in seven essential learning areas, the first of which was the *Mathematics in the New Zealand Curriculum* (1992).

The New Zealand Curriculum Framework divided curricula into seven essential learning areas and identified eight essential skills. For primary school teachers this has meant that they have been required to up-skill themselves in all of the essential learning areas over the last ten years. To support these changes the Ministry of Education offered both primary and secondary teachers professional development opportunities aligned with the successive introduction of curriculum documents. These professional development programmes were designed to assist the initial implementation of curricula, addressing both content change, and in some subject areas to support pedagogical change. However, the initial professional development for mathematics "did not provide them [teachers] with pedagogical content knowledge as this was not an explicit focus of the contracts" (Education Review Office, 2000, p. 36). Other factors that affected the implementation of the mathematics curriculum included schools choosing to participate, or not, in the professional development, as well as choosing which staff were to be trained. Consequently some teachers were not involved in the early initiatives for mathematics (Education Review Office, 2000).

In New Zealand the professional development of mathematics teachers to teach mathematics effectively has received considerable attention since the Third International Mathematics and Sciences Study (Garden, 1996; Thomas, 1998), in which New Zealand students' lower than expected mathematics performance "was significantly below international means" (Ministry of Education, 1997, p. 2). As part of the ongoing concerns with achievement identified by the Third International Mathematics and Sciences Study, and in accord with the international focus on numeracy, New Zealand primary teachers are currently involved in a large scale numeracy initiative funded by the Ministry of Education. The nature of this professional development initiative is directly aligned with recommendations from the 1997 Mathematics and Science Taskforce which noted that "professional support needs to be school-based and provided over a period of time" (p. 11).

School-based professional development programmes are funded in a number of ways. Since New Zealand schools have had autonomy through Boards of Trustees under Tomorrow's Schools, professional development has been funded directly to schools through the operations grants. However, as schools are expected to identify areas of need themselves this funding is not tagged to any specific professional development. Additionally, the Crown through the Ministry of Education purchases in-service training centrally through contracts with providers (Education Review Office, 2000).

Despite substantial amounts of money being invested in professional development programmes in New Zealand little is "known about the effectiveness of any particular training initiative" (Education Review Office, 2000, p. 13). Furthermore, the Education Review Office identified that education systems they have studied have not provided "comprehensive information on the quality or effectiveness of attempts to improve what happens in classrooms as a consequence of in-service teacher education" (p. 37).

In line with the recommendations of the Mathematics and Science Taskforce (1997) a longitudinal research programme (Higgins, 2001, 2002; Thomas & Ward, 2001, 2002) has been funded by the Ministry of Education to investigate the numeracy development and associated components of the professional development.

While these initiatives provide substantial feedback about the nature of professional development and the effectiveness of the current numeracy initiatives, in terms of student achievement, there is little research that examines professional development opportunities and experiences from primary teachers' perspectives. Specifically, issues related to teachers' perception of needs for professional development, perceptions of effective professional development and views on issues relating to the accessibility of professional development are needed to provide a more holistic overview. Information relating to the range and effectiveness of professional development needs sourced from the teachers themselves would inform about future professional development initiatives.

1.2 Research Questions

The aim of this study is to explore teachers' and principals' perceptions of current professional development opportunities in general and specifically in mathematics. The study is designed to gather information based on perceptions of practicing primary teachers' and principals' professional development experiences to answer the following questions:

- What professional development have teachers recently been involved in?
- What are the perceived professional development needs of teachers?
- How are professional development needs of teachers established?
- What do teachers believe to be the nature of effective mathematics professional development programmes?

Answers to these questions will help to identify key aspects of effective professional development practices. In identifying good practices there is an expectation that discussions will also reveal those factors which affect professional development in mathematics—including both positive and negative factors concerning issues of access to, attitudes towards and suitability of professional development opportunities. This data will collectively provide an overview of how well teachers perceive their current professional development needs are currently being addressed.

At present, in New Zealand, while there is an increased focus on evaluation of professional development approaches and mathematics programmes (for example the Numeracy Project reports), there is a limited amount of research and data concerning teacher perceptions of their professional development needs in mathematics. It is intended that this study will provide an insight into the way professional development needs of primary teachers are identified and allocated. Furthermore, principals may consider the findings of this study when planning their school professional development programmes.

1.3 Definition of Terms and Policy Requirements

When conducting research it is important that the terms are clearly defined. Professional development in education is a term that is used often and may have varying meanings for different audiences and in different contexts. Within the education context the term professional development is often interchanged with terms such as: in-service training, staff or teacher development, teacher education, or school-based professional development, to name a few. For the purpose of this study the following definition for professional development, as provided by the Education Review Office (2000), is used:

> *Professional development* signifies any activity that develops an individual's skills, knowledge, expertise and other characteristics as a teacher. These include personal study and reflection as well as formal courses. (p. 3)

Policy documents within the New Zealand education system establish a clear expectation that teachers engage in professional development throughout their careers. The National Educational Goals and the National Administration Guidelines (Ministry of Education, 2000) provide school boards of trustees and teachers with clear directives for strategic planning:

> *"Each Board of Trustees with the principal and teaching staff is required to:*
> *(i) develop a strategic plan which documents how they are giving effect to the national Education Guidelines through their policies, plans and programmes, including those for curriculum, assessment and* ***staff professional development.***" (National Administration Guideline 2)

In my role as a principal, and in conversations with other principals, balancing the needs of all staff with school-wide developmental needs is a challenging task. This task is confounded by the need to be responsive to government priorities and the availability of programmes, which at times, do not always match the school or staff strategic priorities or needs. The research questions will go some way to exploring if these personal experiences are more widely shared and provide some insights into how other principals and their staff address their professional development needs in relation to mathematics.

1.4 Overview

Chapter 2 reviews the literature in the field of professional development and provides a background to mathematics professional development programmes within the recent New Zealand context from which this project can be viewed. The chapter provides a reference for the study, including a summary of the approaches to and types of professional development, the current opportunities available to teachers, and issues relating to the effectiveness of professional development.

The third chapter discusses the methodology. It overviews the data collection instruments and the project schedule. Chapter 4 provides an analysis of the

results from the information collected by the questionnaire administered to teachers.

Chapters 5 to 8 analyse the data from interviews conducted with principals and teachers in four case study schools. The principal and teacher interviews are then discussed within the context of each school and conclusions are drawn.

The final chapter, Chapter 9, discusses common themes from the questionnaire and case study interviews and conclusions are drawn within the context of the study. Implications for future professional development in mathematics are presented and further areas of research are suggested.

Chapter Two: Literature Review

2.1 Introduction

The strength and effectiveness of any school is built on the individuals within. The importance of people as the key can be summed up by the Mäori proverb:

Ke mai koe ki au
He aha te mea nui o te ao?
Maku e ki atu –
He tangata, he tangata, he tangata

If you should ask me
What is the most important thing in this world?
I will say –
It is people, it is people, it is people.

It is important for schools to invest in developing its people, teachers, through professional development initiatives in order to nurture life-long learning and to maintain and grow an individual's knowledge base.

However, to influence the way an individual thinks professional development needs to be purposeful and designed with the intention to modify practice. As such, it should "make a difference to the delivery of the teaching and learning programme, and ensure that both opportunities and outcomes for students is improved" (Hill, Hawk, & Taylor, 2002, p. 12).

In this chapter specific research literature citing the purposes of professional development and issues relating to it are discussed in order to provide a background to professional development models and current provisions of professional development used in the primary-based education sector in New Zealand, highlighting, those that are specific for primary teachers in mathematics: namely the Numeracy Project. The nature of professional

development will be reviewed and consideration of effectiveness and issues relating to it from a teacher's perspective presented.

2.2 Purposes of Professional Development

Professional development can be in response to an inside or outside stimulus or need and thus serves a range of purposes or functions. Cardno (1992) identifies three purposes of professional development:

- The improvement and professional growth of a teacher.
- The need for school wide development which requires the individual teacher in the school to be part of the development.
- A response by schools to a directive from the Ministry of Education.

Schlechty (1983, cited in Clarke & Clarke, 1998) describes professional development as having three principal functions:

- the maintenance function;
- the establishment function; and
- the enhancement function.

The maintenance function encompasses professional development that relates to either the need for a change in practice to ensure compliance or to provide teachers with opportunities to refresh themselves. In New Zealand, professional development that relates to compliance issues has often been determined by internal self-review procedures (as required by National Administration Guidelines). Alternatively, the need for a change in practice may have been identified by the government's external review agency (Education Review Office) as requiring attention. For example, an external review could identify that school systems need to be improved or that a specific curriculum area needs further development. Typically, maintenance professional development relates to a school-wide development and requires a group of teachers in the school to be part of the development.

Additionally, an individual teacher's appraisal may also identify professional development needs to improve classroom instruction, subject knowledge, or interpersonal skills. However, professional development that is undertaken in an area identified as needing to improve as a result of appraisal, such as teaching practice, does not necessarily result in long-term improvement. In some instances the teacher(s) concerned may comply behaviourally but not necessarily internalise the change and therefore revert to their normal teaching practice once support is removed (Corbett, Firestone, & Rossman, 1987). In such cases, the barrier is often the teacher's own beliefs, ideas and understanding of the subject or of teaching and learning pedagogy in general (Clarke & Clarke, 1998; Korthagen & Kessels, 1999; Law, 1997; Lloyd, 1999).

On the positive side professional development that is job-embedded or practice-based is viewed by teachers as relevant. If teachers can see the relevance of the professional development to their classroom practice they will "learn either to pursue the connections between teaching and learning with aggressive curiosity or healthy skepticism" (Little, 1982, p. 339).

The establishment function encompasses professional development that relates to external changes such as the introduction of new curricula. This is likely to be as a result of a directive from an educational authority, such as the Ministry of Education in New Zealand, which acts as an agent for the Government. In New Zealand, throughout the 1990s and the early part of the 21st century, many professional development programmes were contracted out by the Ministry of Education to assist with the introduction of curricula documents for each of the seven identified essential learning areas. The curricula documents gave New Zealand teacher educators, for the first time, a cohesive flow for each curricula from Year 1 through to Year 13. The seven curricula were mandated with the publication of The New Zealand Curriculum Framework (Ministry of Education, 1993).

The first of the curricula to be published was *Mathematics in the New Zealand Curriculum* (Ministry of Education, 1992). To facilitate the implementation of this curriculum document the Ministry of Education organised opportunities for schools to participate in national training and development projects, commonly referred to as 'contracts'. Specifically, the introduction of *Mathematics in the New Zealand Curriculum* (1992) was supported by contracts for the delivery of a mathematics professional development programme. The funding for the delivery of the professional development programme was made available from contestable government funds.

One of the objectives of the national professional development accompanying the introduction of the mathematics curriculum was the requirement for teachers to rethink their beliefs and practices about the teaching and learning of mathematics (Walshaw, 1994). This is because an individual's prior experiences of a subject, and their existing beliefs about teaching and learning affects the success of any reform (Loucks-Horsley, Love, Stiles, Mundry, & Hewson, 2003). Ball (1996) contends that for professional development to be effective it is imperative that teachers' culturally embedded views of mathematics are challenged.

In the case of mathematics it has been said that in many schools the changes made to teaching and learning following the introduction of *Mathematics in the New Zealand Curriculum* (1992) have been minimal (Education Review Office, 2000). Walshaw's (1994) findings noted that the individual teachers interviewed in her study, responded differently to the implementation of *Mathematics in the New Zealand Curriculum* (1992) and consequently "the curriculum's meanings are fractured and incomplete" (p. 65). The reason for this is that the individual's interests and perspective impacts on and filters the schools' or departments' understanding of the curriculum, resulting in a variety of 'implemented' curricula that vary from the 'intended' curriculum. The Mathematics and Science Taskforce (1997) "was established because of reported

difficulties of classroom teachers (especially primary teachers) in implementing the new curricula for mathematics and science and in the light of the reported results of the Third International Mathematics and Science Study" (Ministry of Education, 1997, p. 1). As a result current mathematics professional development initiatives, such as the Numeracy Project were introduced. (These are discussed more fully in 2.7).

The improvement and professional growth of a teacher can be encapsulated in Schlechty's (1983) last function of professional development, namely the enhancement function. This function has the purpose of encouraging teachers to reflect on their practice and to experiment with new ideas. An outcome of this purpose of professional development is that the individual teacher will expand the repertoire of their approaches to teaching and learning, thus effecting sustainable, generative change. By involving teachers in the continuous process of improvement, changes in pedagogy will occur (Loucks-Horsley et al., 2003).

For these three key functions there are a range of professional development programme options. This range includes professional development programmes that are comprehensive, one-shot models, conferences, in-house, and holistic video-based, to mention a few. Accordingly, each of the options has both advantages and disadvantages depending on the need and learning style of the individual (Lauro, 1995). It is for this reason that when planning a professional development programme the facilitator should adopt a model of professional development that meets participants' objectives and desired outcomes. Effective professional development programmes also need to acknowledge that the goals, strengths, resources and barriers of a particular setting are unique (Loucks-Horsley et al., 2003).

If the improvement of teaching and learning is the desired outcome then it is likely that several types of professional development would be needed within a

programme to ensure that the professional development needs of individuals are met. The types of professional development will be explored in relation to specific models in Section 2.5.

2.3 Schools' Professional Development Accountability

The Ministry of Education's National Administration Guidelines make it clear that the responsibility for providing professional development lies with key personnel in a school: the Board of Trustees, the principal, and the staff. The government has supported this by devolving school management to schools since 1989. This policy has resulted in an increase in school-based and managed professional development (Cardno, 1992; Law, 1997). In terms of mathematics, the Ministry of Education's report by the Mathematics and Science Taskforce (1997) highlighted that Boards of Trustees and principals should be aware of the need for ongoing training in the areas of mathematics and science.

However, while the Board of Trustees is responsible for professional development; in a learner centred school "everyone takes some responsibility for everyone else's learning" (Loucks-Horsley, 1995, p. 269). In particular, the principal, as the leading professional in a school, is expected to take responsibility for curriculum development, staff development, evaluation and reporting of both staff and student progress. The implications of the reciprocal relationships between these aspects are considered in Burch and Spillane's (2003) study of leadership strategies supporting reforms in mathematics and literacy instruction. This study concluded that leaders who interact regularly with their staff about teaching and learning also acknowledge the importance of using both internal and external expertise in professional development programmes. Additionally, the study suggested that the leader's view of a subject influenced any reforms; resulting in time allocations, staffing and professional development being dependent on the value attached to the subject.

2.4 Effective Professional Development

There are many types of professional development available to teachers and in turn there are variations to the approaches that schools adopt. An effective professional development programme is not simply about importing a model or following a formula (Glover & Law, 1996; Loucks-Horsely et al., 2003). It is a process of thoughtful, conscious decision making involving: time to plan, design, trial, practice and evaluate a professional development model that is effective for the situation and the teachers concerned (Bobis, 1998; Loucks-Horsely, 1995; Stein, Smith & Silver, 1999; Stigler & Hiebert, 1992).

Professional development programmes need to consider the learner, and in mathematics education the teacher is an adult learner and as such brings existing knowledge and experience to the professional development. Loucks-Horsley et al. (2003) and the Education Review Office (2002) identify that effective professional development will include characteristics such as:

- Effective classroom learning and teaching strategies
- Opportunities for teachers to build their pedagogical knowledge
- Opportunities to examine practice
- A research base
- Engagement of teachers as adult learners
- Opportunities to collaborate with colleagues and experts
- A design based on student learning data being collected and continually evaluated.

However, participation in a professional development programme does not automatically result in effective change in teacher belief, practice or subject knowledge. Additionally, change can occur at a variety of levels. One level of change is superficial. For example, at the end of a single professional development session, while evaluations from teachers may be positive, there is no indication whether the session has helped teachers make long-term change (Irwin, 1994). If, however, change is to be generative, that is evolving as

knowledge and skills change, then professional development programmes need to include characteristics that will support the change process. Timperley (2003) contends that the focus for professional development "should shift from using external courses and workshops to developing strong professional communities with schools, where professional learning is built into every teacher's everyday working responsibilities" (p. 4). Generally this requires professional development to be integrated or embedded into a teacher's job. As such, it needs to be sustained over time in an environment that supports staff collaboration (Ball, 1996; Darling-Hammond et al., 1993; Fennema & Franke 1992; Franke, Carpenter, Levi, & Fennema, 2001; Ministry of Education, 1997).

Cognitively Guided Instruction (CGI) research provides an example of professional development based on collaboration. CGI is based on the principle that teachers develop a basis for understanding and building on their students' mathematical thinking by listening to their students. Franke, Carpenter, Levi and Fennema's (2001) follow-up study of 22 teachers involved in CGI, four years after the professional development had ended, indicated that while all 22 teachers maintained some use of children's mathematical thinking only 10 were engaged in generative growth and continued to learn. Specific characteristics in this study that sustained the change in practice included the following:

- The majority of the teachers within a school participated in the professional development programme
- Continued support and commitment from a research team
- Collegial collaboration in the form of regular meetings with other teachers to plan, evaluate and discuss programmes.

Franke and colleagues (2001) claim that generative growth occurred when the teachers not only listened to their students' thinking but discussed or reflected on student thinking, thus making connections for themselves to create, adapt and investigate their own knowledge. Other examples of professional development that support generative change include activities such as

coaching, discussion, quality learning circles, study groups and mentoring. The key is for teachers themselves to identify that they are "on-going learners, seeking classroom practices that are responsive to the needs of students and continually evaluating and adapting classroom practice" (Franke et. al., 2001, p. 658). This requires the teacher to reflect on their teaching, to listen to the student's thinking, and to integrate new knowledge with existing knowledge Generative change can be sustained if teachers are encouraged to participate in professional development that supports their on-going learning and provides them with opportunities to collaborate with their colleagues (Franke et. al., 2001).

In line with increased accountabilities in education, there are increased calls for professional development needs to be evaluated by all involved. The Education Review Office (2000) noted that there is "an absence of systems for evaluating the effectiveness of [professional development] programmes in schools" (p. 71). Evaluation is not however a straightforward process: effectiveness of professional development programmes is subjective and will depend on both an individual's and a school's perspective. Those involved in the *In-service Training for Teachers in New Zealand Schools* report (Education Review Office, 2000) identified the following as effective measures of professional development:

- "When children can do it" (p. 52).
- "When teachers can apply their new learning" (p. 53).
- "When teachers talk the changes" (p. 54).
- "If teachers want to learn more" (p. 55).
- "They persuade their colleagues to learn more" (p. 55).

Any professional development programme (based on the variety of types, models and approaches) has its own advantages and disadvantages and potentionally contributes in some way "to the improvement of teaching and learning as no one teacher approaches staff development in the same way"

(Lauro, 1995, p. 65). It is the instructional leader's role to support and develop appropriate professional development programmes for the staff in a particular school.

Professional development has traditionally been a practice that concentrates on giving teachers answers by conveying information, providing ideas and training skills (Little, 1993, cited in Ball, 1996). Examples of this type of professional development can be found in the one-day course or the one-shot model (Clarke & Clarke, 1998; Lauro, 1995). Professional development of this nature is considered to be both effective and non-effective depending on the intended purpose. The one-day course is considered effective if the purpose is to convey information to teachers or schools en masse (for example NCEA information training days). However, if it is to change practice then the one-shot model is likely to be ineffective due to the lack of follow up. The result will be superficial change and teachers will revert back to their original practice given time.

Two key factors that can support effective professional development include: reflective practice and tertiary/primary interface.

Reflective practice

Reflective practice is teachers' inquiry into their work. Teachers can reflect individually or as a part of a small or large group. It can be both formal and informal in nature. For example, reflective practice may occur informally, as in conversations with colleagues, or formally, as in set meeting times with specific issues to discuss. Teachers that regularly reflect on their practice demonstrate professional development that is embedded in the job and part of normal practice.

Increasingly, professional development programmes are designed to encourage teachers in reflective practice. If inquiry is based on one's own practice, it is

likely that the individual will use educational research and theories to support their practice (Ball, 1996; Bobis, 1998; Clarke, 1999; Stewart, 1997). Critically reflecting on practice enables teachers to "fashion new knowledge and beliefs about content, pedagogy and learners" (Darling-Hammond & McLaughlin, 1995, p. 597) that are essential in times of curriculum reform.

When a supportive school culture fosters reflective practice, several researchers note advantages for engaging in reflective practices as part of a group (Clarke, 1999; Cooney & Krainer, 1997; Crawford & Adler, 1997; Glover & Law 1996) For example, reflecting at a team meeting or with critical friends fosters an atmosphere of collegiality and collaboration and is more likely to involve teachers as both as learners and teachers (Darling-Hammond et al., 1993; Little, 2003). They receive immediate feedback on ideas and issues relating to their teaching practice (Cardno, 1992; Clarke & Clarke 1998; Little, 2003; Loucks-Horsley, 1995). Moreover, teachers who have opportunities to plan together, observe each other, and diagnose students' learning difficulties and evaluate students' learning "are apparently happier with teaching as a profession than those who do not have such opportunities" (Noddings, 1992, p. 204). Collaboration allows teachers to raise issues relating to their classrooms and removes the isolation that can occur in teaching. Furthermore, Holly (1982) contends teachers undertaking shared professional development gain valuable information, as they share practical ideas, as well as having a chance to plan, read and observe together. Discussion following these forms of collaboration allows teachers to reflect on any progress or concerns that they have.

Primary teachers sometimes feel that the drawback about being a generalist is that they have many irons in the fire (Clarke, 1999). A team approach to teaching provides an opportunity for collaboration and gives the individual support in the delivery of curricula that they are not confident with (Clarke, 1999). For example, discussions relating to teaching and learning provide valuable opportunities for experienced teachers to influence beginning teachers'

knowledge of curriculum (Feiman-Nemser & Parker, 1990). Such opportunities can occur if teachers participate in study groups (Arbaugh, 2003) or professional communities (Little, 2003). A key factor in each case is the allocation of a set time for teachers to meet and discuss. For example, in education, a study group is a group of people "who come together on a regular basis to explore different aspects of education" (Arbaugh, 2003, p. 141). Consequently, the composition and purpose of study groups will vary. However, the underlying assumption is that teachers will use the opportunities provided within the group to be exposed to information and ideas that will improve their practice and beliefs about teaching and learning. An advantage of study groups is that for teachers, particularly secondary, it removes the isolation that can occur in teaching and replaces it with collaboration.

By giving teachers time to discuss issues relating to teaching and learning, schools are maximising teacher involvement in the professional development process (Clarke et al., 1997). An advantage of this approach to professional development is its on-going nature and sustainability. Providing such a culture of professional practice within a school is cognizant of the view that learning about teaching is a life-long process (Darling-Hammond et al., 1993).

Tertiary/Primary interface

In the recent past, custom and practice has been for teachers in schools and lecturers in tertiary education institutions to be quite independent. This practice has hampered teachers' access to research as part of their everyday practice The exception would be when teachers are involved in personal study, commonly involving the reading of the literature, as part of their professional development (Christensen, 1982). Today, however, collaboration between schools and tertiary institutions in the form of professional development or participatory action research is encouraged, creating opportunities for increased capacity and capability of all concerned (Bobis, 1998; Codd, 1997; Lieberman, 1995; Poskitt, 1995, 2001). Other examples of in-service development studies in

which researchers collaborate with teachers to support the development of a professional community include study groups and lesson plans.

Professional development and research should go together if programmes are to be effective in improving teaching (Schmoker, 2001; Hogben, 1980). Action research is a particular form of research which often involves teams comprising both tertiary and school educators. It is regarded as particularly effective as it brings together theory with practice. Researchers have access to the practitioners of teaching and learning and "action research has the potential to both support change in professional practice and provide appropriate active learning opportunities for teachers" (Crawford & Adler, 1997, p. 1202).

One must distinguish action research from good teaching practice in that it is systematic, deliberate and open to scrutiny from others. By enhancing reflective practice through a cycle of planning, acting, observing, reflecting, evaluating, and re-planning action research can be professional development for ar individual, a group or an institution (Loucks-Horsely, 1995; Poskitt, 1995). In a school setting this form of professional development allows the teachers to have input into the planning and focus of the research thus allowing for full involvement for all participants, whether they are teacher or researcher. Additionally, Poskitt (1995) emphasises the need for the action research to be relevant and practicable. By involving teachers in the process of the decision-making that goes with the planning of professional development, teachers will own the development and any change is likely to be lasting. This means that teachers should treat analysis, evaluation and experimentation as tools of their profession, allowing them to design and work better. Professional development which provokes questions, organises responses and analysis, generates evidence of success and differences in approaches to teaching and learning has the change process in mind (Little, 1982; Loucks-Horsley et al., 2003). Change cannot happen in isolation and requires strategic direction. Research based on teaching and learning practices needs to be introduced.

Wood & Berry (2003) contend that despite 'voluminous' research in general teacher education and mathematics teacher education it remains impossible to address all issues at all times in professional development. However, "design research allows us to consider the complexities of mathematics teaching and of teacher development in our initial design" (Wood & Berry, 2003, p. 196). It is through reflections and revisions of the model that the work of teacher educators, teachers and students can be integrated. The professional development model designed requires teacher educators and teachers to collaborate and work jointly on the design, as each individual will participate in different ways and for different purposes. This will occur as individual roles and responsibilities change, evolve and emerge, throughout the design research process. Additionally, design research allows individual creativity to pull together elements of research to 'design' a professional development model that will be both useful and effective within the context the participants are working.

2.5 Professional Development Programmes

In general a professional development programme is designed and implemented by those responsible to meet specific objective and outcome requirements. Lauro (1995) contends that there are three keys to the success of any professional development programme. Firstly, choosing the right programme for the school or teachers and making sure that the right people are leading the programme. Secondly, involving all staff, proactively in identifying their professional development needs. Thirdly, continuing the programme only if there is full support from all staff.

Schools differ in their approach to developing a professional development programme for their staff. Within the literature there are a variety of labels used to characterise the different approaches and types of professional development that contribute to an overall programme (Cardno, 1992; Clarke &

Clarke, 1998; Lauro, 1995). However, there are three overall labels that are commonly used when discussing approaches to professional development:

- The Smorgasbord Approach
- The Do-it-all Approach
- The Holistic Approach.

All of these approaches incorporate several possible types of professional development programmes.

The smorgasbord approach

The smorgasbord approach to professional development allows individuals to spend a predetermined amount of money to support their needs. It could be described as a model based on individual choice. There are both advantages and disadvantages of professional development undertaken in this way. An advantage is that an individual can receive a vast amount of information in a short space of time and consequently is used in times of reform. However, two disadvantages are:

- The issues of what information to pass on to other staff
- The high cost involved in attendance at the course.

Another concern raised in the literature about this *choice*-driven model is that there is "seldom any connection between the evaluation of performance and developmental activities chosen" (Cardno, 1992, p. 19). As a consequence, the professional development is frequently an imbalance both in the range of programmes undertaken and in the spread of the programmes across staff.

Examples of professional development that fit into the smorgasbord approach are the one-shot session, which occur throughout the year including conferences.

The do-it-all approach

The Do-It-All Approach is based on the belief that the more professional development one does the better one will perform. The result is often work overload with little long-term successful outcomes. For some primary schools, this has been their experience as they attempt to cope with the curriculum changes of the last decade by being involved in up to four contracts at a time. There has been a belief that if they do not take up the opportunity of a Ministry of Education funded contract that they will miss out and in turn their students will be disadvantaged (Cardno, 1996).

The holistic approach

The purpose of the holistic approach "is to help school leaders to view professional development as a means of meeting the needs of individuals and the organisation" (Cardno, 1996, p. 26). Rather than an ad hoc approach the holistic approach involves strategic management input. As such, it is a planned approach, which makes better use of the limited resources available to the school. The professional development takes into account school development, curriculum development, management development and personal development (Figure 2.1). Individuals, within the model, identify what professional development they need to help them meet the strategic goals of the school.

The holistic approach relies on the input of staff as well as expertise from outside the institution. There is a commitment made both in terms of time and finances. The implementation of the professional development is a long-term process. Lauro (1995) describes this approach as the *Comprehensive Approach*. He claims the effectiveness of the approach is due to consistent training sessions that focus on goals and objectives. As such, it is important to evaluate progress throughout the programme to ensure that goals are being met and still relate to the strategic direction of the school. The evaluation process may reveal a need to change the professional development programme or the focus of the

programme, in some way, to adapt to the changing environment and personnel that occur over time in schools.

Figure 2.1 A Model for Holistic Professional Development (Cardno, 1996, p. 26)

Organisation of professional development

Early professional development contract models in mathematics that occurred in the early 1990s in New Zealand were based on the sandwich course model The sandwich model was considered as "a small, but powerful shift from the one-shot model" (Clarke & Clarke, 1998, p. 10), requiring teachers to trial ideas generated from the first session and to share the outcome of their trials at the second session. Typically, such a course focuses on a single topic in a curriculum area, pedagogy or assessment. The missing piece of the puzzle in this type of professional development is the on-going support; thought by many to be critical to effect change. In some cases this model allowed for the facilitators to support teachers in between workshops in limited ways such as an additional half day's support.

More recently there has been a move for schools to engage in either whole school or cluster grouping. Clusters involve groups of individuals or schools

getting together to discuss ideas and trial new activities. This approach relies on all parties within a group being able to meet at the same time to share ideas and resources. Alternatively, clusters may use mediums such as teleconferencing or the internet to share ideas. Other terms given to clusters could be *study groups, professional communities, lesson studies, or learning circles* (Arbaugh, 2003; Hiebert & Stigler, 2000; Little, 2003; Loucks-Horsley et. al., 2003; Stewart, 1997; White & Southwell, 2003). It is likely that this approach will be part of a holistic model.

Clusters are often engaged in a structured course that occurs over a period of time, probably 8-10 sessions and involves reading, sharing and discussion in small groups. Clarke and Clarke (1998) report that this type of professional development was typical in Australia during the mid-1980s. For example, Mathematics in the Early Years (MITEY, Western Australian), Mathematics In-service Network Course (MINC, Canberra), Themes in Mathematics Education (TIME, New South Wales) and Exploring Mathematics in Classrooms (EMIC, Victoria) were structured courses. A feature of the structured course is the increase in time devoted to the improvement of teachers' knowledge of mathematical content in comparison to the predominant 'one-off' workshop. Clarke and Clarke (1998) contend that a positive feature of this type of professional development is that "they appear to have led to mathematics teachers sharing an increasingly common language" (p. 12).

School-based or in-house professional development follows the holistic or comprehensive approach where the school develops a professional development programme for the whole school, or a syndicate or group within the school. School-based or in-house professional development based on school-wide needs and issues that have been identified through self-review is considered to be very effective (Cardno, 1996; Lauro, 1995). An advantage of this approach is that teacher expertise within the school is used to lead professional development relevant to the school and staff. Another advantage

is that staff are involved in the planning of the programme (Clarke & Clarke, 1998). However, one of the issues associated with this type of professional development is the challenge to maintain participants' interest and enthusiasm. Also, problems will occur if key lead facilitators shift schools and the programme has only been maintained due to an individual's commitment.

2.6 School Issues Relating to Professional Development

Although there is a requirement in New Zealand for Boards of Trustees to provide effective professional development opportunities for their staff there is no prescription for a successful professional development programme. Consequently, designers of professional development programmes have to consider a number issues such as: resourcing, context, relevance, time, diversity of staff as learners, leaderships and capacity for building sustainability.

While each of these issues will be discussed separately in this section it should be noted that the issues overlap and so boundaries are blurred.

Resourcing

In recent years teachers have been encouraged to reflect upon their practice, both individually and within syndicates or groups. However, if reflection is going to happen and be effective, teachers need time. For teachers to be given time, schools need to allocate money at the time of school budget rounds. The concern is that when budgets are constrained the likelihood of adequate professional development support decreases (Law, 1997; Loucks-Horsley, 1995).

Allocation of a professional development budget allows schools to pay for the professional development and to employ relieving teachers, for those professional development programmes that require a teacher to have time away from teaching responsibilities. However, relieving teachers not only cost money but also require the class teachers to prepare for their time out of the classroom. One possibility is that the school is closed so that all staff can undertake

professional development. For example, in the secondary sector, schools regionally based in New Zealand have closed for approximately three to four days a year to provide professional development for National Certificate in Educational Achievement implementation. Alternatively, schools may set professional development times at the end of a school day, during departmental or staff meetings.

Time

Any professional development has a cost not only in financial terms but also in terms of time. For professional development to be effective in changing teacher beliefs and practice, schools need to provide sufficient time for staff to collaborate and think through learning experiences (Loucks-Horsley et. al., 2003). For this issue to be addressed principals and Boards of Trustees need to have a planned approach to professional development that is supported and implemented by the school leadership team. It is leadership that makes educational matters a priority; "when school leaders are genuinely concerned with leadership that influences educational change and improvement, they are likely to make professional development programmes a priority" (Cardno, 1996, p. 26).

Identifying professional development needs

Professional development needs vary depending on the perspective of the participant(s) and there could well be a tension between the professional development needs of the school, a syndicate or department, and an individual's needs (Law, 1997). Schools, therefore, need to have a system in place which will identify both the needs of individuals and the organisation.

One method, which is used increasingly in the identification of professional development needs, is the appraisal process (Cardno, 1992; Glover & Law, 1996). The appraisal process takes into account school needs; while at the same time determines the specific needs of an individual teacher. At an individual

level the focus could relate to a curriculum area, or to a school issue that needs improvement, or a personal area that requires development. The appraisal process gives the individual the opportunity to reflect on their practice and identify possible solutions to improve it. Without consideration of the appraisal results, the allocation of professional development can be haphazard. In some instances the principal may think that a particular professional development programme is important enough to direct staff to be involved. This has been common practice in the primary sector in New Zealand (Cardno, 1996). However, where the whole staff is heavily involved in contract programmes for curriculum initiatives funded by the Ministry of Education it is likely that individual needs are not given a high priority. As a result "the choice of what to become involved in is seldom connected in any way to problems of practice encountered in the [individual] appraisal process" (Cardno, 1996, p. 28).

Approaches to professional development

Professional development can be approached in a number of ways. Firstly, the co-ordinated approach, where a professional development co-ordinator is appointed. This model is often adopted by secondary schools. The professional development undertaken is requested by individual staff members or directed by the principal in response to an identified need. The providers of the professional development are varied, as is the type and model. The role of the co-ordinator is to keep records of the involvement in professional development for individuals and to manage the financial costs. However, the co-coordinator does not necessarily have a holistic overview of school-wide professional development needs except in terms of budget. The result of such an approach to professional development is heavily weighted in the area of curriculum development (Cardno, 1996). This approach could also include aspects of an *Improvement Agreement Approach* which attempts to give free choice but also has elements of a directive approach (Cardno, 1992).

A second approach, the principal-directed approach, is where the principal decides the choice of development activities and the professional development is usually associated with a specific curriculum development or implementation. This has been common in New Zealand primary schools (Cardno, 1996). With the principal-directed approach the needs of individual teachers are not always a high priority and the professional development is frequently not connected to issues identified as a need in their appraisal. This could be described as a top down approach. With little or no input from teachers the professional development is less likely to be effective, especially if teacher acceptance of the programme is problematic (Lauro, 1995).

The scope of professional development programmes

The success of each professional development programme will be affected by the number of differing professional development programmes that schools are involved with at any one time. In New Zealand, as new curricula were established during the 1990s, schools were offered a range of professional development programmes to support their implementation (Hill, Hawk, & Taylor, 2002). Schools that opt into simultaneous or successive contracts as dictated by government funding seldom connect to individual need (Cardno, 1996). Involvement in large scale national contracts can create issues for schools and providers alike. For example, sufficient experienced facilitators have to be found to deliver the contract and funding has to be allocated, both at the national level and at the local school level. Teachers may find themselves in the situation where they or their school are involved in many different professional development programmes, and are required to move from one focus to another, resulting in difficulties maintaining or consolidating current initiatives, or accessing on-going support (Cardno, 1996). The result is that there is not sufficient time to develop the ideas raised in a professional development programme before moving on to the next programme. The overall result of the constant changing foci results in unsuccessful implementation for many schools (Lauro, 1995). In New Zealand, this has been exacerbated due to the rapid

introduction of seven new curriculum documents over a period of approximately ten years (Hill, Hawk, & Taylor, 2002).

2.7 Strategic Direction of Mathematics Professional Development in New Zealand

Mathematics curriculum, in New Zealand, has changed following the introduction of *Mathematics in the New Zealand Curriculum* (1992). According to Parsons (2000) this curriculum established three major directions for mathematics education: it emphasised continuity and progression in mathematics, focussed on the importance of diagnostic and formative assessment and stressed the need for mathematics to be taught and learned in context, thus allowing for applications of mathematics in the real world.

Teacher professional development related to these three key foci of the mathematics curriculum were addressed in the first instance by schools being involved in the Ministry of Education contracts to support the implementation. These contracts were based, in general, on the sandwich course model of professional development. Teachers were encouraged to trial new ideas between professional development sessions and report back to the larger group at the next session. In between sessions, mathematics advisers and facilitators were available to work in schools with individuals or groups of teachers. However, two key factors influenced the effectiveness of the implementation of the mathematics curriculum. Firstly, over the following ten years, there was little support in the subject area other than that received by mathematics advisers and mathematics associations. Secondly, after the initial professional development, primary schools needed to begin working towards the introduction of other curriculum areas and thus their focus was no longer primarily on mathematics. Secondary school teachers, in contrast, had the advantage of working with subject related departments and adviser support, even if this was minimal with many of the larger regions having access to only part-time advisers.

Concerns about the extent of the implementation of the mathematics curriculum were noted in an Education Review Office *Mathematics in the New Zealand Curriculum* report in 1994. The *Third International Mathematics and Science Study* published in 1996 also identified concerns about the level of achievement of New Zealand students in the area of number, measurement, and algebra concepts. Although the concerns could not, as such, be attributed directly to the new curriculum, the TIMSS study suggested areas where teachers needed specific support (Parsons, 2000).

Findings from these two reports resulted in the Government establishing the Mathematics and Science Taskforce in 1997. The purpose of the Taskforce was to provide advice on how to improve the teaching of mathematics and science in New Zealand schools. The Taskforce identified a number of issues that related to the raising of performance in mathematics. Of particular concern was that: "Satisfactory learning of mathematics and science is strongly influenced by the teacher's own confidence." (Ministry of Education, 1997, p. 3). Although The Taskforce (1997) identified the need to provide resources for teachers to assist and support implementation of the curriculum "strategies for helping classroom teachers relate the use of the resource to their own practice" (Ministry of Education, 1997, p. 5) was also considered.

The principles that should underpin the teaching and learning of mathematics were clearly identified in *Mathematics in the New Zealand Curriculum'* (1992). However, if the level of mathematics was to improve for all students then the curriculum had to be understood, planned, implemented and monitored. A target group of five to nine year olds was identified (Ministry of Education, 1997). Number concepts were identified as a target area. The rationale for this target was that number concepts underpin all strands in the mathematics curriculum. It was also noted that any support intervention would have to be "accompanied by school-based professional development over time" (Parsons, 2000, p. 2). Alongside the targeted interventions and professional development

the Education Review Office Report *In Time for the Future* (2000) noted the need for:

> "....research and development in appropriate institutions such as universities and colleges of education in the teaching methods and approaches.... for successful student learning in mathematics..." (p. 105).

The Ministry of Education, in response to the Mathematics and Science Taskforce initiated the development of resources and provided professional development programmes. These included:

- *Developing Mathematics Programmes* (1997)
- *Connected* series (1998)
- Development of Problem Solving web-site (1999)
- *Figure It Out* series (1999)
- Centrally funded professional development for Year 3 teachers (1998-2000).

Additionally, the Ministry of Education convened the 'Exploring Issues in Mathematics Education' research seminar in 1998 to identify current key research issues for mathematics education.

In 1998 the Government adopted new literacy and numeracy goals for New Zealand later published in National Administration Guideline Number 1:

> *"Each Board, through the principal and staff is required to –*
>
> *I develop and implement teaching and learning programmes –*
>
> *(a) to provide all students in years 1-10 with opportunities to achieve for success in all the essential learning and skill areas of the New Zealand curriculum;*
>
> *(b) giving priority to student achievement in literacy and numeracy, especially in years 1-4."*

Since this time, one of the key issues identified has been the need to improve, through professional development initiatives, the professional knowledge, skills and confidence of teachers in mathematics (Parsons, 2000). The centrally

funded professional development contracts, which started at the Auckland College of Education, included "number knowledge frameworks drawn from Professor Bob Wright's mathematics recovery programme, the New South Wales *Count Me In Too* teacher development programme, and the *Cognitively Guided Instruction (CGI)* programme" (p. 5). The results of this initiative were brought to a national hui of mathematics advisers in 1999 and three further projects were established. These were:

- A national pilot of the *Count Me In Too* professional development package
- The *Counting On* exploratory study based at University of Waikato.
- The *Cognitively Guided Instruction* pilot based at Massey University College of Education

The research evaluating *Count Me in Too* and the *Counting On* projects provided "an opportunity to review and clarify the strategy for mathematics education in the early years" (Parsons, 2000, p. 7). The benefit of all of these projects is that they stimulated a numeracy strategy for New Zealand and "a national professional development programme for all primary school teachers" (Parsons, 2000, p. 9). Experience on the pilot programme indicated that for any large scale mathematics professional development to be successful the professional support needed to be school-based and provided over a period of time (Ministry of Education, 1997).

A major impetus of the *Count Me In Too* and *Counting On* projects was to improve the number learning of New Zealand children through a professional development project, in which teachers were expected to reflect critically on their own mathematical pedagogy and content knowledge (Thomas & Ward, 2001). Facilitators modeled and observed both lessons and assessment techniques, thus supporting teachers by providing effective feedback through discussion. "The Numeracy Exploratory Study emphasises developing children's strategic thinking and their number knowledge, with the aim of developing their understanding of how numbers work" (Higgins, 2001, p. 26).

The focus on number has required teachers to move from having students practising algorithms for each operation to developing students' number knowledge and the use of mental strategies.

With a range of differing projects all working towards the improvement of numeracy it became clear that there needed to be some consistency of approach and terminology. In 2001 there were four numeracy projects in New Zealand, which were identified as being part of the Ministry of Education's Literacy and Numeracy strategy. The projects were the *Early Numeracy Project, Continuing Support, the Advanced Numeracy Project* and the *Numeracy Exploratory Study*. At this stage all numeracy projects came under the name, *The Numeracy Development Project (NUMP)*. The Numeracy Development Project covered Years 1-10 of the New Zealand school system. The Ministry of Education's literacy and numeracy strategy reflects the key themes of "clarifying expectations, improving professional capability and involving the community" (Thomas & Ward, 2002, p. ii).

The evaluations of the Numeracy Development Project indicate that a whole school approach that incorporates in-class modeling and effective feedback based on the needs of the teacher's own students, are important components of professional development that brings about changes in teaching practice and improvement in student learning. In addition, the role of the facilitator is claimed by participants to be a key contributor to the effectiveness of the professional development model used. The facilitators scaffold, model, facilitate, observe, discuss and coach both at the school, the individual and the classroom level (Higgins, 2001; Parsons, 2001). Additionally, when professional development programmes are focused on the categories of knowledge that are important for effective teaching and "underpinned by what is known about effective professional development and teacher learning, student outcomes are improved" (Parsons, 2001, p. 4). Recent professional development, involving a lesson study group, to sustain changes introduced with the Numeracy Project is

currently being researched (Thomas, Tagg & Ward, 2003). Teachers involved in the study have found the professional development useful but are concerned about their ability to sustain the developments considering the number of curricula they are responsible for.

2.8 Summary

The research suggests that the potential effectiveness of each professional development programme may be associated with the selected model combined with a number of other factors related to the school and teacher.

Increasingly professional development programmes are subjected to evaluation. Recent evaluation of mathematics professional development in New Zealand suggests a number of key factors which support effective professional development. However the true effectiveness will be the examination of the long-term effect—the sustainability and generative change effects. Longitudinal studies in mathematics education in New Zealand are rare with current data focused on student outcomes (for example National Education Monitoring Project) rather than teacher practices and knowledge.

Professional development has traditionally been a 'one-off' reaction to perceived needs rather than a systematic programme of teacher development. The current evaluation of the Numeracy Project offers some potential to address this issue.

A review of the research has suggested that professional development needs are determined and met (or not) in a number of ways. Research suggests that professional development programmes improve and support teacher capability and as a consequence impact on student learning when the following key characteristics are part of the development programme (Begg, 1993; Bobis, 1998; Education Review Office, 2000; OECD, 1998; Parsons, 2001):

- The needs are identified systematically

- There is a focus on the classroom, which incorporates the learner, content knowledge, assessment and pedagogy
- There are links made with the gathering, analysis and use of assessment data and school development initiatives
- Opportunities are given for modelling, observation, coaching, reflection, and the use of action research approach is incorporated into the development
- Where a school-based approach fosters collaboration and collegial support over a period of time
- There is effective facilitation, and ongoing guidance and support from both within and outside of the school
- School leaders/managers are involved and committed to the development
- Evaluation based on data provides the evidence of the impact of the professional development on student achievement and teachers' knowledge beliefs and expectations.

The literature review has provided background information about the types and availability of professional development in mathematics education within New Zealand. It has also highlighted the scarcity of research related to teacher perceptions and schools perceptions about professional development opportunities. As well as the outputs of professional development we need to exam more critically teachers' access, planning and guidance to professional development programmes.

Chapter Three: Methodology

3.1 Introduction

The choice of methodology a researcher undertakes for a project must be guided by the goals of the project. As this study aims to explore teacher and principal perceptions of current professional development experiences in general, and specifically in mathematics, a qualitative methodology was considered suitable. Merriam (1998) contends that qualitative research in education endeavours to discover and understand phenomena, processes or perspectives of the participants involved. Furthermore, the researcher interprets the data from two perspectives: that of the participants and that of the researcher. The final product is a mix of description and analysis as qualitative research is influenced by both the interpretive and critical theory perspectives of inquiry.

Qualitative research is an umbrella term for different approaches to methods of research. Some examples of qualitative research include: grounded theory, ethnography, the phenomenological approach, and case study. A variety of research techniques can be utilised in case study such as: questionnaires, surveys, observations, document survey, and interviews (Merriam, 1998). In order to both capture an overview of teachers' access and experiences in professional development in the recent past a survey approach was used. Surveys are a common data collection tool ranging from simple descriptive data to complex exploratory tools designed to extract respondents' beliefs and some understanding of these (Burns, 1997). Following the survey case studies involving teachers and principals from four primary schools enabled a more in-depth exploration of teacher and principal perceptions. Consequently, a combination of a survey and case studies in this study has enabled the researcher to collect qualitative and quantitative data to add value and depth of meaning to a specific situation, in particular teacher and principal perceptions about professional development in mathematics. Merriam (1998) contends that

case study is a good design for practical problems arising out of everyday practice. Consequently, case study can be emancipatory, the key element of critical theory, as it can lead to further action or create possibilities for action to occur.

3.2 Data Collection Methods

Data collection instruments appropriate for this study are the questionnaire, interview, and the researcher.

The questionnaire

A questionnaire is a common qualitative data collection tool. It involves asking set questions and assessing the responses. Questionnaires can be written to obtain descriptive data, such as the counting of the frequency of responses, using closed questions. Alternatively, questionnaires can be written using open-ended questions, which seek to extract a respondent's ideas and beliefs.

The use of a questionnaire in research has the advantage of being easy to administer and able to produce a large number of responses in an efficient and timely manner (Burns, 1997). A questionnaire allows participants to receive the same set of questions and can guarantee the participant's confidentiality, thus providing an opportunity for more honest responses. In this study, a postal questionnaire had the added advantage of enabling participants to set their own time frame for answering the questions.

A questionnaire (Appendix C) was designed to provide data on teachers' views on what is effective mathematics professional development and to identify issues relating to professional development. The questionnaire design included both closed and open-ended items. The questionnaire was self-administered and participants were asked to post it back in the pre-paid envelope supplied.

However, there are limitations when using a questionnaire to collect data. One of the key limitations is that the responses cannot be followed up, as the questionnaires are confidential. Other limitations of a questionnaire are: that the participant must understand each question, there is an assumption that each answer has been honestly responded to, and that all participants will answer all questions. Furthermore, depending on the length of the questionnaire and the depth of answers expected, the response rate can vary in respect of each question, thus creating a biased sample.

Interviews

Interviews are a very useful technique for collecting data which would be unlikely to be accessible using the techniques of observations or questionnaires. Interviews enable the researcher to question further and clarify issues that have been raised in questionnaires. There are differing types of interviews, for example the researcher may choose either to interview an individual or to interview a group.

A focus group brings together a number of individuals to discuss a subject which is common to them (Anderson, 1990). The interview is relatively unstructured, in that the interview centres on a topic in a setting that is comfortable for the participants. To ensure that the topics for a study are addressed the interviewer will have identified some structure beforehand and the focus group interview allows an individual the choice to explain or clarify their point of view or to not respond at all. A focus group interview will provide an opportunity for individual participants to remember or mention an issue that others in the group have commented on. Morgan (1997) claims that this is an advantage when working with teachers, as such interactions expose a wealth of ideas.

Increasing flexibility, within the interview situation means that you can both "generate and answer research questions" (Morgan, 1997, p. 18). A focus group

interview gives members of the group, and the researcher, the opportunity to express and hear many different views and opinions. Collecting data this way can be very cost effective. The data collected from focus group interviews is complementary to the data collected from individuals.

Morgan (1997) notes the limitations of a focus group interview as being limited to verbal behaviours and difficult to identify interactions within the group. Other limitations of interviews are the time it takes to conduct an interview and the expense of arranging them compared to a questionnaire (Burns, 1997). Furthermore, the interaction between the researcher and the participants can be susceptible to bias.

This study used both interviews and focus group interviews to explore the issues that had been raised in the questionnaire (Appendix E).

The researcher

A researcher will bring to a study personal experiences, expectations and values. As the researcher is the one who decides on the research questions, designs the study, gathers and interprets the data any bias should be stated explicitly.

The researcher in this study is an experienced educationalist. Currently, the researcher is a secondary school principal with responsibility for professional development and curriculum leadership within the school. Prior experiences include: teaching in a number of curriculum areas, adviser to secondary schools in mathematics, and head of a mathematics department. As such, the researcher brings her experience as a supervisor and facilitator to the study as well as her own perceptions of the nature of professional development.

3.3 The Project: Setting and Sample

This section outlines the setting for the study. Details about participants are provided and the phases of the study are described.

Setting

The interest in this study was established when the researcher as part of course requirements participated in university study (2000) which required a focus group interview. The researcher used the interview to answer a question relating to the amount of professional development that teachers had undertaken since Mathematics in the New Zealand Curriculum (1992) had been implemented. The responses received at this time initiated an inquiry into wider issues relating to mathematics professional development. For example, of the four teachers interviewed only one had undertaken professional development in mathematics since the introduction of the new curriculum in 1992. This teacher's experience of professional development was below expectations when compared to the professional development support for the introduction of other curricula, throughout the 1990s in New Zealand.

As a result of this earlier study, the researcher identified the need to canvas a wider group of principals and teachers to determine the nature and scope of professional development in mathematics. The research for this study was undertaken in two phases during 2002 and 2003.

(a) Questionnaire to those school's expressing an interest in participating (2002).

(b) Interviews with teachers and principals from four case study schools at the end of 2002 and beginning of 2003.

Sample

The use of a questionnaire for this project allowed the researcher to obtain data from a large number of primary teachers. To facilitate the distribution of the questionnaire to willing participants, the researcher first contacted primary

schools in the central region of the North Island by way of an information sheet requesting an expression of interest and an indication of the number of questionnaires required (Appendix A). The schools were also asked to provide the researcher with a contact person to send the questionnaires to for distribution within each school.

Within the central region there are 379 primary schools and of these 58 schools replied indicating that they would participate. Seventy-four schools responded indicating that they did not wish to participate. Five primary schools in the region no longer exist or are in the process of closure. The total number of responses received for data analysis came from 153 teachers in the 58 schools. The 58 schools represented a range of both rural, urban and decile mix from throughout the region.

A disadvantage of this type of sampling, for this project, was the inability to follow up individual responses for clarification due to the anonymous manner in which the questionnaires were distributed.

In order to delve further into the principals' and the teachers' perspective of mathematics professional development the researcher conducted a number of individual and group interviews. These interviews were based in four primary schools in the vicinity of the researcher's base. The four case study schools were selected to provide a range of factors such as: decile, roll size, urban/rural mix, year levels, and participation in the Numeracy Project. In each case there was an interview with the principal of the school by themselves and a group interview with up to four of the staff within the school (Appendix E). The interviews were audio taped and the researcher transcribed and analysed the audio tapes for analysis.

Data analysis

The framework for the analysis was to evaluate the data separately, recording and assessing the results from each survey tool: the teacher questionnaire, the principal interviews and the focus group interviews. Common themes and areas needing clarification or elaboration from the questionnaires were used as the basis of subsequent interview probes.

Questionnaires were collated into a number of categories using a spreadsheet. These were based on the researcher's interpretation of what question fitted into each category. The categories are as follows and details are given in subsequent chapters reflecting the purpose of the research:

- Demographic data (based on quantitative data)
- Type of professional development
- Mathematics professional development over the last three years
- Professional development allocation process
- Impact of the professional development
- Effectiveness of the professional development in mathematics
- Barriers to effective mathematics professional development.

From these categories the data was summarised using descriptive statistics.

Each of the principal and group interviews were audio-taped and transcribed by the researcher. As the data contained in the interviews is of a qualitative nature the interpretation relies on direct quotation of the discussions.

3.4 Quality Criteria

Results from the analysis of data, in any study, should be valid and reliable (Merriam, 1998). For a qualitative study this requires the study to have been conducted in an ethical manner.

Reliability of a study addresses the issue of whether the results would be replicated under similar conditions. If, for example, a question produces a different answer under similar conditions then the result is deemed unreliable. The question for qualitative researchers is how can reliability be achieved? Merriam (1998) answers this by acknowledging that the individual's experience will influence the interpretation of reality as there are no benchmarks and further studies will not replicate the findings in the traditional sense of quantitative research. The reliability of a study is "whether the results are consistent with the data collected" (Merriam, 1998, p. 208)

There are two aspects to validity in research (Burns, 1997). The first is internal validity and the second is external validity. Maxwell (1992, cited in Pirie, 1998) notes that qualitative research must be credible at every stage, however at the same time one must realise that validity is relevant to the purposes and circumstances of the research.

Internal validity deals with the match between reality and the research findings (Merriam, 1998). To ensure internal validity, one needs to be confident that the responses from participants and the analysis by the researcher are true for those involved. For this to occur there is an assumption that there is a shared understanding between the researcher and participants.

In this study, the researcher has 20 years teaching experience and direct involvement with professional development from a personal teaching perspective, a facilitator's perspective and a managerial perspective. As a researcher, not only are the factual details of the interview introduced but also general knowledge of the professional development issues.

Triangulation enhances internal validity by using multiple researchers, multiple methods of data collection or multiple methods to analyse results (Merriam, 1998). The purpose of triangulation is to look for convergent outcomes:

however this is not always the case, as it is possible that a triangulation strategy will produce inconsistencies and even contradictions among the data. As it is possible for data to show inconsistencies and contradictions it is the researcher's responsibility to construct "plausible explanations about the phenomena being studied [using] the data at hand with a holistic understanding of the specific situation and general background knowledge" (Mathison, 1988, p. 17).

This study sought teachers' and principals' perceptions on mathematics professional development using multiple methods of data collection: a teacher questionnaire, principal interviews and focus group interviews. Primary teachers views on access to professional development, effective mathematics professional development and barriers to mathematics professional development were sought using the questionnaire and the interviews provided the researcher with an opportunity to elicit, not only a deeper understanding of the perceptions of principals and teachers, but also to provide a comparison of perspectives.

The generalisation of results is referred to as external validity. Qualitative research is concerned with generalisation and the difficulty for research of this nature is the possibility of the lack of an equivalent study occurring (Merriam, 1998). This study is a snapshot of perceptions in relation to mathematics professional development and contextual to each individual's point of view. The themes that emerge from the data analysis are descriptive. The researcher acknowledges that this study has limited generalisability. However, it does offer principals and teachers an insight into some of the issues surrounding effective mathematics professional development.

3.5 Ethical Considerations

Research is the subject of ethical considerations and as such is subject to principles, rules, and conventions (Anderson, 1990). Issues relating to consent and confidentiality needed to be considered by the researcher. In this project to ensure that ethical principles had been adhered to the following steps have been taken:

(i) Approval sought from the Human Ethics Committee, Massey University

(ii) Approval sought from the principal of the school to conduct the study. This included sending questionnaires to teachers within the school and requesting participants for follow-up focus group interviews.

(iii) Information supplied to the participants outlining informed consent procedures and advising them of the purpose of the study and their right to withdraw at any time and

(iv) An assurance to protect the identity of individual participants and schools within the report.

3.6 Summary

For this study a survey research design combined with interviews has used to explore primary teachers' and principals' perceptions of effective mathematics professional development and issues surrounding this. The major data collection techniques used are: a teacher questionnaire, principal interviews and focus group interviews. The data was analysed by the researcher. The results of the data collection are presented in Chapters 4, 5, 6, 7, and 8.

Chapter Four: Results of Questionnaire

4.1 Introduction

This research questionnaire was designed to obtain information about both the nature and extent of professional development opportunities available to primary school teachers. In particular, the study looked at professional development opportunities in mathematics. The questionnaire provided information on:

- School composition in terms of type, decile rating, and teacher experiences.
- Professional development opportunities for primary teachers in general and specifically in the essential learning area of mathematics.

Respondents were also asked to comment on their:

- Perceived professional development needs.
- Views on access to, and barriers to, professional development both generally and specifically for mathematics.
- Views on effective mathematics professional development.

The data from the questionnaire was coded into different categories to reflect both quantitative and qualitative data. Some individual responses are included in the discussion to ensure a true reflection of the views of respondents.

Data was collected from 153 respondents, representing 58 primary schools. Not all respondents answered every question in the questionnaire and where this occurs the number of respondents is noted.

4.2 Teacher/School Profiles

The first section of the questionnaire examined school type, decile rating, and teacher background data such as gender, age of participants, years of teaching, their highest qualification in mathematics, and participation in professional

development. The questionnaire also examined the extent to which primary teachers have or have not participated in professional development for mathematics associated with the introduction of the mathematics curriculum or the current numeracy project.

Gender and experience of respondents

The 153 responses (Table 4.1) reflect, the current gender balance, for teachers in the primary sector in New Zealand schools.

Table 4.1 Gender of Participants

Male	Female	No Response
29	119	5
19%	78%	3%

The experience of the respondents (Figure 4.1) is recorded in terms of years of teaching, not position within the school.

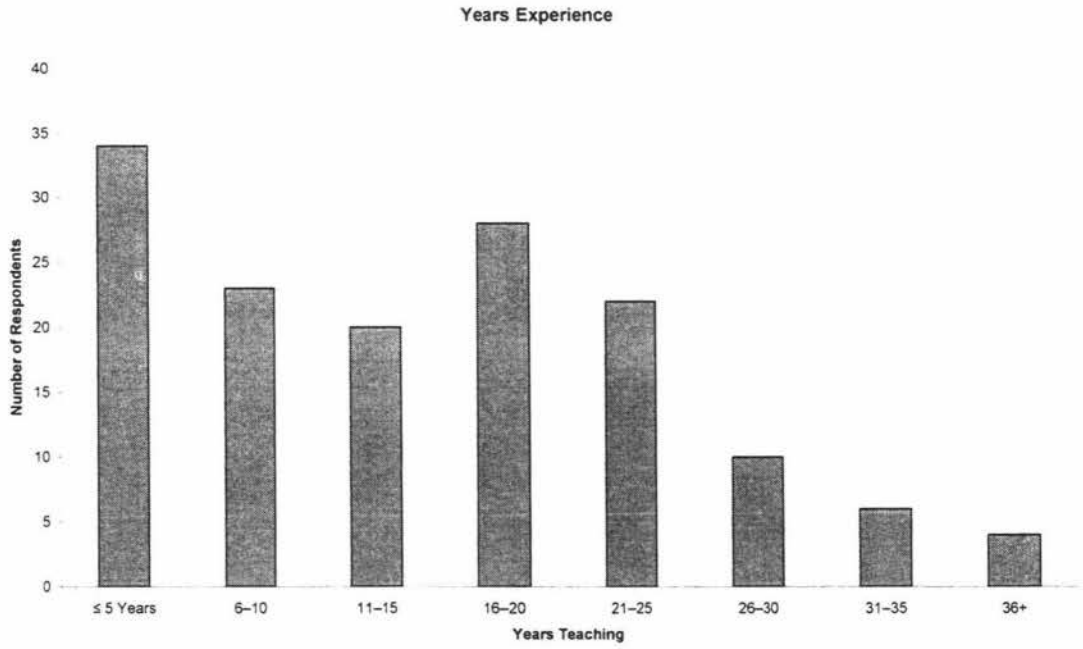

Figure 4.1 Teaching Experience

Figure 4.1 shows that the majority of respondents have taught for five or less years, closely followed by those with 16-20 years experience.

School type and decile

Of the 153 responses received, 77 identified their school as a rural primary and 71 identified their school as an urban primary, the balance (5) classified themselves as rural/urban. Responses to decile rating are summarised in Figure 4.2. Eleven schools chose not to give their decile rating. The decile rating is an index that is given to schools in New Zealand by the Ministry of Education and is based on socio-economic groupings identified using census data. Additional resources are allocated to schools based on their decile rating. For example, schools with a decile rating of 1-5 are eligible, upon application to the Ministry of Education, for funding from the reading, writing and mathematics pool for literacy and numeracy initiatives such as the Numeracy Project. During 2002 decile ratings for all schools in New Zealand were reviewed as a result of the 2001 census and as a consequence the data analysed for decile in this project could now be different, as questionnaires were completed prior to the notification of decile changes.

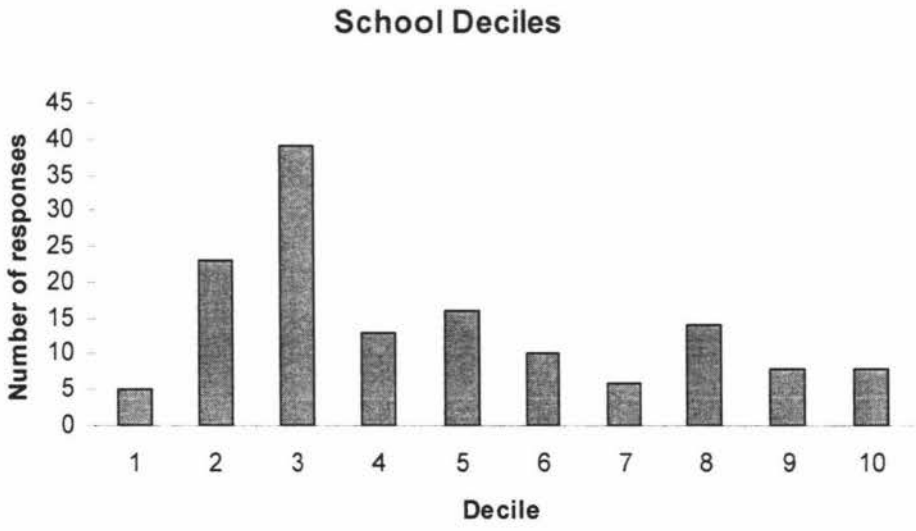

Figure 4.2 School Deciles

While the sample represents teachers from decile 1-10 schools, Figure 4.2 shows that the majority (63%) of all respondents come from decile 1-5 schools. This would influence the outcome of analysis as schools within this decile range have recently been a target for the Ministry of Education's literacy and numeracy initiatives, through Literacy and Numeracy Pool Funding and prioritised admission to some professional development programmes.

An analysis of schools by type (rural and urban) and decile (Figure 4.3) shows again that the range of decile schools were represented by both urban and urban responses. An exception was that there was no decile one rural schools.

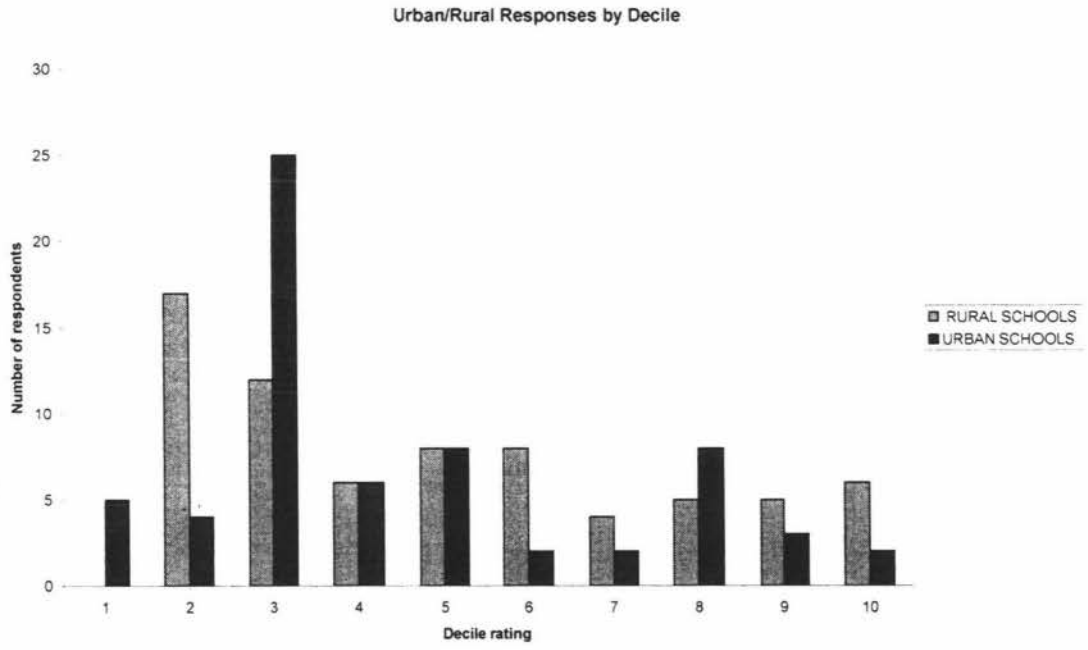

Figure 4.3 School Deciles in Relation to Urban/Rural School Type

Highest mathematics qualification of respondents

Figure 4.4 shows that 66% of the respondents surveyed have a qualification equivalent to University Entrance or less in mathematics.

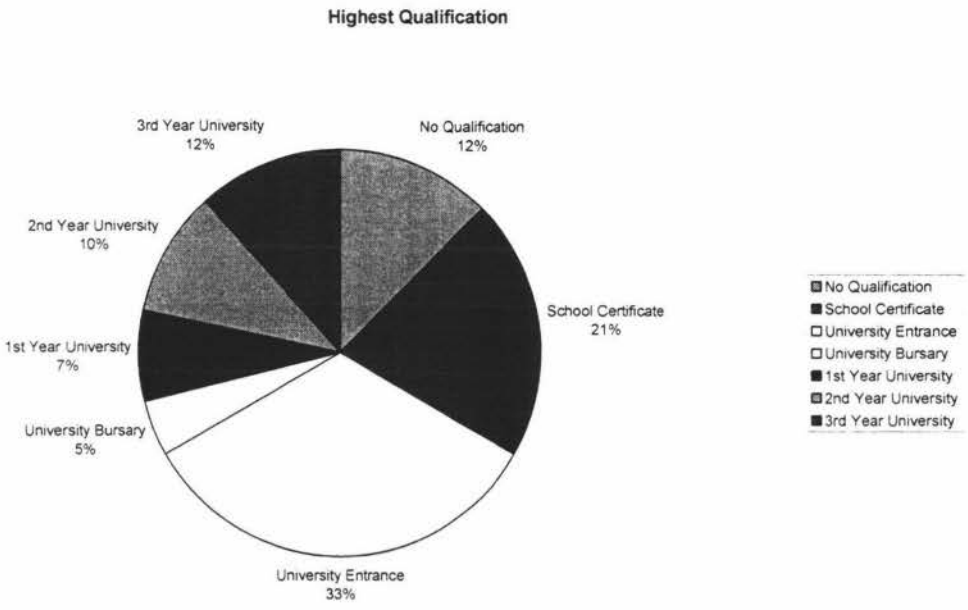

Figure 4.4 Highest Mathematics Qualification

The data from Figures 4.5 and 4.6 shows that male primary teacher respondents are more highly qualified in mathematics than their female counterparts. This data will be linked to the question: Does the professional development undertaken in mathematics reflect the level of qualification? (Section 4.4.3).

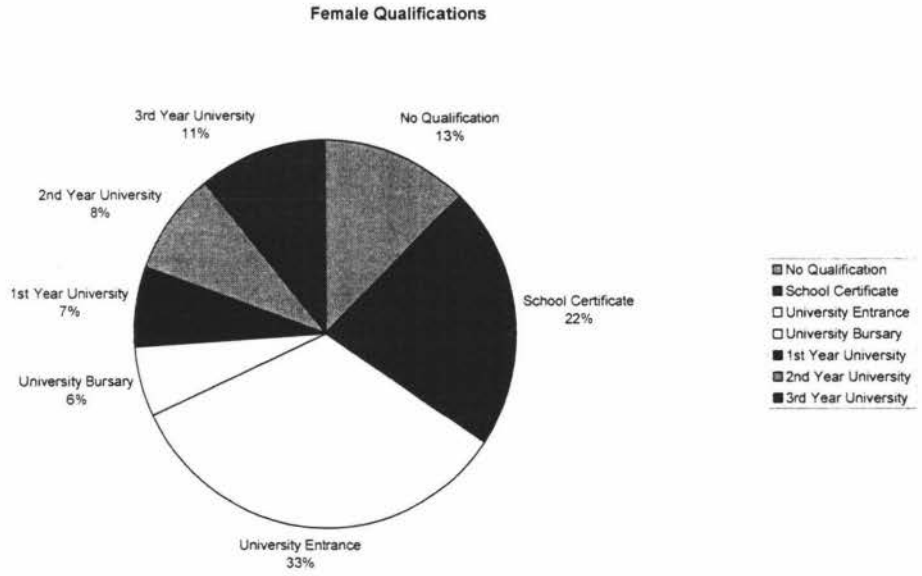

Figure 4.5 Female Mathematics Qualifications

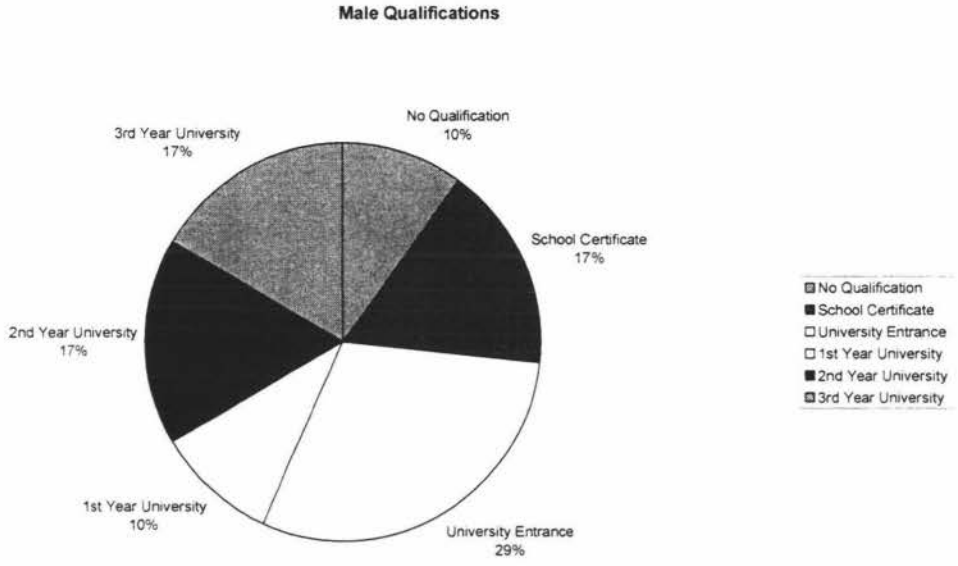

Figure 4.6 Male Mathematics Qualifications

Participation in professional development for *'Mathematics in the New Zealand Curriculum'*

From the 153 responses, Table 4.2 provides information regarding participation in the implementation of 'Mathematics in the New Zealand Curriculum' (1992) professional development.

Table 4.2 Participation in Professional Development for MINZC

Yes	No	Not applicable
88	52	13
57.5%	34%	8.5%

Of the responses received it is necessary to note that 26 of the 'yes' responses identified the years from 1999-2002 as the year that they had received professional development for the mathematics curriculum document. However, since professional development specifically for the implementation of Mathematics in the New Zealand Curriculum (1992) has not been offered since 1995 one assumes that respondents in this group were provided with mathematics professional development through pre-service or advisors to

support their work. A further 13 respondents stated that they could not remember when they had participated in the professional development for mathematics or left this question blank.

Numeracy initiative involvement

Of the teachers surveyed approximately half (71) stated that their school was not currently involved with Ministry of Education numeracy initiatives, one teacher was unsure of any involvement and 81 stated that their school was involved with a numeracy initiative. However, further analyses of the 81 affirmative responses shows 12 of the respondent's schools rather than the respondents themselves were directly involved.

One third of respondents not involved with the numeracy initiative reported that they have responsibility for mathematics in their school or syndicate. Likewise, approximately one third of the remaining 69 involved in the numeracy initiative were responsible for mathematics in their own school. Half of the participants in the numeracy initiative are from schools in the decile 2-4 range, 20% from decile 5 range and only 13 (16%) of these respondents come from schools which have a decile rating of 6 or more. This is in accordance with the priority given to low decile schools accessing the numeracy project at the time. High decile schools participating in the numeracy project must budget to be involved the project, as unlike schools of lower decile, they receive no additional Ministry of Education funding support.

4.3 Recent Professional Development Experiences

A general question, not specific to mathematics, was posed to identify the professional development that respondents have participated in over the last three years. The participation of respondents in the different types of professional development are recorded in Table 4.3. Respondents could tick as many types of professional development as appropriate.

Table 4.3 Professional Development Participation

Type of professional development.	**Number of participants involved with this type of professional development (n=153).**	**Percentage**
Personal Study *(for example study award or tertiary study)*	47	31
One day courses	123	80
Ministry of Education professional development contracts *(for example Early numeracy project, arts curriculum contract)*	123	80
School Support Services *(for example advisor support)*	65	42
Teacher Refresher Courses (TRCC)	6	4
Other schools *(for example clusters of schools)*	49	32
School-based *(for example professional development initiated and supported by your school)*	91	59
Teacher professional associations *(for example Manawatu Mathematics Teachers Association)*	28	18
Teacher unions	32	21
Professional support of colleagues *(for example mentoring or study groups)*	53	35
Supervision	12	8
Conferences	44	29
Other *(please elaborate)*	15	10
TOTAL	688	

Data in Table 4.3 shows that for 80% of the 153 respondents the most common type of professional development participation is the one-day course or Ministry of Education professional development contracts. It is not clear from

the data whether respondents have distinguished between one-day courses in isolation and one-day courses that are part of a contract. Many of the Ministry of Education contracts often have one day courses as part of the contract; however this is not the only aspect of the contract but rather one aspect that contributes to the overall model for the professional development.

School-based professional development is the third most common type of professional development for respondents (59%). It should be noted that the term 'contract' is used loosely in schools for professional development provided by School Support Services and other providers. Schools enter into a contract and each contract will have specific conditions. It is common for these contracts to be school-based to reflect models of professional development that research (Loucks-Horsley et. al., 2003) purports to support change that is sustained and effective. One of the conditions can be that the school involved has to commit to whole school, staff professional development. The questionnaire did not request information about which essential learning area the contracts involved, or the number of contracts that each individual (or their school) participated in.

It is pleasing to see approximately one third of the respondents are involved in personal study or receive organised, formal, support from their colleagues.

4.4 Mathematics Professional Development Over the Last Three Years

When identifying mathematics professional development in this project the three years that the respondents refer to are from 1999-2001. Primary teachers must deliver many different aspects of the curriculum and mathematics is only one of seven essential learning areas. From the information in Section 4.3 it is clear that while all respondents have participated in some type of professional development over the last three years the proportion participating in mathematics is much less (See Table 4.4). Given that Table 4.3 indicates an average of 4-5 professional development experiences (some of a substantial

nature such as personal study) it is disappointing to see that approximately one third of respondents did not participate in any mathematics professional development in the three year period 1999-2001. However, one third of those surveyed have participated in at least one year of mathematics professional development.

Table 4.4 Number of Participants in Mathematics Professional Development

YEAR	NUMBER OF PARTICIPANTS
1999	46
2000	45
2001	78

Responses did, however, indicate that there has been a significant increase in the number of participants involved in mathematics professional development over the three years 1999-2001 and this could be attributed to the increased focus of the Ministry of Education on numeracy initiatives and the National Administration Guidelines (Ministry of Education, 2001).

Types of mathematics professional development

Although approximately 40% of respondents identified that they had participated in some mathematics professional development, it is of concern that the majority examples involved limited professional development. Selected examples of limited professional development include:

- *Numeracy updates*
- *Syndicate meeting*
- *Staff meeting*
- *Resource ideas and tidying up of resources*
- *Manawatu Mathematics Day*
- *One day junior mathematics courses*
- *Provisionally registered teacher courses*
- *Family Mathematics courses.*

Of the 20% of respondents, who have been involved with mathematics professional development for two years there appears to be a more sustained nature of the development. Selected examples of the responses include:

- *Fortnightly meetings with colleagues*
- *Early Numeracy Project followed by the Advanced Numeracy Project*
- *Year 3 contract followed by Early Numeracy Project*
- *Maths adviser visits followed by Early Numeracy Project*
- *Mathematics education personal study.*

Only approximately 7% of respondents involved themselves in mathematics professional development every year over the last three years. Selected examples identified by these respondents include:

- *In house professional development for two years followed by the Manawatu Mathematics Day*
- *Personal development followed by Early Numeracy Project*
- *Mathematics education leading to involvement with numeracy within the school*
- *School-based initiatives resulting in numeracy project.*

However, more professional development does not necessarily mean quality!

Numeracy initiative involvement in the last three years

In 1999 only one out of the 46 respondents (Table 4.4), who undertook mathematics professional development, took part in a numeracy initiative and this was Count Me in Too. By 2000, this number had grown to 13 out of 45 respondents (Table 4.4) being involved in the numeracy initiatives. Six were involved with Count Me in Too, 6 with the Early Numeracy Project, and 1 identified numeracy. This is consistent with the Ministry of Education's numeracy initiatives which offered New Zealand schools the opportunity to pilot a professional development programme for numeracy (Higgins, 2001). By 2001 this number had grown to 44 out of 78 respondents (Table 4.4) indicating participation in the numeracy initiative. Of the 44 responses, 36 were involved

with Early Numeracy and 8 with Advanced Numeracy. It is about this time that the terminology in New Zealand for the numeracy initiatives was reviewed by the Ministry of Education and all initiatives came under the term Numeracy Project or NUMP.

Relationship between mathematics professional development and qualifications of primary teachers

The questionnaire explored whether there is any correlation between the participation in mathematics professional development and the highest qualification of a teacher or gender.

Figures 4.7 to Figure 4.10 represent the mathematics professional development that respondents have undertaken in the last three years and their highest qualification.

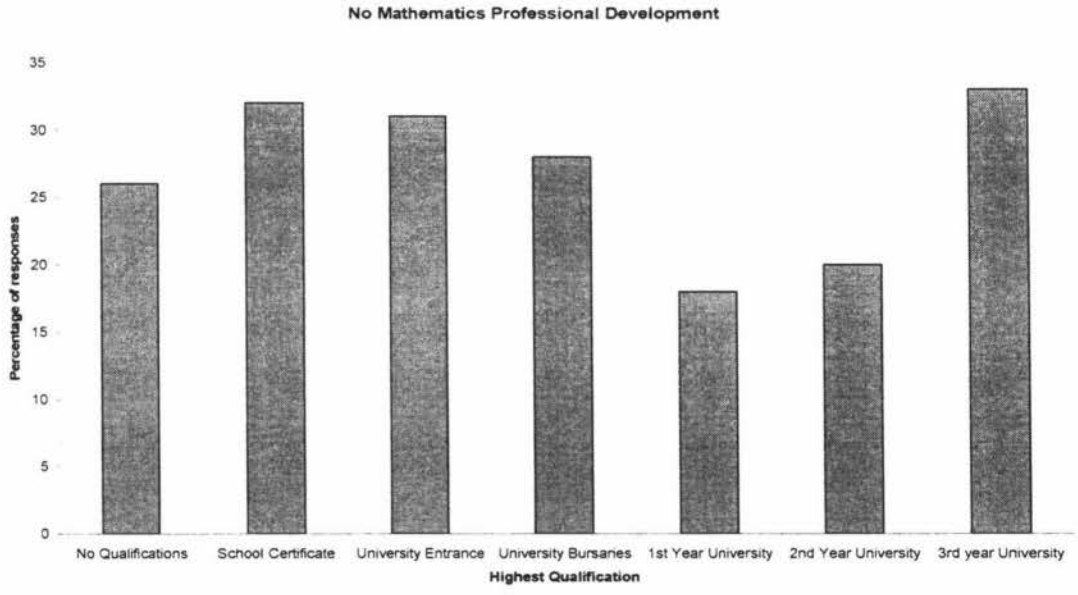

Figure 4.7 No Mathematics Professional Development

Figure 4.7 shows that regardless of the level of qualification at least 20% of each qualification group have not participated in mathematics professional development in the last three years. The reasons for this were not asked for in the questionnaire.

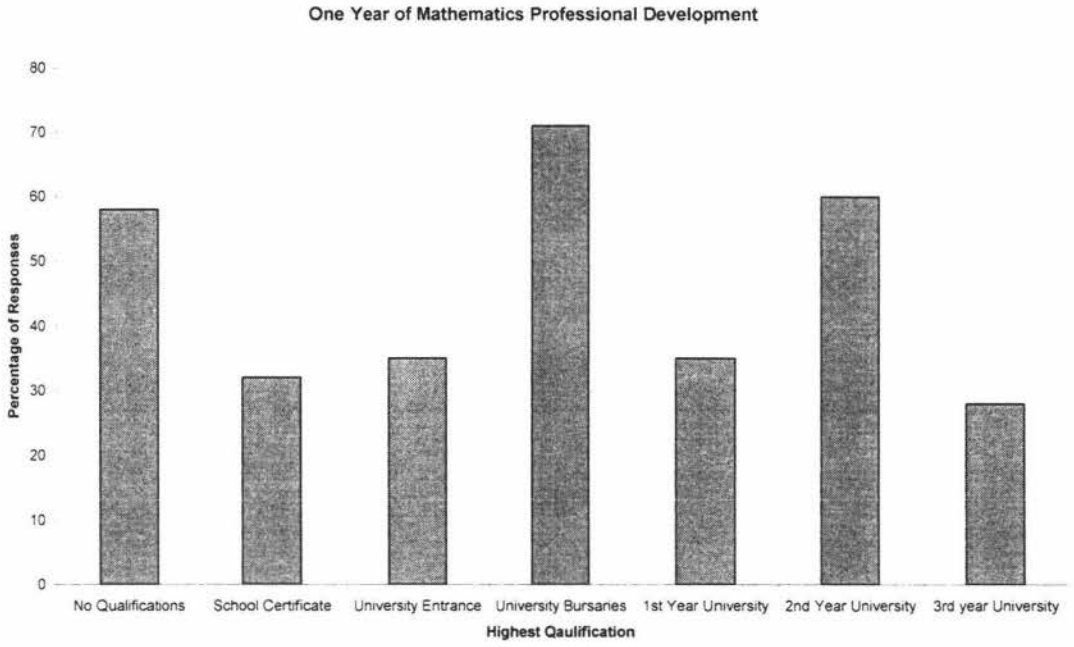

Figure 4.8 One Year of Mathematics Professional Development

Figure 4.8 shows that at least 25% of each qualification group have participated in at least one year of mathematics professional development. Respondents, who have no qualifications, are well represented in this, as are respondents who have a University Bursaries and 2nd Year University qualifications.

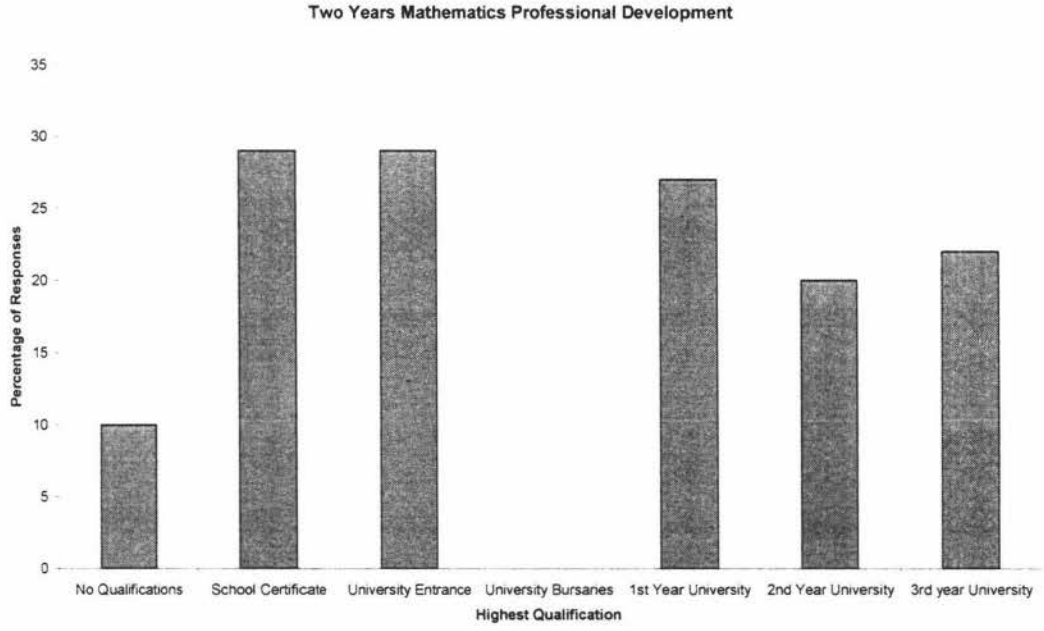

Figure 4.9 Two Years Mathematics Professional Development

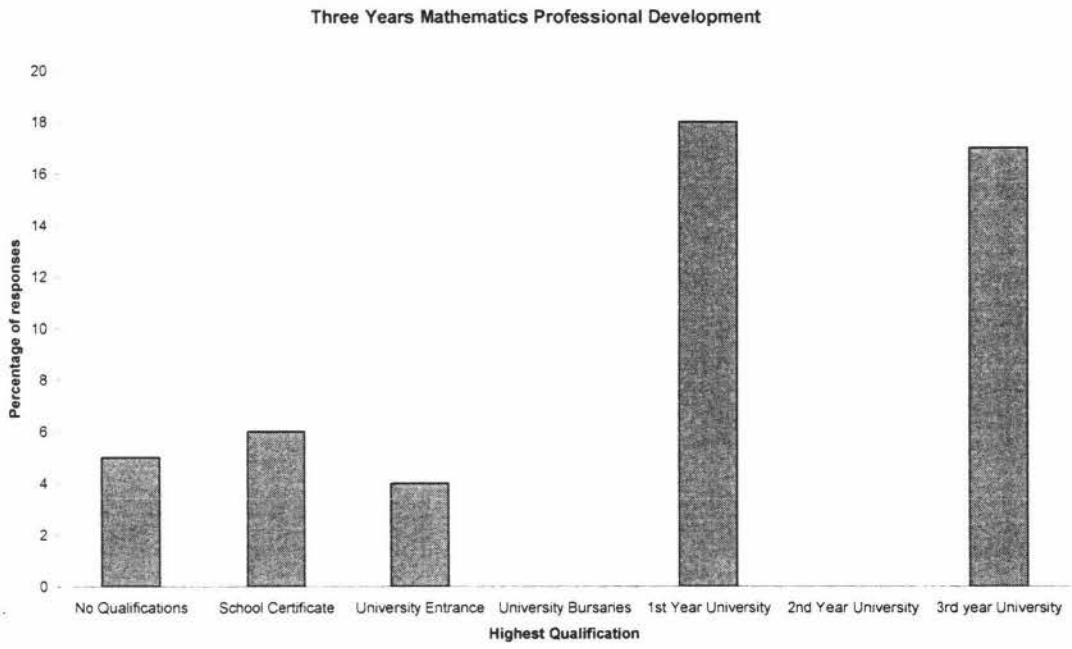

Figure 4.10 Three Years Mathematics Professional Development

When one looks at teachers who report a more sustained involvement in mathematics professional development it is apparent that as the number of year's participation in mathematics qualification increases, the percentage of respondents who participate in mathematics professional development decreases significantly for those with no qualifications (see Figure 4.9 and Figure 4.10).

The data did not indicate any trends relating to gender and participation in mathematics professional development.

4.5 Professional Development for Curriculum Areas

In addition to identifying the most common type of professional development that individuals participated in (Section 4.3) respondents were asked to identify the most common type of professional development undertaken in curriculum areas in general (Appendix C, Question 15).

The professional development did not have to be in mathematics but could be in any of the seven essential learning areas as identified in the New Zealand Curriculum Framework (1993). Teachers were able to give more than one response. Sixteen percent of respondents indicated that professional development was in a specific curriculum area. The remaining 84% identified their most common type of curriculum professional development to be one day course, contracts and school-based professional development, without identifying any specific curriculum focus. Respondents also mentioned a combination of types of professional development such as contracts with one day courses or school-based development and contracts.

The 'other' category response included a mix of topics and types of professional development: reading/language, literacy, assessment, personal study, management, special needs, staff meetings and collegial.

Some individual responses provided evidence of the range of professional development undertaken in curriculum areas. Selected examples of the responses included:

- *Introduction to the strands within the curriculum documents, philosophies, planning, achievement objectives and assessment' and as a result there was some personal development which did not impact initially on class work – this usually happens at end of contract or course.*
- *Professional support of colleagues.*
- *Curriculum implementation focus.*
- *To develop new curriculum documents. The Arts is the last one.*
- *More about how to implement the curriculum.*
- *Usually whole school, school-based. We do a half yearly whole school study each year and get in the "experts". Terms 1 & 2 2002 NUMP; Terms 3 & 4 2002 Arts.*
- *Whole school everything that we have done has had a whole school focus, including tertiary study.*

From these responses it is clear that there is no one model or type of professional development, rather that for many schools the focus has been on curriculum implementation.

4.6 Personal Professional Development Needs

As the focus in many New Zealand primary schools in the last 10 years has been on curriculum change and implementation of new curriculum documents, many schools have been involved in curriculum-based contracts. The questionnaire asked if the professional development that was accessed met the respondents' needs and respondents were asked to identify their own perceived needs for professional development. The responses were varied. The data indicated that no one model, type or topic dominated the perceived professional development needs of respondents. Teachers indicated that they would like a range of professional development opportunities, based on their individual needs. This is in accord with the desirability that professional development should be "consistent with teachers' goals, addressing real and daily concerns, and build on earlier experiences and learning" (Hill et. al., 2002, p. 12).

Teachers indicated a concern that their individual development needs are not always able to be addressed and this is evident in the words of a respondent who wrote:

> *"Although I realise that whole school development has it advantages I sometimes find it is one size that fits all with the delivery not always meeting my needs".*

Issues related to schools' attempts to met individual needs are discussed further in the focus group section (Chapters 5-8).

Respondents did identify a need to have professional development facilitators who are competent and up-to-date with current practices and theory. In the words of one respondent this is summed up by the phrase *"courses by quality people"*. A number of other respondents identified that their personal

development needs would be addressed by having **on-going** support from course facilitators or advisers through School Support Services.

Approximately 41% of respondents felt that they had personal professional development needs in the area of mathematics (Table 4.5). Although less than half indicated mathematics professional development was desirable, this was by far the greatest need of all identified professional development personal needs. In addition, 20 of the 53 teachers identifying that mathematics was a professional development need for them personally, also identified other areas where they believed that they needed professional development. These included areas such as information technology, reading, personal study. The 53 respondents who indicated mathematics as a professional development need were approximately evenly split between those that already have been involved with numeracy initiatives (25 respondents) and those who have not (28 respondents).

Table 4.5 Personal Professional Development Needs

Topic for professional development	**Number of participants identifying this need(n=129)**	
Information Communication Technology	12	9%
Management	14	11%
The Arts (includes: dance, drama and music)	20	16%
Learning Styles	5	4%
Mathematics (includes: ENP, ANP, NUMP, resourcing, and ideas)	53	41%
Science	4	3%
On-going support and modelling of good practice	7	5%
Keeping abreast of changes	5	4%
Other	13	10%

Respondents identified specific areas of professional development needs in mathematics as follows:

- *On-going support for mathematics after spending 2 years on the maths project. To keep updated on course etc, new resources.*
- *Look at doing a paper in 'How children learn mathematics'. What are the processes for how children learn maths?*
- *Observing other teachers' maths programmes would be beneficial.*
- *Building up what we have learnt in the number field. How to use resources.*
- *Continuing support within school and from maths adviser.*
- *ENP/ANP for the long term.*
- *Transferring knowledge from ENP to ANP.*

The diverse personal needs that individuals have for professional development in general areas related to teaching included:

- *Too much to do and we need to do less better.*
- *I need relevant classroom appropriate information.*
- *Modelled lessons for areas of concern.*
- *Practical modelling of teaching a concept in a new way.*
- *Motivation, insight into how students learn.*
- *Innovative ideas that are age appropriate.*

Some respondents referred to needs across 'all areas', for example:

- *On-going in all areas.*
- *Continuous up-skilling to ensure I know all the alternatives.*
- *Good teaching practice in all curricula.*
- *Keep up to date, teaching style update, enriches me as a teacher and in turn environment.*

Such identification is perhaps indicative of an 'anything would help' attitude, or an awareness of the importance of regular on-going professional development and review of practices.

4.7 Impact of Mathematics Professional Development Over the Last Three Years

Respondents were asked to identify, from the mathematics professional development that they had undertaken in the last three years, what they believed to be effective professional development for them in relation to four specified target outcomes: personally, their students, their syndicate, and their school (see Table 4.6). Respondents were able to respond to all four areas specified.

Table 4.6 Response Rate to the Impact of Mathematics Professional Development

Impact of Mathematics Professional Development	Number Responses	Percentage of responses received to this target area (n=153)
Personally	111	73%
Students	102	67%
Syndicate	75	49%
School	88	58%

The descriptions about the impact of the mathematics professional development are many and varied. Some common trends are identified with respondent's individual comments used to summarise the tone of the responses. Respondents were asked to comment on aspects of mathematics professional development that impacted on them personally. Their responses are found in Table 4.7.

Table 4.7 Personal Impact of Mathematics Professional Development

Impact Trend	Number of responses
Increased Confidence	15
Increased Enthusiasm	9
Increased Knowledge	13
Increased Motivation	7
Increased Understanding	10

The respondents' interpretation of 'increased understanding' covered aspects such as theories, how children learn, concepts and approaches to mathematics. Specific comments about the impact of mathematics professional development on them personally include:

- *The professional development challenged/informed my whole approach to teaching maths. Teaching now is aimed more specifically, targeting children where they are at.* (Increased knowledge and understanding)
- *Changed the way I teach maths. I think about the processes more, strategies emphasis and it has given me more confidence. It has made my maths teaching more like my reading/language programme.* (Increased knowledge)
- *More enthusiastic about my maths programme.* (Increased enthusiasm)
- *Yr 3 contract changed my maths teaching, not day courses.* (Increased knowledge and understanding)

Responses indicated a variety of ways in which mathematics professional development impacted on their students (Table 4.8).

Table 4.8 Mathematics Professional Development Impact on Teaching and Learning

Impact Trend	Number of responses
Motivation, fun and enjoyment	34
Strategies/New ideas	22
Quality Programme	3
Relevant	5
Number emphasis	8

Firstly, respondents noted that the mathematics professional development helped them to motivate their students. Secondly, respondents noted that the numeracy focus provided their students with strategies to deal with number concepts. Thirdly, the mathematics professional development provided students with *"enthusiastic and confident teachers"*. Fourthly, students *"benefit from improved teaching methods"* as teachers gain confidence to provide a *"better presentation of lessons – better progression and teaching"*. Consequently, students are able to have *"more social interaction, using alternative strategies, greater knowledge of basic facts and place value"*.

Impact of mathematics professional development on syndicates and schools

A number of the responses for schools and syndicates were common or overlapped and are considered together in Table 4.9.

Table 4.9 Impact of Mathematics Professional Development on Schools and Syndicates

Impact Trend	Number of Responses (n=98)	Percentage of Responses
Collegiality and Team work	35	36
Sharing (vision and targets)	35	36
Improved expectations	8	8
Other (ideas, resources)	20	20

Responses indicated that a positive impact of the mathematics professional development on schools and syndicates has been the increase in collegiality, team work and sharing. The school wide impact occurred in three areas. Firstly, the school was working towards the same target. Secondly, there was an improvement in resourcing across the school. Thirdly, the professional development that focuses on mathematics resulted in a consistency of programming throughout the school.

Syndicate respondents noted that there was a better *"sharing of resources and ideas"* and since *"the development was for all syndicate members* [they were] *on the same wave length"*. Respondents commented on two areas of improvement for schools. Firstly, *"better community involvement"* such as *"maths packs going into homes with Y3 based numeracy games"*. Secondly, *"an increased time allowance for maths teaching and a consistent co-ordinated approach to the teaching of number throughout the school"*.

A small minority of teachers expressed some dissatisfaction with the professional development. Comments related both to the short-term barriers and the concerns about the likelihood of long-term change.

- *Students never see their teacher.*
- *Cost of relievers.*
- *Workload.*
- *Confusion having to learn another maths programme.*
- *Very little.*
- *Not a big change.*

4.8 Effective Mathematics Professional Development

Respondents were asked to consider what they believed to be the one most effective mathematics professional development for themselves personally, their syndicate/team and their school (Table 4.10).

Table 4.10 Effective Mathematics Professional Development Response Rate

Effective Professional Development in Mathematics	Number of Respondents	Percentage of Responses
Personally	124	81%
Syndicate/Team	92	60%
School	87	56%

In considering professional development that could be personally beneficial 29 (23%) out of the 124 respondents identified that involvement in the numeracy project would be or is effective mathematics professional development. Of these 29 responses, 19 of them had already been involved in some aspect of the numeracy project over the last three years. It is not clear from responses on what basis the other 10 respondents make this statement, but there appears to be a general perception that participating in this professional development programme would be beneficial.

A further 13 respondents identified that discussion, further study, or collegial support provided effective mathematics professional development. Fourteen respondents noted that observation either of a facilitator or other teachers was effective, and 16 noted that practical ideas shared through visits or courses was effective.

A number of respondents still identified the one day course or a course (without specifying the length of the course) as an effective form of professional development for mathematics.

One respondent could not identify any effective mathematics professional development as they *"haven't done any for so long"*. Another respondent described effective mathematics professional development in terms of outcomes: *"that which you do and flows through"*.

When asked to consider what would be the most effective mathematics professional development for a syndicate 33 (36%) respondents indicated inclusion of the following aspects: *discussion, sharing, support of each other, being part of a team, planning, and observation.* The numeracy project was also identified as being effective mathematics professional development, for syndicates, by 23 respondents. Not surprisingly, the numeracy project has many aspects in common with the list which respondents identify as being effective factors.

A further 13 respondents noted that in-school or school-based development was the most effective professional development for a syndicate in mathematics. A number of individual comments highlighted the need for the following aspects to be present if whole syndicate professional development in mathematics was to be effective:

- *A curriculum leader in the school, who is organised, enthusiastic and confident.*
- *Geared to needs.*
- *Being taken through a lesson with me as the pupil.*

These three points indicate that the facilitator of any professional development is a key driving force, and that the practical demonstration of a lesson is valuable for classroom teachers, and the need for relevance to work in schools.

Only eight respondents identified courses as being an effective type of professional development for mathematics. Of these responses, two qualified their responses, that courses with follow up visits were effective, two others said that courses with other staff, or in one case with the whole team attending, were effective, and two said that courses were effective for gaining new ideas and resources to try in their own lessons.

At the school level, when identifying the most effective mathematics professional development, one needs to note that the national Numeracy Project moved to a school-wide model of professional development in the

second year of implementation. Table 4.11 provides details of the responses from the questionnaire.

Table 4.11 Effective Mathematics Professional Development

Effective Professional Development for Mathematics	Number of Respondents
Numeracy Project	34
Whole school/ school wide development	23
Contracts	12
Sharing and support	11
Practical ideas	7

Whole school or school-wide developments were seen as giving the schools a common focus and consistency in approach. Contracts which involved all staff were viewed as having a *"common focus which allows all staff to support each other"*.

Thirty-four (39%) respondents identified that the most effective professional development for mathematics at a school level was the Numeracy Project. Some of the reasons given in support of this response are:

- *empowering*
- *common purpose*
- *in depth*
- *resources*
- *support each other.*

Five responses were not necessarily mathematics specific but noted the following aspects about effective professional development:

- *Reflection of personal knowledge.*
- *Well presented.*
- *Holiday or weekend course so no relievers are needed and money goes to professional development.*

- *Coordinated so there are no gaps.*

One respondent, who undertook professional development for the Mathematics in the New Zealand Curriculum (1992) in 1994, and has not been involved in the numeracy project, or undertaken any mathematics professional development in the last three years made the following detailed response for effective mathematics professional development:

> *"Ensuring we are using current practice and adapting. Making sure we don't just chase trends, fads, short term views. Being wary of new ideas which are costly both in time and money. Ensuring that whatever we do has a solid base and focuses on good practice, is child centred and ensures maximum learning opportunities are provided".*

4.9 Identification of Professional Development Goals

Of the 153 respondents, 147 said that professional development goals were set as part of their annual review appraisal. For approximately half of the respondents mathematics was identified as a professional development goal for 2002 (Table 4.12).

Table 4.12 Professional Development Goals for Mathematics Set 2002

Response	Number
Yes	78
No	69

Respondents also identified how professional development goals were prioritised (Table 4.13). Some respondents noted more than one way of prioritising their professional development goals.

Table 4.13 Prioritising Professional Development Goals

Prioritised By	Number of Responses
Board, principal, management	20
Based on need	44
School	69
Personally	32
Contract of Ministry foci	9

In one case the respondent noted that the *"Ministry foci tend to take over individual needs as identified in the performance appraisal"*. In another situation, finance and government thrust were identified as the means of prioritising professional development. Only in two cases was there mention of consensus or collective agreement by staff.

Respondents also considered whether personal or school-wide goals took priority when planning for professional development. The responses are found in Table 4.14 and Table 4.15.

Table 4.14 Are Personal Goals Considered?

Are Personal Goals Considered (n=100)	Percentage
Considered	39%
Equal Priority With School	50%
Priority	3%
Other	8%

Table 4.15 Are School Goals Considered a Priority?

Are School Goals a Priority	Number of Responses	Percentage
Equal Priority with personal	50	39%
Priority	71	55%
Other	9	6%

Additional optional responses noted that personal goals needed to be balanced with school-wide goals:

- *One goal is personal, one is a school goal.*
- *Personal goals are considered if they do not clash with school goals.*
- *Personal goals are considered if finances permit.*
- *School-wide goals are an additional development.*

Although personal goals are considered in the allocation of professional development the data in Tables 4.14 and 4.15 indicates that school-wide goals are the main basis for allocation. The results in Table 4.16 indicate that the most common type of review used to prioritise school-wide goals is school review.

Table 4.16 Type of Review Used to Prioritise School-Wide Professional Development Goals

Type of review	Number of responses	Percentage of response to questionnaire
Self Review	27	18%
School Review	85	56%
External Review	6	4%

In addition, four respondents identified the following specific issues:

- *Goals are set depending on school, personal, children's need and the severity of that need.*
- *School review identifies school wide goals/needs and some years may be influenced by budget.*
- *Staff are helped financially if they undertake their own personal study.*

- *Curriculum areas are put into a cycle and school-wide goals are prioritised in this way.*

4.10 Barriers to Mathematics Professional Development

The last section of the questionnaire looked at what primary teachers considered to be the barriers to professional development in mathematics for them personally. Table 4.17 lists the identified barriers from 121 responses.

Table 4.17 Barriers to Mathematics Professional Development

Identified Barrier	Number of responses (n=121)	Percentage
Resources	16	13
None	26	21
Own Knowledge and Beliefs	4	3
Relievers (availability and cost)	9	7
Cost	43	36
Location (availability and distance to travel)	19	16
Time	34	28
Poor facilitation	7	6
Exclusion from professional development	6	5
School Focus	6	5
Finding a balance	4	3
Other (Support, validity of programme)	10	8

The most common barrier that teachers identified in regard to mathematics professional development was the cost (36% of respondents). One respondent summed it up as: *"school budgets are small and having focussed on mathematics for one year there isn't the resource to repeat it"*. With schools it should be noted that

the cost reflects not just the cost of a course but also the cost of relievers and resources.

The barrier of time reflects the lack of quality time to reflect on practice and the need for primary teachers to work with curricula other than mathematics. Responses from individuals include:

- *Too busy.*
- *Time to digest and implement.*
- *Time commitment is too much to have two contracts at the same time.*
- *Time constraints are the biggest barrier. Everything has to be crammed in. Little time to consolidate or experiment.*
- *Teachers need ... deserve quality time to reflect on practice.*

Encouragingly, 21% of respondents could not identify any barriers to mathematics professional development and this was supported with comments such as:

- *We have great support within the school.*
- *No – it has been a wonderful three years of continuing mathematics professional development – the most ever.* [Teacher with 30 years experience]

Balancing mathematics professional development with professional development for other curricula was another perceived barrier. It is summed up with the comment: *"mathematics is only one curriculum area. We are supposed to be continually up-skilling in all curriculum areas. It is hard to do justice to all within the time constraints we have".*

With regards to the validity of the programme one respondent questioned the pedagogical base of the numeracy project and in their words said: *"have seen so many trends in how to teach maths – is this new project (numeracy) based on soundly based research? Doubts about trends".* In the same vein another respondent said that *"as an experienced teacher I question the validity of some research that states this*

course will definitely work". While one said that the numeracy project was *"for older teachers".*

Some of the barriers identified by respondents overlap, for example the cost of professional development and the cost of relievers. Also, the opportunity to participate in professional development programmes and location may act as barriers.

4.11 Summary

Respondents to the questionnaire had a wide and varied range of responses to the questions and in some cases their responses could relate not just to mathematics professional development but to sound professional development practice in general.

Although teachers' reports suggest access to professional development for mathematics is available, they indicate the challenges involved in balancing and supporting a range of professional development needs. For some teachers a number of barriers exist to accessing professional development in mathematics.

It is evident that for those, who have participated in some form of the Numeracy Project, or for those, who have heard about the numeracy project from their colleagues, that professional development of this type is valued by teachers.

While the comments and responses analysed are from a small sample of primary teachers they highlight a range of current issues relating to professional development in mathematics. These issues are explored with teachers in more depth through the focus group interviews and reported in Chapters 5-8.

Chapter Five: School A

5.1 Overview of School A

School A is a rural full primary state school consisting of 61 students. The decile rating of the school dropped from 10 to 9 in 2002. The school is currently staffed at 3.6 Full Time Equivalents (FTEs); consequently as the principal is a teaching principal there are three other teachers in the school. The principal and the two full time teachers are experienced teachers and the principal release teacher (0.6 FTE) is a second year teacher.

At the time of interviewing for this study two staff members were available and the principal was interviewed separately.

5.2 The Nature of Professional Development

All interviewees considered professional development to be important for growth and school improvement. The principal has a strong belief that there are two foci for professional development.

- *The first is the whole school-wide professional development and then there is the professional development of the individual staff member.*

Staff members agree but also add the terms up-skilling and needs when speaking about professional development:

- *There is your personal professional development and then professional development that relates to your classroom, to school-wide.*
- *To up-skill /to maintain and improve on what you already have. Fulfilling a need.*

Within a small school the principal believes that it is important for professional development to be focussed on a major issue or development each year:

- *The major school-wide, this year, will be around literacy so that we've all got the same message to portray from new entrants through to Year 8.*

The school-wide literacy focus is being supported by individual teachers focussing their personal professional development in related areas. For example, one staff member is being retrained in reading recovery and the principal expects that *"her retraining will come back to the school and have a spin off"*. Another staff member is involved with the National Library Focus professional development programme and the second year teacher is involved with provisionally registered teacher courses as well as the school-wide development in literacy.

5.3 Professional Development Identification and Allocation

With this school the principal has a key role in the identification and allocation of professional development, both for the individual staff members and the school wide focus. Individual needs are identified through the appraisal system and classroom observations. A directive by the principal to undertake any specific professional development is rare but instigated where necessary.

- *I will direct but that is not great at this school. There is only one directive that is the result of that sort of thing.*

School wide professional development plans are cyclic in nature and determined by *"where our policies are as far as review goes"*. The principal felt that by having a school focus for the year the ad hoc nature of professional development that had occurred in the past no longer occurred.

- *In the past* [professional development] *has been identified and allocated on a fairly ad hoc basis. Now a lot of needs are identified and allocated because of the school focus and the teacher need that comes from out of that.*

Views of how professional development is identified and allocated vary. Staff members acknowledged that there was some identification of need through the appraisal system. One staff member felt that his experience in the area of professional development was limited so looked at identification and allocation from a personal perspective.

- *Identified when I am worried about something and allocated when I am addressing the worry.*
- *When you realise yourself and then come and ask the principal or one of your colleagues for support.*

5.4 Effective Professional Development

The principal believes that effective professional development needs to be a whole school approach because *"then you know that you are going to get the whole school pulling on the same string rather than splinter groups"*. There was an acknowledgment that this was easier to do in a small school with a small number of staff, rather that a large school with many staff.

The staff viewed their professional development as being effective when it had a purpose, fitted in with the overall focus of the school, reassured them that what they were doing in their classrooms was on the right track, and encouraged them to make positive changes to their classroom practise.

- *I think that it is only effective if you have really narrowed down what it is you need to know rather than 'Oh, here is a maths course that I will go on or is here a whatever course....'*
- *About effectiveness I think that from a PRT two weeks ago I am not going into the reading programme as blind as I thought I was. I found that what I was doing was actually right.*
- *What you are doing is ok and also effective if it is allowing you to make changes too.*

Another aspect to effective professional development identified by the principal is the on-going nature of a development. This occurs when staff meetings throughout the year continue to focus staff on the development, by showing staff something and then encouraging them to try it for themselves, then with their children, and then reporting back to the whole staff on how things went. Using the Information Communications Technology (ICT) professional

development that was started in 2002, as an example, the principal describes the ongoing nature as follows:

- *Like last year we started with, when I came in, I wanted something simple, and that was ICT. That was once a fortnight after school for a couple of hours. That was on-going, go away, do it with yourself, do it with your children, come back, have you done it, where do we go next, the next step come back in a fortnight, because it puts pressure on you to actually do it. We haven't stopped there, this year it is once a term.*

While the staff acknowledged the desirability of on-going professional development:

"Well it should go on for a lifetime. You know if you could sustain it", they also suggested that this was more likely to happen with wider school support.

- *It probably requires I suppose the principal or team leader to bring you back to it and say are you still working on this. Revisiting.*

Such support was seen as critical for reinforcing the on-going nature of professional development. Both staff acknowledged that the principal *"does a ton of reading"* and *"is good at it saying 'remember last year when we discussed ... are you still doing that or have you thought more about that. Or how is it going?"*

5.5 Effective Mathematics Professional Development

Effective mathematics professional development is viewed differently by the teachers and the principal. In part this is because the teachers look at the professional development programme from their own perspective while the principal looks at it from a management or school-wide perspective.

The teachers believe that effective mathematics professional development needs to be:

- *Closely related to my situation. Like if I can go on a course and I can relate it and think yes this is going to work in a multi- level junior class. Or this is helpful for my personal situation.*
- *It is good at the PRT where they split us up into junior school and senior school teachers.*

The principal acknowledges that her staff identified mathematics as an area needing development and is supportive of this need. From the principal's perspective an ideal mathematics professional development for this school would be based on identification of individual strengths and weaknesses and a subsequent needs analysis:

- *We would start to begin by identifying individual strengths and weaknesses. Because there are obviously things that we can learn from each other, and then we can pick, you know support one another in what we are doing. Just talking about general organisation things like that. Start with that. Pooling all our resources to see what we actually have. Looking in cupboards and things like that. That's a professional development. Asking the staff what it is that they actually see as current good practice and listening and seeing whether if we in fact all agree with what each person is talking about. Also we would speak with other schools and identify schools where good practice is actually happening and make visits to observe before we got the professionals in to say this is how it is done. So we have got an idea of where we are and where we need to go to. Before we do the heavy stuff I guess.*

When asked to explain what was meant by getting *'the professionals in'* and what would be expected from them the principal responded that the professionals should provide staff with:

- *the background knowledge to why we are going to be changing our practices if we do have to change and to give the theory behind it. Nation wide, why? What is the data and statistics that are determining the change?*

The principal noted that if mathematics was to be next year's focus then the steps outlined above *"would occur in the later part of this year during staff meeting*

times so that staff would be prepared for when the professionals come in". At this stage there would be a whole day session and some call back days. The principal was of the opinion that if you tried to do everything after school you would set up a situation where the professional development would not be effective: *"I don't believe that sort of stuff happens well after school. It's got to be clear* [as in uninterrupted time, clearly focused time], *otherwise you bring in a negative aspect to it before you even start don't you?"*

An additional step outlined by the principal to ensure that a professional development programme met the needs of her school was an expectation that she would liaise with the facilitators or the adviser to discuss the programme to ensure that the programme *"meets the needs of our school".*

5.6 Barriers to Professional Development

A number of barriers for effective professional development were identified by the principal and staff, including budgetary constraints, availability of expertise, distance, and meeting multiple demands.

Expense

Both groups identified professional development costs as a barrier. Additional to facilitation costs, the expense of hiring relievers facilitators were mentioned. The principal expressed a need to source support for professional development that does not cost the school excessively. Often this support is for the minor developments that are being undertaken by the school, while the major development (or focus) is acknowledged as incurring a large expense. The principal summed this barrier up by saying:

- *I guess, like we've got little ones [developments] going on around us but we can tap into advisers to help us and it is costing nothing. So therefore, I have got an ICT focus and another staff member has got a Te Reo one. So those sorts of things are still happening but cost wise they are not as expensive as our major focus.*

- *Really there are two expenses. The facilitators aren't as expensive as releasing the staff to do it because the courses are all during the day and it's the release of that teacher that is what we struggle with. About $165 a day. That's huge.*

The principal also noted the cost of materials associated with professional development needed to be included in school budgets: *"I always tag on money for resources when a need is identified".*

Facilitation

Both the principal and the staff identified facilitation as a key aspect of effective professional development. The principal identified the need for a school to *"get the right people being able to support you".* The principal noted that they were unable to access appropriate facilitation for their identified focus for the year so they were forced to change their focus to something else with the view of working on numeracy next year. The principal said that the school had identified their need for professional development as being numeracy *"but the way round that it has happened has depended on the availability of facilitators really".*

Distance

The principal identified that at her previous school distance was a barrier for effective professional development. However for her current school, distance was not a barrier due to the close proximity of a university. A further advantage of close proximity to a university was the reduction in travel costs when accessing either courses or facilitators.

Multiple curriculum requirements and demands

As a small school the staff felt that they were sometimes pulled in many directions. Partly this is because staff are very busy and they feel that they do not have sufficient time to do everything.

- *Classic example with our staff meeting yesterday someone made the comment where and when and how are we suppose to fit that in. You know we are already doing this, this and this and we are getting stretched.*

The staff expressed concern over the multiple requirements related to all seven essential learning areas. They felt that they were being pulled in *'every direction'*. The second year teacher said that the PRT courses focused in the first year on all curriculum areas and the balance was determined by the facilitators.

- *They picked on everything last year. Except some subjects get a whole day like literacy, that was a whole day but last year it was only from 1-3 or 1-4 or something and on a particular day we had a whole day but we covered social studies, the arts and science.*

However, they are hopeful that schools may be refocusing what they do and indicated that they believed that the numeracy and literacy focus from the Ministry of the Education is in part responsible for this.

- *But I think in some ways it has been good with the numeracy and literacy contract, it has brought people back to what is really important. Back to the reading, writing and arithmetic. I think that the trend may be moving away from trying to fit everything.*

Barriers for effective mathematics professional development

In addition to those mentioned above there were two specific barriers identified with regard to mathematics professional development. The first was an individual's personal beliefs or in her words *"personal hang ups"*. A result of this is that the teacher concerned realises now that courses relating to mathematics have been avoided. Avoidance of mathematics courses was perceived to be related to one's confidence with mathematics, and with participation in professional development with other colleagues.

- *For me you know I always thought that language and the arts, language that is my thing and I have always had to work harder at the maths because I feel that I am not as good at it. I have possibly in the past shied away from going to maths pd because I feel inadequate or feel threatened. And yet when you go it is not threatening, it is not like that [The other staff member interrupts here 'you are not the only one']. But you have those; I think I have those feelings, hang ups over the years. I put here: too hard threatening, and you know that sometimes the*

reason for not opting for the maths and opting for a reading thing, that I possibly didn't need as much.

Secondly, the principal identified a number of related barriers for mathematics specific to this school. Although the school had identified mathematics as a school focus for professional development for this year, the school was not able to access any mathematics professional development that year. As a result the school changed its major focus for the year from mathematics to literacy. The cost of having all staff involved in mathematics professional development was also of concern as it would require significant budget expenditure.

- *Well one is being able to identify that that is a need but not being able to get, link into the numeracy project, which I think is a priority for us to start with. Then the cost of the compulsory three days release for all staff. We would find that extremely expensive for all staff, which you have to do. Put relievers in. There's probably $1000 gone.*

  And then with numeracy too, we are obviously going to be needing quite a lot of equipment, and replacement of texts and things like that. The thing is do we use the photocopy? Do we buy texts? Those sorts of issues.

5.7 Discussion and Conclusion

In line with her management role, the principal when discussing professional development keeps in mind the effect of any programme on the school as a whole and how it will move all staff forward in the same direction. In contrast, staff view the effectiveness of professional development programmes from individual perspectives, focusing on what will be the result in the classroom. They are also very aware that it is the principal who encourages them to revisit or refocus on issues by asking them questions either at staff meetings, or at appraisal interviews or in just in conversation.

The barriers that the staff and the principal identified as affecting professional development are similar. When asked directly about the barriers for

mathematics professional development the staff identified their own personal 'hang-ups' as affecting their willingness to access the professional development. This was not identified by the principal; however the principal did say that she would direct a staff member to undertake a particular form of professional development if the need was identified in an appraisal and not being addressed by the individual concerned.

While interviewees were not asked specifically what they considered to be long term professional development, both the principal and staff believe that sustainability is achieved by revisiting the topic. Both staff identified that a contract would provide professional development that is usually a long term thing *"as in like a year, usually it involves the whole school"* and they also said that it was *"ask related or focussing on looking at or trying this and reporting back on how it worked or whatever"*.

Chapter Six: School B

6.1 Overview of School B

School B is a year 1 to 6 primary school consisting of 230 students. The school has a decile rating of 2, which was unchanged under the last review. The school is currently staffed at 15.2 Full Time Equivalents and this means that the principal is a non-teaching principal.

At the time of interviewing, two experienced junior school staff members were available, of which one had release time due to management responsibilities. The principal was interviewed separately.

Each year the school has a focus for professional development and this is included in the school's annual plan. Although the school was selected to participate in the Numeracy Project (in 2002), the opportunity was declined as the principal identified student behaviour management and literacy as a high priority for school improvement. These two areas have been the professional development foci during 2002.

The school has a policy whereby staff members must report back to the whole staff giving *"feedback on the course*(s)*"* they have attended.

6.2 The Nature of Professional Development

The principal believes that professional development involves both *"personal professional development, which each teacher is entitled to and should be having for personal professional growth"* and *"school development. How are you going to help your staff develop their skills in the areas that the school is heading?"* Consequently school development focuses on one or two areas annually, such as a curriculum area or behaviour management.

For the principal professional development has many outcomes. It should:

- *Change the behaviours of the teachers. Creating some success in the children.*
- *Take people out of their comfort zone and challenge them.*
- *Make you "feel you have succeeded in what you want to succeed in".*

Staff members view professional development as an opportunity to up-skill themselves and this occurs in ways such as *"chit chat, university papers or courses."* Staff identified that courses are *"quite therapeutic"* because they give them time to:

- *Actually sit down and have a good chat or bounce ideas of each other and from other schools.*
- *To share.*
- *Have a day away from the school environment.*

Additionally, staff identified three further benefits including, reassurance that their programmes are *"alright"*, information about *"new trends"* or on topics such as *"different learning styles"*, and hands on information. While these teachers considered theory to be an important part of professional development they believed that the hands on practical was more *"rewarding than just listening to a whole lot of jargon"* because they could use the practical in their classrooms but not the jargon.

6.3 Professional Development Identification and Allocation

The principal stated that professional development needs were identified in two parts. Firstly, needs were identified through the performance management system which includes staff appraisals. Secondly, individual teachers identify their own *"perceived needs"*. However, the principal qualified the latter by saying that *"a senior staff member"* could identify an individual's *"particular need when they go into a classroom"*. In this instance the staff member would be directed to a particular course or support person to address the need.

In the case of school-wide development, the principal said identification is *"because it just leaps out and hits you on the nose"*; however this is moderated *"through a curriculum committee system, through school review, through curriculum review and through team reviews"*. A team review involves the school being divided into a junior and senior team. Curriculum committees based on the seven essential learning areas of the New Zealand Curriculum Framework (1993) review their curriculum area, undertake professional development and keep all staff abreast of developments. Curriculum committee membership is selected on *"a teacher with strength in that area leading but also a couple of other teachers. It is by choice being on that committee but also some teachers are put into a team to fit their particular needs"*.

Conversely, the staff said professional development was identified and allocated *"primarily"* on *"the needs of the school"* and by looking *"at what the school is focussing on in professional development"*. The school focus will determine the area *"where there will be a lot of professional development"*. Additionally, staff noted that the school focus for professional development *"depends on what the Ministry makes available"* and consequently the school must *"look ahead and know when the new documents are going to come out so we can plan our foci accordingly"*.

Staff did, however, acknowledge that their individual needs could *"be identified through the appraisal system and sometimes by teacher self evaluation"*.

6.4 Effective Professional Development

The principal identified that effective professional development is when the *"whole staff or a team"* is involved. The principal's reasons why this is effective are twofold. Firstly, time is taken by the school (or team) to identify what is actually happening, to look at what is possible and to decide how to achieve the desired results. If necessary outside help, such as an advisor, is brought in to give support. The principal called this *"needs identification"* and said it required the following questions to be asked:

- *How are we going to do it?*
- *What is the best way to do it?*

Secondly, there needs to be guidance from the principal, the team leader or a senior manager to balance the *"theory and practice"* and to keep in mind *"how this* [professional development] *fits into the whole school need"*.

Since the principal's appointment there has been *"little consultation or choice"* regarding professional development programmes and the principal believes that *"staff are relieved that someone is taking the initiative and driving professional development"*. It is the intention of the principal to hand over the professional development portfolio to others on the staff *"but* [the principal will] *still keep an eye on it to ensure that it happens'*.

The principal believes that outcomes of effective professional development would be *"changed behaviour in teacher and children"*, resulting in teachers *"feeling good about themselves"* and providing a sense of *"personal responsibility"*.

Staff believe that the effectiveness of professional development depends on the facilitator and the timing of a course. To illustrate the need for a good facilitator, one interviewee gave an example of a professional development session that she attended that had no effect at all.

- *I think that the facilitator of the course is very, very important and as you said the content. I can remember a course that we all went to after school once for a couple of hours and never in my life have I been to a course that achieved so little and the Ministry was paying for this, this was the taxpayers' money and we learnt absolutely nothing.*

Others noted that for such courses the time could be used more effectively preparing resources for classes, or marking student work.

6.5 Effective Mathematics Professional Development

Staff said that an effective mathematics professional development programme for this school would be one with *"every teacher attending, hearing the same thing"*. There was a belief that if *"everybody hears the same story then...you have a better chance of moving forward"*.

The principal agrees with the staff view and suggests a positive outcome would be hearing staff *"talking about mathematics"*. Specifically, the process that leads to an effective mathematics professional development programme would include the following:

- *Start with review. It would be a staff review to see the learning needs.*
- *Lots of teacher talk and practice.*
- *Funding given to the release of teachers for that purpose.*
- *Tasks set and a period of time given to do those tasks and getting together to discuss what we have done.*
- *Opportunity to go to other schools (other places and see what they are doing).*

It was noted that the process outlined by the principal is similar to the process she would follow for any effective professional development programme.

6.6 Barriers to Professional Development

A number of barriers for effective professional development were identified by the principal and staff including budgetary constraints, facilitation, curriculum requirements and attitudes and beliefs.

Expense

The staff identified that *"money"* was a major barrier to effective professional development. They did not express clearly why this was so but hinted at the costs incurred. Some examples given by the staff were: the cost of producing *"resources"*, the *"costs to get on that numeracy project"*, the notion of being *"viable*

financially where the lead teacher brings it back to staff" and the cost of *"attending the professional development that is available"*.

While the principal mentioned that the availability of resources was a barrier to effective professional development, costs were not the only reason for not participating in a programme school priorities, be it buildings or professional development are the *"first area where"* the money is spent.

Facilitation

As mentioned earlier in this chapter (6.4) staff identified facilitation could be a barrier to effective professional development. The principal said that *"not knowing the right people to tap into"*, or *"not asking the right questions"* could affect the facilitation of professional development programmes so she tried to identify facilitators who are able to work *"in the classroom"* with teachers providing *"positive reinforcement"* as well as being *"like minded"* and able to *" spur each other on"*.

On a positive note, an experienced teacher noted that while there *"use to be a lot* [of poorly facilitated courses] *around in days gone by and unfortunately there is still some"*, there are not as many.

Curriculum requirements and time issues

The staff at this school feel that there is *"just too many things to cover in the curriculum"* and consequently there needs to be some prioritising. In this school professional development is based on the four areas: reading, writing, mathematics, and social skills. Staff expressed some concern about the potential to ignore developments in other curriculum areas. Outside directives regarding professional development also impacts on the professional development that teachers within a school undertake. In this case, both the principal and staff see the Ministry as controlling professional development participation.

- *It is really hard because when something else comes up you feel, hey we had better get on to that because if we don't we may miss out. So it is actually very, very hard. We did that with the drama and the dance, we had the enthusiasm but we cannot sustain it.*

"There was a literacy leadership contract going and we were sort of tied into anyway because we had been last year". One of the teachers interviewed said that everything had changed over the last six years and it was *"just unbelievable,"* while another was clear that teachers do not object to change but they do want to know on what grounds changes are made.

- *If you look back over the last 6 years, just about every curriculum has changed. Every year that I have been teaching there has been a new curriculum document or a new supplement to the curriculum. It is just unbelievable. I feel for people like X who have been in the game for so long and know something really well and then wham....*

X, however is not perturbed by change, rather she suggests that teachers need to understand why change is required:

- *It has always been changing. It is just the speed of change has picked up. There has always been change since I have been teaching, it is just gathering momentum. The challenge for us is to keep up with it and to also know; bear in mind that we do not change for the sake of change, that we actually make sure that there is good philosophical grounds on which to base the change. That we know why we are changing.*

The most significant barrier to effective professional development for the staff is time and a number of reasons for this were discussed. Firstly, staff felt that there is lack of time for quality thinking, particularly if a course came at the end of a day:

- *I think another barrier or it comes under effectiveness of professional development is the time of the day because teachers go off to courses at the end of the day, that uses their own time and teachers are exhausted at the end of the day. Sometimes they are bringing baggage in with them that no one knows. They may have had a*

disruptive child, an upset parent or who knows what it might be. You just don't know what has happened to them during the day, so when they arrive it is like the kids, you don't know what has happened.

When asked what would be a better time for professional development the response was:

- *Well, probably school holidays or during term time. But teachers do need time to rejuvenate so school holidays, if they are either at the beginning or the end where it doesn't interfere with them having a break. Saturday, yes and no. I think teachers need rest. I think they do need to have a life like everyone, more and more we find teachers feel that they don't have a life.*

The principal also identified the *"biggest barrier"* as *"time to think, to vision, to brainstorm, to plan for professional development"*.

Secondly, there is the lack of time *"for resource making"*. As one teacher said:

- *I mean it is great. There are great ideas and fun stuff but, check it out, when is there time to make the stuff?*

Thirdly, the energy levels of staff involved in the multiple demands of teaching need to be taken into account. The principal described this in the following way:

- *You can only do a certain number of things. So I guess time. Time is a barrier. Also people's energy levels*

Attitudes and beliefs

One staff member said that *"people's attitude and beliefs get in the way and can often be a barrier"* for effective professional development. Two possible reasons were given as to why attitudes and beliefs were a barrier. Firstly, *"some people may not be as accepting of new trends or new ways"*. The implication being that they are *"set in their ways"* and they believe that what *"they do is good and it has worked like that for a long time"*, therefore there is no need to change. Secondly, teachers perceive *"the course content as sometimes not practical"*. They want to have

professional development that they can *"learn and use"* and that *"can be implemented quickly and easily without too much hoo-ha"* into their daily lessons.

Barriers for effective mathematics professional development

The staff, in this case, believe that there were no specific barriers for mathematics professional development. The principal, however, had strong views on the barriers for effective mathematics professional development. She believes that teachers put up barriers themselves because of their own mathematical ability or perceived lack of ability.

- *The ability of teachers themselves. They put up barriers for themselves because they think.....elect to teach in the junior school area and say 'oh we couldn't possibly do that senior school maths'.*
- *Their capability. Like me, for example, I am a complete dodo at maths so that limited me. I hate to say it, but it did.*

When asked to elaborate on the limiting effect of teacher capability the principal acknowledged that while staff may feel limited they are in fact keen to learn more.

- *In my level of competency and I am sure I wasn't the only one and I am sure I am still not the only one to be like that. Having said that I don't actually see it in my staff because they are very keen to learn more about maths.*
- *I see it in literacy. I see it with the focus of writing not just the skill but the whole incorporating literature, love of books, love of reading and writing. They cannot see a point in writing for writings sake is. That is where your own capabilities limit you. I guess I was like that in maths.*

The principal acknowledged that barriers will go up in any area if a teacher feels they do not have the required skills. The principal said this could be because of a lack of passion or ability to see the point of the professional development.

Other barriers, the principal noted for effective mathematics professional development included:

- *Availability of resources, being able to go on course.*
- *We really wanted to do that maths contract (NUMP), got accepted but unfortunately the literacy contract and the behaviour management contract got in the way.*

Involvement in the Numeracy Project, which would work with year levels in the school not the whole school, was seen as creating a barrier by the principal as she believes that effective professional development involves that whole staff.

- *The other thing about the maths contract though was that it wasn't for the whole school. Our school need was for the whole school but the maths contract was for only one part of the school and that wasn't what we wanted.*

When asked why this was so important the principal replied:

- *Because that is where you get the most spin off with teachers. You hear them talking about maths or the curriculum area*

Sustainability

The principal and staff considered that long-term professional development was any programme about a year in length. In terms of sustainability the principal thought that *"task orientation"* was important. She defined task orientation as:

- *Tasks that you do in between periods of time, feeding back to the facilitator, working on things together.*

To help sustain a development the principal uses staff meetings. Every staff meeting is *"set up with an element of professional development. Notices, report back, reflection"*. Staff are given readings to review and asked to discuss good practice. The principal does this by using *"focus questions"* and asking staff the question *"what do you think?"* She believes that a principal's role is to *"support and keep the impetus going"*.

However, the staff feel that while they may have the enthusiasm at the time of a course or professional development programme they cannot sustain it.

- *We had the enthusiasm but we cannot sustain it. (This was a reference to The Arts professional development the school had been involved in recently).*

6.7 Discussion and Conclusion

The principal of this school purposely drives the professional development programme and staff are aware that the first priority for any professional development that they undertake will be professional development that relates to the school-wide focus.

While the staff and principal identified similar barriers that affect effective professional development the major barrier identified for this school is time. The principal feels that there is no *"time to think, to vision, to brainstorm, to plan, to make time for professional development"*. While the staff sometimes feel that they are missing out, they need to remind themselves what the school-wide focus is as professional development must relate to this.

- *It is hard as a teacher though because I find myself saying oh we should be doing... You have to remind yourself for our school, our kids. I stress out about it a bit. Trying to cram something else in.*

An effective mathematics professional development programme for this school would be one that involves all the staff at the same time, as this will enable the staff to have professional dialogue about mathematics but also allows the school to identify their own needs and to provide a programme that takes everyone from where they are and moves them forward.

Chapter Seven: School C

7.1 Overview of School C

School C is an urban primary school (Years 1 to 6) consisting of approximately 500 students. The decile rating of the school has been raised from 4 to 5 in the last year. The school is currently staffed at 24.5 Full Time Equivalents (FTEs). The principal is a non-teaching principal.

The four teacher participants in the focus group interview all taught in the junior school and have been involved in two major professional development programmes involving information communications technology and numeracy over the last three years. The principal was interviewed separately.

7.2 The Nature of Professional Development

Professional development is considered to be an important part of the school's programme. The professional development undertaken by staff is linked to the school's focus and the focus may be over a period of years rather than short term.

The principal believes that professional development involves the *"up-skilling teachers to be able to more effectively to do their work and that involves the quality of their teaching and the ability of the children to learn within their programme"*. More importantly, *"it involves a process which has got to bring about a change in teachers thinking and practice. And that is a big issue"*.

As such, he regards professional development as long term and on-going in nature. However, in accord with the literature (Loucks-Horsely et. al., 2003), the sustainability of long term change outcomes are difficult to achieve with certainty. The principal describes this change process as the *"big challenge"*.

- *It is obvious that often, I guess we have all been guilty of going along to courses and seeing lots of nice things but really quickly we will move back to what we*

know and what we has been comfortable for us and so there has been little change in our practice. And if that professional development is to be meaningful and whatever programme we are doing in the way professional development is going to make a change for the better. I guess that is always a judgement call too in itself, then we have to perceive things differently, we have to think things differently and then we have to bring about a change in practice and sustain that.

Staff acknowledge that teachers have a responsibility in the change process and value the opportunity to maintain or develop their expertise in a subject area through professional development.

- *Professional development not only takes our knowledge further on but I think it needs to translate into our practice in the classroom. Because that is what we are aiming for is to get better in the classroom.*

For some, it is the opportunity *"to further personal knowledge of a subject area that* [they are] *not really very proficient at"*. While for others, it provides the opportunity in areas that they *"do feel strong in to update and take on board all the new things that are happening"*. Then there is the opportunity of *"being made aware of changes that have been made in the curriculum areas"*.

7.3 Professional Development Identification and Allocation

Both the principal and staff noted that there are three ways that professional development needs can be identified and allocated, namely through appraisal, self knowledge, and needs analysis.

For the principal, professional development needs are identified firstly from *"teacher's own knowledge of themselves and their practice and where they see the need for growth and development. I think that is a very genuine and appropriate area to consider"*. Secondly, needs will be *"become evident through the appraisal process, where the team leader will have observed and worked with them* (the teacher) *and discussed areas where there needs to be growth and development"*.

For the teachers the order in which a professional development need is identified is reversed. Staff perceive that the initial identification will *"come from our attestation, where senior staff can appraise staff"*. Secondly, staff can identify a need personally:

- *Also personal own feelings like, what I feel I need to perhaps acquire further skills in, to get better at doing, we work really hard at everything but sometimes I just like to try and learn something new here.*

The staff believe that they are very honest in their personal identification of a professional development need and they are aware that the performance management system within the school supports their development:

- *We ourselves feel in ourselves that I think we are very honest at what we would like to get better at* [agreement from other] *but then there is also a follow up from appraisal, attestation visits and discussion with others we have had.*

By not making all professional development compulsory the principal believes that they are able to effectively maintain professional development initiatives. It has allowed the school to *"run lots of optional meetings"*. For example, a staff member in charge of computing might say *"look I will be in the computer suite Tuesday and Thursday afternoon this week 3.15 to 4.30 to dah de dah de dah. Come along if you want"*. As a result the staff who attend are those *"who want to be there and are interested and they are getting on with it"*. The principal notes that this gives teachers the choice to respond to their individual professional development needs.

However, both the principal and the staff noted that government priorities can impact on an individual's or the school identified need. In such cases the professional development identified is not by needs analysis within the school, rather the professional development is *"driven by the Ministry of Education when they say X, Y or Z is to happen and so there is a need for professional development in that particular area"* [Principal]. Staff agree with the principal's view acknowledging that because *"it is even government orientated, not what we want to*

do so we go along with whatever it is, for example the maths and the literacy [agreement from others] *at this stage. We have got to fit that in with other areas that we perhaps feel we want to develop".*

The allocation of time for professional development for individual staff varies and is largely determined by the principal according to basic guidelines which include:

- *Everybody within the school has certain rights with regard to their professional development. They get some support for study from the Board. They get maybe 2 or 3 days of leave for courses and things like that.*
- *But on top of that there is always open an opportunity for professional development beyond that. We have had staff go off to Melbourne last year to the world autism conference. X is going down to Christchurch, these holidays, for a health conference. So apart from the Principal and Deputy Principal's, staff members who have a particular interest, strength or need, we will support them beyond what I see as the core professional development funding and options.*

An example of funding beyond the core is the Board contributing to a staff member's personal study at university. However, there are specific guidelines associated with such funding.

- *That personal study is linked into their professional development programme for the year.*
- *If they are getting funding from the Board for example, for their university work, they only get that is directly related to their teaching. So if they are doing archaeology or something, that is their cost?*

The day to day allocation of courses is co-ordinated by the Deputy Principal. She has the responsibility to talk to *"any teacher who requests to go to X, Y, or Z and asks where does this fit with your PD programme because again if it doesn't fit then they may not get to go on that course unless they can justify the reason why that course is going to be particularly helpful to them".*

7.4 Effective Professional Development

Effective professional development from the principal's view is a development that is *"tied all together so that it isn't just one off. It has got to be linked into a package"*. The effectiveness can be measured with the evidence from the classroom of a *"change in practice"*. The principal commended the Numeracy Project as being an example of a Ministry driven initiative that *"has brought about a change in teaching practice, not because their team leader or the principal or their own thinking has initiated that change but because it has been initiated from outside"*. Identified components which contributed to effective professional development included: *"an expert who is confident and capable"* [referring to the facilitator of the numeracy project]; the ability for staff to observe *"demonstration"* lessons; the opportunity for teachers and facilitators to have *"time to talk to teachers"*; and the *"on-going"* nature of the development.

Staff in this focus group identified the on-going nature of professional development as a key component for effectiveness. From their perspective on-going implies that there are links made between the different components of a professional development package. The principal describes this as the *"flow on stuff to get the thinking processes going"*. The principal sees the responsibility of follow-up as a role of team leaders. As key personnel within the school, team leaders provide opportunities for staff to refocus on the topic throughout the year.

- *Building on the stuff and again keep coming back to it and keep you challenged about it, asking questions such as:*
  - *(i) 'What have you done?'*
  - *(ii) 'What is different in your programme this half term from what it was the last half?'*
  - *(iii) 'What new things have you tried with regards to this vocabulary development we have been talking about?'*

The purpose of revisiting a professional development topic is to ensure that all staff are moving forward, challenged and as a result thinking about their teaching so that their practice is improved. The principal summarises it as:

- *Keeping on and pushing teachers to keep thinking and using and trying stuff. Then not leaving it there but coming back again, you know a couple months later and talking some more. So teachers actually start practising the stuff and it becomes a part of their teaching practice and doesn't just revert back to the old stuff.*

Furthermore, the principal identified that an impetus for effective professional development occurs when the staff receive the same initial training.

- *Another thing that we have found is the whole staff full day stuff* [teacher only day] *when you have everybody together and you can get some someone in who is passionate about something then you can work on that again through the year.*
- *She came and did a half day session with our full staff at the beginning of the year and through the year she is coming back working with the teams.*

Both the staff and principal also identified that effective professional development needs an enthusiastic, *"passionate, and fun"* facilitator.

7.5 Effective Mathematics Professional Development

When the staff and principal spoke about an effective professional development they offered the Numeracy Project that they had been involved in as an example:

- *The maths one, the way it was run has had lots of positive components to it* [Principal].
- *I think the ideal programme is what we did for numeracy* [Staff member].

Notable components that both the staff and principal identified as being effective for mathematics professional development were: *"that package thing"*, the *"on-going"* nature of the development and the expertise of the facilitator. Characteristics of the facilitator and facilitation process were regarded as a key

feature to effective mathematics professional development. Having a facilitator who is available on a regular basis gave staff the confidence to try new things, to demonstrate to others, to support them and to talk to others about mathematics. Staff recognised attributes of expertise, reliability, consistency and enthusiasm:

- *We had a very good facilitator. We were very lucky, I mean she was very good and she came in regularly and was very accessible.*
- *You have got someone that you can relate back to, that is available to answer any queries or questions.*
- *Just to re-evaluate because that person is a specialist.*
- *Encourages enthusiasm.*

Staff also noted that without *"a good presenter"* the negative effects of inadequate facilitation would be the *"waste of money on someone who is going to fill in the day for you. It's too expensive. That might sound mean but you think I don't know about that person I've been to something before and... we cannot afford the time or the money to go to courses like that"*.

The staff also felt that the Numeracy contract was *"consistent"*, that is it provided them with more than *"a one day course and getting bombarded with all sorts"*. The Numeracy Project had a focus which enabled the staff to work together, giving each other support while at the same time supporting the staff from outside of the school with *"an expert in mathematics"*.

The principal offered the notion of staff *"buy in"* as an overall indicator of an effective professional development. He observed staff *"really enjoyed it. They could see, and I guess that was due to the good ability of our facilitator and the way that the programme was introduced that it had advantages in it for the children and because they could see that it was going to be of benefit to kids so they really got involved in it"*.

7.6 Barriers to Professional Development

While the staff and principal of this school identified aspects of effective professional development they also identified a number of barriers for effective professional development.

Expense

The school budget determines the amount of professional development that the school can make available to staff. One teacher said that it is the budget that *"impacts on the course you can go on. If a very popular course comes up and everyone wants to go, it sort of gets down to a representative from each team maybe or something like that"*. To overcome a barrier like this the school might *"actually be able to get that person to come to the school, so the whole school can hear"*.

The staff acknowledged that they are lucky and have good support from the Board and that they seldom have a request for professional development turned down and are aware that this might not be the case at all schools. As well as staffing release constraints, course related costs such as travel can pose a barrier to access:

- *If it is not sort of locally then you thin, oh gosh, I've got the accommodation etc, that is one thing and the finance, I guess again comes into it.*
- *I think too we are much more aware of costs these days compared to a few years ago.*

The principal reported that the *"lack of funding"* for professional development as a major concern. In this school the principal *"had to find"* the funds to make the resources to support the Numeracy Project. He acknowledges that because of the school's decile rating that there was *"sufficient funding to cover quite a lot of that stuff but many schools didn't. But even actually making it happen was hugely time consuming"*.

Curriculum requirements and the time issue

For the staff a major barrier to professional development is time. The barrier of time comes in many forms: finding the time to participate in professional development; balancing the time between professional development and daily work commitments; finding sufficient time to complete a development, or finding time to reflect on and to implement changes. These barriers appear to affect long-term sustainability of professional development opportunities:

- *The ones in isolation* [one day] *get you all fired up and you never get to put them into practice.* [General agreement from others here]. *You know they get put aside like for a rainy day, thinking I will come back to that. You know you are buzzing from it but it just gets pushed into the background because everything else takes priority over it.*
- *I think it is quite sad in that way. Because I went to this wonderful course on thinking and we are still thinking about it and in the meantime we suddenly get .... And I have to have some time to make the stuff.*
- *We always think we do not have time. Guilt thing.*
- *We do not stop long enough to see, oh wow, look how far we have got.*

The principal also notes that time is a major barrier to effective professional development both in the planning and implementation stages:

- *And also that there is sufficient time available for that teacher not only to attend that course but also to reflect on that course.*
- *A significant issue is the teacher being able to reflect on their practice and really being honest about where their needs are.*

In his comments the principal does not appear to blame his staff for not taking the time to reflect on their practice; he believes that this is a workload issue and in this case sees it as the responsibility of the senior management team or team leaders to work with the staff concerned so that reflection can take place:

- *I think often time is an issue and the workload. I don't think teachers deliberately try to cover up that they are not very strong in something in science or whatever. But when they are all involved in their work and whatever they may well decide*

to stay with what is safe for them rather than be prepared to stretch the boundaries and push the boundaries as far as their own knowledge and skills is concerned. It then becomes the responsibility of the principal, team leaders and senior management of the school to see if it is the science programme or the maths programme that is not really challenging the children. It happens in maths as well as any curriculum area. You know with some teachers they are coasting and the kids are coasting and aren't really being challenged with an interesting environment and vital sense of progress.

Meeting the individual needs

Although this school has enjoyed the supportive nature of the Numeracy professional development programme, for some of the staff there have been barriers. Not all staff experienced the same barriers. The ones that were raised remind us that everybody starts their professional journey at different points and thus for professional development to be effective the *"package"* needs to allow for the different starting points:

- *That whole thing of having enough time to for the amount of information that you are expected to digest and then to actually put that information into practice.*
- *It wasn't a user friendly document.* [Numeracy Project material] *Then there is all the equipment to use, many, many resources to be made by teacher aides. You needed the stuff didn't you?*
- *With maths a lot of teachers do not feel very strong in it.*

The principal is unsure *"if maths has probably got any other barriers that are special barriers as far as maths is concerned, apart from the point of view that some teachers may feel that I am no good at maths and therefore it is going to be hard and I am not going to manage".*

In terms of school-wide needs the principal highlighted a number of issues that could be a barrier for schools that were involved in contracts and included the following:

- *There is nothing wrong with a contract as long as the result of it is relevant to the needs of the school.*
- *And whether or not what is being delivered in that contract is actually going to benefit the children or not.*
- *Sometimes we had to do it, whether we wanted to or not.*

Sustainability

Both the principal and staff are aware that for professional development to be effective the development outcomes need to be sustained. Staff noted that during their involvement in the Numeracy Project (for this school one year) they had a lot of support from the external facilitator, however after this period there was no official support. They explained how they needed on-going support, even if it was once a term from the facilitator to re-evaluate their work. Staff suggested that the revisiting of the material with a facilitator would help maintain their enthusiasm. Without this they believed that they will revert to using material and ideas that they are more familiar with as teachers:

- *Well, I think that first we had one year of contact and virtually nothing in the second year. I think it shouldn't be cut off like that. .We need support you know even, if the support was once a term* [agreement from all].
- *Just to revaluate because that person is a specialist. It is nice to have your specialist to support you.*
- *Also just to get your enthusiasm going. You get bogged down with all this information, well I do and I think, oh my god. How do you do that one? You tend to go back to the ones you know well.*

However, two of the teachers in this group continue to maintain the changes they were introduced to through the numeracy project by planning together *"every Saturday specifically for maths"*. They noted that shared planning is *"supportive"*. *"Actually talking together about it"* was helpful to each other. However, not all staff are able, or willing, to allocate time in the weekend to sustain development in this manner:

- *Not everyone is prepared to do that. I am not.*

The principal is aware that to sustain new developments staff need to have the opportunity to *"continue to talk about and question how things are going, what is happening"*. In this school the Deputy Principal is expected to provide on-going support for mathematics. However, the principal also noted the on-going issues of money and time as impacting on the sustainability of the Numeracy Project:

- *How to manage the testing on a one to one basis twice a year.*
- *Where do you find the money to be able to release staff or the personnel to be able to release the staff to do it?*

He suggested that the key was *"to keep them talking about it. Keep revisiting. It keeps people's minds on target as it were"*.

Another factor affecting sustainability, according to the principal, related to the range of reforms in recent times and he believes that *"there is always too much"*. The reforms of the curriculum are imposed from outside and while reform has provided staff with an initial impetus to change, this is not sustained as the school moves on to the next reform.

- *We can look back to the Arts Curriculum, the Health and Physical Education Curriculum. We have only really skimmed the surface of a lot of them because we have been doing maths, because we have been doing literacy and then somehow you have to cope with the Arts Curriculum document, dance and drama. Now we have done it and upgraded our stuff but the staff have not had anywhere near the amount of support that they should have to really implement that document. And there are little pockets of good things and different things happening here and there but you can't do it all. You cannot fit it into your timetable, let alone say that you are proficient on top of the whole breadth of the curriculum.*

7.7 Discussion and Conclusion

Both the staff and the principal of this school believe that they have a responsibility to develop their expertise across the range of issues that surround teaching and learning. The principal sees his role in professional development as challenging *"teachers' thinking and practice"*. The ultimate goal is that the practice of individual staff *"improves"*, resulting in changes being evident in classrooms.

Within this school there is an expectation that school management support staff in their endeavours to improve their practice by: continually asking questions which remind staff to reflect on practice, offering support to individual's in areas of need specific to them in their journey to become an effective teacher. This requires the principal to balance the needs of the school with the needs of the individual staff and the school's strategic priorities.

Chapter Eight: School D

8.1 Overview of School D

School D is an urban full primary school (Years 1 to 8) consisting of approximately 520 students. The decile rating of the school is 3. The school is currently staffed at 22.4 Full Time Equivalents (FTEs). The non-teaching principal is supported by a management team of two deputy principals. The principal describes the senior management team as *"walking deputies"* who support staff by releasing them for classroom teaching for professional development purposes.

The two teacher participants in this focus group were experienced teachers. Both were team leaders. One taught Years 5 and 6, while the other taught Years 7 and 8. The principal was interviewed separately. All staff in this school have participated in the Numeracy Project in the last two years and numeracy continues to be a professional development focus this year. The principal was interviewed separately.

8.2 The Nature of Professional Development

Staff identified that the main purpose of professional development is *"to benefit the school and the students"*. When asked to elaborate staff noted that there were different aspects to professional development. Firstly, there is professional development at *"staff level like staff meeting* [which] *tends to be more about coming up with policy and school-wide decisions"*. Secondly, there is the *"more practical application"* where advisers work with *"either clusters or teams"*. Professional development of this nature focuses on classroom practice and planning.

The principal is clear that professional development has two purposes. Firstly, to keep schools *"up with what is happening in the big wide world"* and secondly, for teachers *"personal growth"*. She elaborated her notion of personal growth to include the development of the individual, resulting in participation in *"a*

learning community". The growth process involved teachers looking at themselves and the way they deliver programmes. The principal summarised this by saying that teachers are *"continually reflecting"*. The principal was very clear that professional development is not a case of saying, *"right we have finished that let's do the next thing"* but rather *"a continual cycle"*. Consequently, since all her teachers have been involved with the Numeracy Project the principal expects them to be continually *"reflecting on it"*. She expects teachers to reflect on how they will improve their delivery of mathematics. To support staff reflection the school has *"senior teachers going into the classrooms to see how they can assist and look at what is happening"*. These observations have been set up so that the teacher decides what is to be looked at during the observation.

8.3 Professional Development Identification and Allocation

Both the principal and staff believe that school improvement and student achievement are central to professional development needs identification. School review is the tool used to identify the areas of need. School review includes the following aspects: appraisals, team reviews, the ISAC (*"important stuff about curriculum"*) book, cluster meetings, hub meetings, observations, diagnostic tests, Education Review Office reports, and quality learning circles.

The allocation of professional development, according to the principal is based on the school's strategic plan. It is the plan that provides the principal, as the professional development co-ordinator, with the discretion of how to allocate funding. Her position is that funding needs to be used wisely and based on the school focus. At the same time, while the funding *"is quite set, you also have that little bit extra, just in case. For example, this year we had a Year 1 teacher arrive at the beginning of the year"* unexpectedly due to the fact that *"someone was sick"*. The reserve funds were used to bring the new staff member up to speed with the numeracy school initiatives.

The school improvement focus has meant that in any one year there is *"usually one major"* focus and maybe *"one or two minor foci"*. Both the staff and principal see the aim of professional development as an opportunity to *"build on what we have done"*. It is important for curriculum development to maintain *"a continual cycle"* of professional development and review. For example, if a professional development focus has started in the junior school it will be continued into the senior school as in the case of the Numeracy Project. At the completion of the cycle staff do not simply say *"we have finished that, let's move on to the next thing"* but take the time to reflect on progress and to identify areas of further need and/or improvement. The Board supports the reflection process by setting aside funds so *"senior teachers can go into the classrooms to see how they can assist"*.

Quality learning circles (QLC) have been introduced this year across the school to assist with the identification of professional development needs. Numeracy has been set as the topic for quality learning circle discussion. Staff view quality learning circles as an opportunity to *"meet and talk about anything"*. They describe the meeting time as *"professional dialogue"*, where *"any problems, any suggestions"* and *"successes"* can be shared.

Appraisals are used to identify areas of personal need; however this does not necessarily constitute a reason to source professional development.

- *For our appraisals, individual teachers have their own goals and if something comes up that we think is really applicable to them then yes, they can go off on a course, which is not very often* [Principal].

Staff said that they *"choose to tie it* [personal goal] *in with something that we are already doing as it is more feasible and manageable"*. The principal sees the strength of the team approach to planning as *"everyone sharing"*. The principal is quite clear that professional development is not *"like supermarket shopping"* and therefore course books are not left out for staff to look at. It is the responsibility of the deputy principals and staff to utilise the appraisal process to identify areas of need and only then would a suitable course be sourced. If a staff

member wishes to undertake further study then the Board will fund course fees for appropriate papers.

8.4 Effective Professional Development

According to staff in the focus group, effective professional development for staff involved an opportunity *"to improve something you are doing in the classroom"*. It should provide teachers with something that *"fits in with what they are doing"* and be *"realistic"* for the classroom. There needs to be a direct bearing on curriculum, good facilitation and the opportunity to have somebody (the facilitator) *"come in that you have time to talk to"*. Staff were adamant that effective professional development was not the *"one off sort of things where you go along"* and there was no follow up, such as one day courses.

While teachers focus on everyday classroom practices the principal believes that truly effective professional development is that which *"can change their* [the teacher's] *philosophy"*. This requires teachers to be challenged and to understand why they do something. It begins by *"looking at themselves first"*. Two questions that the principal uses to challenge her staff are:

- *Why do you teach that way?*
- *Why are you doing that?*

To support such 'change' the principal suggested that there needs to be time: *"Time for the teacher to reflect. Time to actually sit, reflect and think about things."* To facilitate reflection the principal puts readings in staff boxes, but believes that *"three-quarters of them are going in the rubbish bin"*, consequently the team, cluster, hub and quality learning circle meetings are important.

The principal also identified that effective professional development requires *"back-up with the school's commitment"* whether that is the purchasing of resources or the provision of time for professional development.

Additionally, the school needs to review progress towards professional development goals, and this might include *"doing less more"*:

- *When we are reviewing at the end of the year, we might say, well hang on a minute, we are not too hot on this. Where are we at? Where are we going? It is evolving all the time. With the NUMP now we are evolving it and yes it is just about right and we might pick up something else but in a couple of years we might relook at it.*

In the principal's opinion, without review and reflection processes, professional development becomes *"ad hoc"* and *"the money has been wasted"*. By allocating set meeting times to staff with a specific focus on school improvement and student learning professional dialogue occurs and professional development initiatives are sustained.

8.5 Effective Mathematics Professional Development

Both the staff and the principal, when asked about effective mathematics professional development, referred to the Numeracy Project as *"the best thing"* or *"the best contract"* that the school had been involved with. The reasons for this are similar to those that Loucks-Horsely et al. (2003) expound and include:

- *facilitators modelling lessons*
- *regular support*
- *time to reflect on mathematics*
- *accountability*
- *discussion*
- *facilitator credibility*
- *observation.*

Both staff and principal agreed that an advantage of being involved in the Numeracy Project is the facilitator being available to work with a team or whole school. The staff likened the facilitator role to that of a *"school mentor"*. The facilitator observes classroom practice and asks staff questions such as:

- *How are you going?*

- *How did you get on with that?*

8.6 Barriers to Professional Development

Due to the positive experience of the Numeracy Project and the culture of this particular school, which supports professional development, both the staff and the principal could not immediately identify barriers to professional development. However when comparing this initiative with earlier developments they noted that lack of follow up was a barrier:

- *They had to try it but there was no one who followed them up.*

Staff comments also suggest that time could be a barrier to professional development:

- *It needs to go back to having someone to come in that you have the time to talk to. The good thing about last year was that we had a lot of time with the facilitator by ourselves and also as a team. We had time to do some of it in school time and some in our own time.*
- *It was programmed in as part of the contract. We were released to go to meetings that might start at 1.00pm and go through to 5.30pm so some of it was our time and some was school time.*

When asked to think particularly about mathematics the principal identified a number of barriers for professional development. In particular, a teacher's *"experience"* or *"thinking about maths"* is a barrier to mathematics professional development. The Numeracy Project, in the opinion of the principal, helped her staff overcome this barrier:

- *For some it is just their knowledge. NUMP is very specific and is a lot clearer. People can see the stages they are going through.*

8.7 Discussion and Conclusion

This school has a strong culture of professional development. It is normal practice for staff to meet on a regular basis to discuss student progress and to share planning strategies. Times are set for team meetings, cluster meetings, hub meetings, and quality learning circles that provide professional development opportunities for staff. Notably, the senior management team support this culture by releasing staff to go and observe others teach, whether for the school foci or for an individual's appraisal goal. The Board commits funding to professional development initiatives and the allocation of the funding is at the principal's discretion as the professional development co-ordinator.

The overall goal of the professional development meetings and the school-wide support is to create an expectation that professional development initiatives are sustained collectively.

Chapter Nine: Discussion and Conclusion

9.1 Introduction

The aim of this study was to explore teacher and principal perspectives of current professional development experiences in general and specifically in mathematics. Particular focus was on both teachers' and principals' perceptions of professional development needs, the identification of these needs and the allocation of resourcing to satisfy the needs. A further focus was the nature of effective mathematics professional development and factors that supported it or not. Although teachers and principals in this study considered professional development important, there are a number of issues to consider. In this chapter issues associated with professional development are discussed using data from teachers' and principals' questionnaires and interviews. Implications of this study and suggestions for further research are outlined. Finally conclusions from this study are presented.

9.2 Professional Development: A Balancing Act

This study highlights that the act of balancing professional development opportunities with the needs of individuals and/or schools is a delicate and complicated task. Since 1992 it has been common practice for teachers, particularly in the primary sector, to be involved in curriculum professional development as a school-based initiative. Funding, through the operations grant to schools, has been given to professional development linked to government priority areas and these priorities have had limited implementation periods (Thomas, 1998, Cardno, 1996). However professional development such as this does not take into account the fact that every teacher will be at a different starting point in terms of curriculum experience nor the teacher movement within the sector that affects access to professional development opportunities.

Looking at mathematics specifically, the questionnaire responses indicated that 57.5% of the teachers had some involvement in professional development opportunities related to the implementation of *Mathematics in the New Zealand Curriculum*. Approximately a quarter of this group identified the years 1999-2002 as the years that they had been involved in professional development for the mathematics curriculum, which suggests involvement with the centrally funded professional development for Year 3 teachers. Centrally funded professional development for Year 3 teachers was established at the recommendation of the Mathematics and Science Taskforce (1997) and precedes numeracy initiatives. In the last three years half of the respondents to the questionnaire and case study interviews were involved in the Numeracy Project. Although the questionnaire demonstrates that the numbers involved in the Numeracy Project have increased steadily since 1999 there are still few respondents (7%) participating in consecutive years of mathematics professional development. However, despite opportunities afforded by large scale Year 3 and Numeracy Project professional development programmes it is of concern that there are a number of teachers (one third of respondents) reported an absence of any mathematics professional development in recent years. Additionally it is of concern that the majority of respondents reporting access to mathematics professional development appear to have been involved in mathematics professional development which is limited in nature and scope, such as numeracy update meetings and day courses such as junior mathematics days.

Many teachers (41%) clearly felt that they had on-going professional development needs in mathematics that were not presently being addressed. Approximately half of these respondents had already accessed numeracy initiatives but noted the need for on-going support in mathematics to sustain developments. Although responses did not identify any one type, model, or topic dominating the perceived professional development needs, respondents indicated that they would like a range of professional development

opportunities, based on individual needs. This, combined with overall concerns about professional development across the range of curricula that primary teachers are responsible for, was an on-going concern for both teachers and principals.

Teachers and principals in the case study interviews identified the nature of professional development as the ability to up-skill both personally and professionally. By acknowledging that professional development supports self improvement, school improvement, and improved student achievement, teachers and principals noted that professional development needs are diverse. One response from the questionnaire expresses this in the following:

- *Although I realise that whole school development has its advantages, I sometimes find it is one size fits all with the deliver, not always meeting my needs.*

The need for professional development to both address individual and school needs was a commonly reported tension. While teachers' expression was in accord with earlier research that professional development should be "consistent with teachers' goals, addressing real and daily concerns, and build on earlier experiences and learning" (Hill et. al., 2002, p. 12), principals' focus was concerned chiefly with whole school needs. It is this diversity that is a dilemma for those planning professional development programmes.

To ensure that personal and school needs are balanced principals must have systems in place whereby they can identify individual teacher needs for both personal growth and school improvement. The questionnaire and case study responses identified that in all schools the identification of professional development needs comes from both performance management systems such as appraisal and self-review systems such as curriculum reviews. Teachers in the case studies noted that appraisal provided them with an opportunity to identify areas where they needed to *"perhaps acquire further skills"*, but this did not necessarily provide *"a reason to obtain professional development"*. Likewise the majority of the questionnaire respondents noted that although personal goals

are considered in the allocation of professional development, school goals are a priority. Balancing these needs were addressed by the case study principals by using a range of strategies. For example, School C makes some professional development programmes voluntary and School D allocates meeting times to allow for discussion about *"important stuff about curriculum"*.

Participants in this study identified effective mathematics professional development as having a number of components but a common feature was the idea of whole-school or in-school professional development supported by a facilitator. The rationale being that this enables a common starting point, focus, understanding and consistency of approach. For the participants involved in the Numeracy Project key aspects for effectiveness included the availability of a facilitator, time to discuss and plan, and improved student achievement.

- *They could see, and I guess that was due to the good ability of our facilitator and the way that the programme was introduced, that it had advantages for the children and because they could see it was going to be of benefit to kids so they really got involved in it.*

It was clear that respondents perceived that the long-term sustainability of any professional development requires on-going support, either external or internal. Specific examples of school-based strategies to maintain developments were exemplified in the case studies where the principal or a team leader was identified as the driving force.

- *Principal or team leader to bring you back to it and say are you still working on this? Revisiting.*
- *A curriculum leader in the school, who is organised, enthusiastic and confident.*

The questionnaire and case study interviews further identified the support of external facilitators as crucial, noting that if facilitators could come back into school each term to discuss progress, and in particular practical concerns from a classroom teacher's perspective, there would be continued improvements in practice. The principal of School D noted that for the effectiveness of a

professional development programme to be maintained the school needed to be committed to the development through the provision of time, resources and review. Clearly the case study schools were moving away from one-off professional development opportunities and using meeting times as opportunities to maintain developments through focus questions, set tasks and discussion.

9.3 Unresolved Issues

A number of specific concerns such as planning and accessing professional development have emerged from this study. Both teachers and principals expressed concern in relation to on-going support, time and resourcing for effective professional development.

While schools are encouraged to identify areas that require development, it was of concern that Ministry of Education initiatives were seen to drive professional development in some instances. There was a danger that initiatives driven by an external source that strive to change practice are viewed with an element of mistrust.

- *Is this new project [numeracy] based on soundly based research? Doubt trends.*
- *As an experienced teacher I question the validity of some research that states this course will definitely work.*

While during the initial stages of a professional development programme there is strong support, in practice many teachers expressed concerns that change may not be sustained once supports were removed.

Additionally, the questionnaire responses noted that mathematics is only one of several curriculum areas that principals and teachers see as needing development. Teachers are clear that it is through appraisal and self-reflection that they identify curriculum areas that they need support in. If one curriculum

is the focus of an on-going professional development programme then other curricula are only covered superficially:

- *We can look back to the Arts Curriculum, the Health and Physical Education Curriculum. We have only really skimmed the surface of a lot of them because we have been doing maths, because we have been doing literacy and then somehow you have to cope with the Arts Curriculum document, dance and drama. Now we have done it and upgraded our stuff but the staff have not had anywhere near the amount of support that they should have to really implement a document. And there are little pockets of good things and different things happening here and there but you can't do it all. You cannot fit it into your timetable, let alone say that you are proficient on top of the whole breadth of the curriculum.*

Furthermore, the tension between Ministry of Education initiatives and school needs, as identified through school review, were evident. For example, School A identified numeracy as a need for 2003 but was unable to access support through the Ministry initiative at this stage and School B was offered the Numeracy project but turned it down as it had identified student behaviour as a priority need for the school.

The effectiveness of any professional development programme depends on leadership and the commitment of the participants. Teachers and principals alike acknowledge that there needs to be a common purpose or goal to any development aimed at improving student outcomes. If teachers do not see the development as being beneficial to them in the classroom within a short time frame then the likelihood of change is unlikely. Even if a purpose for professional development is shared concerns about funding and on-going support are noted by principals and teachers. For example, although the case study schools involved in the Numeracy Project perceived that the development was effective; questions from both the principal and the teachers arose:

- *Well, I think that first we had one year of contact and virtually nothing in the second year. I think it shouldn't be cut off like that. We need support you know, even if the support was once a term [agreement from all].*
- *It is nice to have your specialist to support you.*
- *How to manage the testing on a one to one basis twice a year.*
- *Where do you find the money to be able to release staff or the personnel to be able to release the staff to do it?*

Case study schools also identified *"personal hang- ups"* and teacher confidence and beliefs in mathematics as an issue when planning and implementing whole-school mathematics professional development programmes. Unless individuals are supported from their starting point and moved forward, the outcome could be one where there is no change because the individual *"does not accept"* the rationale for change but only *"sees it as the latest trend and not practical"*. In the case of School A, one staff member identified lack of confidence in mathematics as the reason for not choosing mathematics as an area needing professional development.

Curriculum demands in the primary sector until recently have been dominated by curricula changes and the question of how to balance curriculum demands across all curricula was evident in principals' and teachers' responses. Furthermore, the speed of change and having to balance the time needed for professional development with daily work commitments is of concern to teachers.

- *You know they get put aside like for a rainy day, thinking I will come back to that. You know you are buzzing from it but it just gets pushed into the background because everything else takes priority over it.*
- *We always think we do not have time. Guilt thing.*

One principal also acknowledged this.

- *I think often time is an issue and the workload. I don't think teachers deliberately try to cover up that they are not very strong in something in science or whatever. But when they are all involved in their work and whatever they may well decide*

> *to stay with what is safe for them rather than be prepared to stretch the boundaries and push the boundaries as far as their own knowledge and skills is concerned.*

On the other side of the continuum, one group of teachers regularly met to plan and prepare common lessons for mathematics; another school set time aside for teams to plan and prepare programmes. Teachers reported that this provides them with collegial support and allows them to discuss issues pertaining to their classes and students.

9.4 Implications for Mathematics Professional Development

This study has highlighted a number of issues for professional development practices, generally, in schools which have implications for teachers, principals, Boards of Trustees and the Ministry of Education when considering professional development programmes.

Firstly, expectations and support for professional development needs to be embedded into a teacher's job. As some teacher's career plans appear to have limited checks and balances regarding professional development programmes to meet their own professional development needs, principals need to establish systems to ensure that teachers' professional development needs are identified and addressed effectively. It needs to be an integral part of teaching and learning, not an add-on.

Secondly, the nature of professional development programmes, while based on a theoretical framework, need to be connected to the everyday reality of the classroom. Consequently, links to student learning need to be specifically identified, while at the same time allowing teachers to address any personal barriers in an environment that is conducive to learning effectively. This requires principals to ensure that school priorities allow sufficient time and resourcing to occur.

Thirdly, for any professional development programme to be sustainable the school environment needs to establish professional development practices that support generative change. This requires effective leadership, time, resourcing, planning and evaluation of professional development programmes. Effective evaluation should identify if individual teacher goals are met and establish improvements to programmes based on individual or school knowledge and learning experiences.

Fourthly, support for any initiative needs to be on-going. Internal support identified by both teachers and principals including having someone responsible for initiating staff revision of topics which have been part of earlier professional development programmes are considered valuable. This means that time needs to be provided to discuss programmes, make alterations and to revisit purposes. This may result in a cyclic approach to developments.

When looking specifically at mathematics professional development it is necessary in planning to acknowledge teacher attitudes and beliefs about mathematics, identifying how barriers such as a lack of confidence in mathematics may be addressed.

9.5 Further Research

It is suggested that the following issues identified from the results and implications of this study warrant further research:

1. Both teachers and principals identified time as a barrier to effective professional development. In order to identify strategies that support the development of effective practice it would be useful to find examples of how schools provide time for professional development and how this is managed effectively in terms of resourcing.

2. In primary schools the need to balance curriculum requirements was mentioned often by teachers. It would be useful to investigate strategies to effectively balance professional development needs of individuals with curriculum requirements.
3. While personal professional development needs are considered in two of the case study schools, it was clear that school goals are a priority for professional development. Research that examines the most effective way of developing a professional development programmes which integrates the needs of individuals and the school is warranted.
4. In the case study schools teachers and principals noted that individual teacher attitudes and beliefs about mathematics could impact on teachers willingness to access professional development in mathematics. Research on the impact these attitudes have on student learning in mathematics would perhaps provide some guidance on how best to support teachers in delivering a mathematics programme for their classes.
5. Government driven professional development initiatives are seen as impacting on schools. Longitudinal research studies on how initiatives impact on schools in terms of sustainability could lead to best practice being established to ensure the sustainability of initiatives.
6. Teachers and principals articulated a concern about not only fitting professional development into their programmes but evaluating the effectiveness of it. Research which examines the most effective way to develop and evaluate professional development programmes, in a school context, would have worthwhile, practical implications for a school.
7. This study revealed that on-going support of professional development initiatives, such as the Numeracy Project, is an issue. It would be useful to find out more about the nature and cost of on-going support and how this can be accessed by schools.

9.6 Conclusion

While this study was designed to identify, particularly, issues relating to mathematics professional development it is clear that many of the findings apply to effective professional development in general. As the study took place at the end of a period of time where there has been significant curriculum implementation sustainability, resourcing and time are common issues.

Teacher and principal perceptions about current professional development practice in their schools suggest that unless schools commit time and resources to professional development so that it is an integrated aspect of teaching and learning, it is likely that teachers will continue to regard professional development as an add-on to their busy schedules.

Access to appropriate and timely professional development remain as issues for many teachers and schools. Specifically, it appears that it is possible in some schools, and the system as a whole, for some primary teachers to either avoid or not have access to professional development in a particular area where they lack confidence, such as mathematics. It is the responsibility of those in management positions to establish an environment where such concerns can be identified and then to provide support to address individual needs.

Professional development is a key feature of raising teacher capability. Principals, with delegated authority from the Board of Trustees, are accountable to the Ministry of Education to provide sufficient resourcing and access to professional development based on individual and school needs. The success and accountability of professional development programmes appear to involve balancing teacher versus school needs, short-term versus long-term needs, school versus Ministry of Education priorities, and curriculum demands with subject needs of individuals. Currently in New Zealand, with the government focus on literacy and numeracy it is essential that individual teacher needs are accounted for to ensure that professional development is integrated into an

individual's job. While this study showed that in some schools a culture of professional learning is developing or established in which teacher professional development is an expectation of the teaching and learning process, there is still a need for guidelines and strategies to be developed to assist principals to balance school and individual teacher needs effectively.

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Appendix A: Intention to Participate

Massey University
COLLEGE OF EDUCATION
Te Kupenga o Te Matauranga

Department of Technology, Science and Mathematics Education
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 351 3472

10 March, 2002

Dear Principal

I would like to invite the staff at your school to participate in a research project dealing with professional development in Mathematics.

Over the last 4 years, I have undertaken study at Massey University towards a Masters of Education Studies (Mathematics). I am interested in issues dealing with professional development that primary teachers have experienced in mathematics and in particular their perceived needs, the effectiveness and accessibility of the professional development.

My questionnaire is an attempt to obtain information relating to the above from practising primary teachers. I include a copy of the questionnaire with this letter, for your information.

I would like you to consider with your staff whether you would be prepared for me to send you questionnaires to complete. I would appreciate as many of your teaching staff as possible completing the questionnaire. The questionnaire is likely to take approximately 20 minutes to complete. No one will be asked to give their name or the name of their school on the questionnaire. This is to ensure anonymity of both the individual and the school. In addition to this, all data will be aggregated. Please advise me of your schools intentions outlining the number of questionnaire forms required by using the fax form enclosed.

I would appreciate return of the Fax Response by 28 March 2002 if you have staff willing to participate. The Questionnaire will be mailed out in Week 1 Term 2 to participants.

At the completion of my project, I will supply your school with a summary of my findings. If requested I will be happy to supply a copy of my thesis.

If you have any concerns please contact me at home [redacted] or email me at [redacted] Alternatively, you may wish to contact my supervisor Dr Glenda Anthony during work hours on [redacted]

Thank you for you time.

Yours sincerely

Johanna Wood

A:\Intention to participate.doc

Professional Development Questionnaire

Intention to Participate

Please complete the following and fax to the number listed below.

The teachers at _____*(include name of school)*

will / will not *(please circle)*

be participating in the professional development questionnaire.

How many teachers on your staff will be participating: _____

Does your school wish to receive a copy of the summary of project findings: **Yes/No**

Who will be the contact person at the school: _____

We would like you to contact us to discuss our concerns concerning this research, which are listed below.

Please fax or mail this form to:

Johanna Wood
Department of Technology, Science and Mathematics
Massey University
Private Bag 11222
Palmerston North

[redacted]

A:\Intention to participate.doc

Appendix B: Information Sheet

Massey University
COLLEGE OF EDUCATION
Te Kupenga o Te Matauranga

Department of Technology, Science and Mathematics Education
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 351 3472

March 2002

Dear Teacher of Mathematics

I am a Principal of a secondary school with an interest in mathematics education currently studying at Massey University, for a Masters of Educational Studies (Mathematics).

The topic I have chosen for my thesis is 'Professional development opportunities in mathematics for primary teachers'. The objectives behind my chosen topic are:

(a) To find out from primary teachers, what professional development needs in mathematics are a high priority for them.
(b) To identify what teachers believe to be the most effective professional development.
(c) To identify issues concerning access to professional development.

I would like you to fill out the enclosed questionnaire and return it the prepaid envelope. As a member of the teaching profession, myself, I realise that taking time for questionnaires impacts on your workload and I would like to thank you for your efforts.

Individual questionnaire responses will be kept confidential to me (the researcher) and my supervisor. The questionnaire will not ask your name to ensure anonymity. In addition to this all data from responses will be aggregated so that no individual or school can be identified. At the completion of my written report I will destroy all questionnaires.

Please note that you have the right to decline participation in this survey. I have included a prepaid envelope for you to return the questionnaire to me. All respondents will be sent a summary of the questionnaire responses by end of Term 4 2002.

If you have any queries about the questionnaire or wish to obtain further information about the project I can be contacted in the evenings on ([redacted] or by email at [redacted]. Alternatively you may wish to contact my supervisor Dr Glenda Anthony during work hours on [redacted].

Thank you once again for your time.

Yours sincerely

Johanna Wood

Appendix C: Questionnaire

Massey University
COLLEGE OF EDUCATION
Te Kupenga o Te Matauranga

Department of Technology, Science and Mathematics Education
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 351 3472

Professional Development Questionnaire

Thank you for agreeing to participate in the completion of this questionnaire. The questionnaire is about professional development for mathematics. You have the right to decline to participate at this stage. To ensure anonymity you will not be identified by name. Neither will you be asked to supply your school name for the same reason. In addition to this, all data will be aggregated. In accordance with the requirement of Massey University Ethics Committee, you have the right to:

- Decline to participate
- Refuse to answer any particular question
- Withdraw from the study at any time
- Ask questions about the study at any time during your participation

At the conclusion of this research project, all source data will be destroyed. You will not be identified by name, or otherwise, in any written reports.

A summary of findings from the research will be sent to your school at the conclusion of the project.

Thank you for your time.

Johanna Wood

Professional Development Questionnaire

Please complete the questions below by circling the appropriate response or writing in the space provided.

1. Gender: Male Female

2. Age: 20-24 25-29 30-34
35-39 40-44 45-49
50-54 55-59 60+

3. Number of years teaching experience *(including this year)* _____years

4. What size is your current school? _____

5. What is the decile rating of your school? _____

6. Do you consider your school to be rural or urban? _____

7. What is your highest qualification in mathematics?

School Certificate University Entrance/Sixth Form Certificate

University Bursary 1st year university 2nd year university

3rd year university No formal qualification

8. Did you have the opportunity to participate in professional development for the implementation of New Zealand in the Mathematics Curriculum?

Yes No Not applicable because (i) not trained
(ii) not in New Zealand

9. What year did you participate in a contract for Mathematics in the New Zealand Curriculum?

_____

10. (a) Is your school currently involved with Ministry of Education Initiatives for numeracy?

Yes No

(b) If yes, are you involved? Yes No

If no, why not? _____

11. Do you have responsibility for Mathematics in your School?

Yes No

Briefly outline these responsibilities.

_____

_____

12. What types of professional development have you participated in over the last three years?

TYPE OF PROFESSIONAL DEVELOPMENT	NAME OF PROFESSIONAL DEVELOPMENT
Personal Study *(for example study award or tertiary study)*	
One day courses	
Ministry of Education professional development contracts *(for example Early numeracy project, arts curriculum contract)*	
School Support Services *(for example advisor support)*	
Teacher Refresher Courses (TRCC)	
Other schools *(for example clusters of schools)*	
School based *(for example professional development initiated and supported by your school)*	
Teacher professional associations *(for example Manawatu Mathematics Teachers Association)*	
Teacher unions	
Professional support of colleagues *(for example mentoring or study groups)*	
Supervision	
Conferences	
Other *(please elaborate)*	

13. Please list the professional development you have undertaken specifically for mathematics in the last 3 years.
2001:

_____

_____

2000:

_____

_____

1999:

_____

_____

14. What is the impact of professional development in mathematics that you undertake on:

(a) you personally ? _____

_____

(b) your students? _____

_____

(c) your syndicate? _____

_____

(d) your school? _____

_____

15. What is the most common type of professional development that you have undertaken in curriculum areas? *(see question 12 above)*

_____

_____

16. List what you consider your personal needs for professional development are?

_____

_____

_____

17. If any professional development needs identified in Question 15 above are in mathematics
(a) what was the focus?

_____

_____

_____

(b) was this focus what you believed it should be? Why/Why not?

_____

_____

_____

18. (a) Are professional development goals set as part of your annual review appraisal

Yes No

(b) Did you identify mathematics as part of professional goals for 2002?

Yes No

19. (a) How are professional development goals prioritised?

_____

_____

_____

(b) Are personal professional development goals considered or do school wide goals take priority?

_____

_____

_____

(c) If school wide goals take priority was this a result of

(i) self review

(ii) school review

(iii) external review?

20. What do you consider to be the most effective professional development in mathematics for:

(a) you personally

_____

(b) your syndicate/team

_____

(c) your school

_____

21. Can you identify any barriers to professional development in mathematics for you personally? *(for example personal, school wide, practical such as location or cost, and pedagogical)*

_____

_____

_____

22. What support do you get at the conclusion of a professional development session? *(For example what follow up is there; what opportunities do you have to continue the development?)*

_____

_____

Thank you for taking the time to complete this questionnaire.

Appendix D: Request for Follow-Up Interview

Massey University
COLLEGE OF EDUCATION
Te Kupenga o Te Matauranga

Department of Technology, Science and Mathematics Education
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 351 3472

31 January 2003

Dear Principal/Chairperson

Recently staff at your school participated in a questionnaire relating to my research project: Professional Development Opportunities in Mathematics for Primary Teachers.

This research is part of my study at Massey University towards a Masters of Education Studies (Mathematics). In order to gain more detailed information about professional development opportunities in mathematics for primary teachers I would like to include some focus group interviews. The interviews will form the basis of case studies from the principal's perspective and from the teacher's perspective.

In an attempt to obtain a purposeful sample and to represent a range of schools I would like to invite yourself, as Principal, to be interviewed. In addition, I would also like to invite up to four staff from different levels within your school to be part of a focus group interview. Your school has been selected from the original **Intention to Participate** forms that were completed by your school in March 2002.

Interviews will be at a time convenient to you and your staff. It is expected that interviews will take approximately 30 minutes and will be taped for subsequent analysis. Participants may refuse to answer a question or ask to have the tape recorder turned off. The tape recordings will be treated confidentially and stored securely. After completion of the report they will be destroyed.

I include an information sheet for participants with the proposed questions for the interview.

I will follow up this request by phone in the next two weeks to establish whether your school is able to participate in the interview process.

If you have questions regarding this section of my research project please do not hesitate to contact me at home [redacted] or email me at [redacted] Alternatively, you may wish to contact my supervisor Dr Glenda Anthony during work hours on [redacted]

Thank you for your time.

Yours sincerely

Johanna Wood

Appendix E: Interview Information Sheet

Massey University
COLLEGE OF EDUCATION
Te Kupenga o Te Matauranga

Department of Technology, Science and Mathematics Education
Private Bag 11 222
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 351 3472

Information Sheet for Focus Group Participants

Professional Development Opportunities in Mathematics for Primary Teachers

During the last year your school was involved in completing questionnaires for my research about professional development opportunities in mathematics for primary teachers. To further my research I have found it necessary to include some case studies, using focus group.

Outlined below are a sample of the questions that the discussion will focus on. There may be other issues related to professional development that you would like to discuss.

Under the requirements of Massey University's Ethics Committee, you have the right:

- To refuse to answer a particular question
- To withdraw from the study at any time
- To ask any questions about the study at any time during participation

Interviews will be recorded on audiotape with the permission of the interviewee and transcriptions of the recordings will be made by myself. Taped responses will be kept confidential to the researcher and supervisor. The tapes will be held securely and will be destroyed at the completion of the research. Any written reports will not identify you or your school by name.

Focus Questions for Discussion

1. What is the nature of professional development?
2. How are professional development needs identified and allocated?
3. What are the issues relating to the access and effectiveness of professional development?
4. What barriers exist for mathematics professional development?
5. What would be an ideal mathematics professional development programme for your school?

Appendix F: Interview Consent Form

Massey University
COLLEGE OF EDUCATION
Te Kupenga o Te Matauranga

Department of Technology, Science and Mathematics Education
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 351 3472

Professional Development Opportunities in Mathematics for Primary Teachers

Focus Group Consent Form

This consent form will be held for a period of five (5) years

I have read the information sheet and have had details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask questions at any time.

I understand that I have the right to withdraw from the study at any time and to decline to answer any particular question.

I agree to provide information to the researcher on the understanding that my name will not be used without my permission.

I agree to the interview being audio taped.

I also understand that I have the right at any time during the focus group discussion to ask for any or all of my individual comments to be removed from the transcript of the session.

I agree to keep the content and identities of other participants in the focus group confidential.

I agree to participate in this study under the conditions set out in the Information Sheet.

Full Name:

School:

Signed:

Date: