Chapter 1

Introduction

Identification of the challenge

It is our contention that how we feel is almost always more important to us than what we know, and that since behaviour is frequently determined more by how we feel about a situation than by what we know about it, the affective dimension of our lives will play a major role. (Annesley & Putt, 1992, p. 2)

Mathematics has often been viewed as a content-driven subject (Ernest, 1991) with insufficient attention given to the views held by the students, parents and teachers involved in its learning and teaching (Australian Education Council, 1991; HMSO, 1982; McLeod, 1992; National Council of Teachers of Mathematics, 1991; NCTM, 2000).

The beliefs that teachers and students hold towards mathematics and themselves as mathematicians play a central role in the learning and teaching of mathematics (Battista, 1994; Frykholm, 1995; Garofalo, 1989a; Pajares, 1992; Thompson, 1992). Thompson (1992) proposes that the relationship between teacher beliefs and their classroom practice is interactive, evaluative and reflective. Students’ beliefs towards mathematics evolve as a result of the social and cultural experiences that they encounter in their learning, particularly in mathematics classrooms which are usually the primary source of their mathematical experiences. Their beliefs develop gradually,

…over a long period of mathematical encounters and experiences… Thus, what goes on in the classroom will strongly influence the mathematical beliefs of the students in that classroom. (Frank, 1988, p. 33)

The experiences that occur in mathematics classrooms involve teachers, educational assistants and students and are influenced as well by parents. The beliefs which each of these parties holds towards mathematics directly impacts on the students’ learning of mathematics (Pajares, 1992; Van Zoest, Jones & Thorton, 1994; Weissglass, 1992b). Many people dislike mathematics and the learning of mathematics (Carroll, 1994). In many mathematics classrooms there is an emphasis on a ‘transmission’ approach to the teaching of mathematics. In such an approach the teacher is viewed as the holder of appropriate mathematical knowledge and the teacher’s task is to pass on this mathematics knowledge to the learner and check that the learner has absorbed it. The learner’s task is to internalise the knowledge and present it on demand (Ernest, 1989c; Perry, Howard & Tracey, 1999).

The National Statement on Mathematics for Australian Schools (AEC, 1991) provides a
framework for schools and school systems to develop their mathematics curricula. This
document begins by suggesting that a national statement "should describe the
mathematical understandings, knowledge and skills to which students will be typically
exposed and teaching methods which are likely to encourage productive learning
strategies and positive attitudes towards their involvement in mathematics" (AEC, 1991, p.
1). The statement's aim emphasises two aspects of the affective domain concerning
students liking mathematics and feeling good about themselves as doers of mathematics
(AEC, 1991). Teachers are important in both of these aspects. As well, the development of
positive views towards mathematics is influenced by people and events that students
encounter outside of school - primarily their parents and significant others in their home.
This has been recognised in curriculum documents (AEC, 1991; NCTM, 2000;
Disadvantaged Schools Program, 1999).

Mathematics and Aboriginal children

There has been considerable research in mathematics in traditional Aboriginal
communities and this has had some influence on the teaching of mathematics in these
communities. Most Aboriginal Australians, however, live in rural and urban areas, but
there is little research available on the linguistic and cultural influences on their
learning of mathematics. (AEC, 1991, p. 9)

Aboriginal people have been identified as "the poorest, sickest, most unemployed and
least educated of all Australian" (Aboriginal and Torres Strait Islander Commission, 1995,
p.1). For example, most Aboriginal men do not live beyond 50 years, 40% of Aboriginal
men and boys under the age of 25 are in detention, Aboriginal babies die at twice the rate
of other Australians and the life expectancy for an Aboriginal person in Australia is 54-56
years (Australian Bureau of Statistics, 1997).

The participation of Aboriginal people is poor at all educational levels (Aboriginal and
Torres Strait Islander Commission, 1995, 1996; Atweh, Cooper & Kanes, 1992; Kemp,
1999). Educational systems are failleveling Aboriginal students and the situation is worse
for those living in rural communities. There is a "deep and systemic problem which
requires a concerted approach by governments, communities and education providers"
(Aboriginal and Torres Strait Islander Commission, 1999, p. 5). The educational
achievements of Aboriginal students are linked to the disadvantaged experienced in terms
of health, housing and levels of economic independence resulting from colonisation,
dislocation and historical circumstances" (Aboriginal and Torres Strait Islander
Commission, 1999, p. 9). Across Australian primary schools, almost 45% of Aboriginal
students have lower achievement levels in literacy and numeracy compared to 16% of
other students (Stanley & Hansen, 1998). There is continuing comment that "the
improvement of educational outcomes for Indigenous children is amongst the most
serious and urgent of the responsibilities of Australian governments" (Boston, 2001, p. 18).

The learning environments of Australian Aboriginal children are affected by events and
people at school and at home (S. Harris, 1990; Harris & Malin, 1994). Further, both
Aboriginal children and the adults who are caring for them have limited access to
schooling beyond the primary years and they feel that their views are often not heard or
even sought (Department of Employment, Education and Training, 1994). They have not
“yet managed to articulate to policy makers what they really want. This is partly because the schooling system is too persistent, too unstoppable and too untrained at listening to Aborigines for them to get a tentative idea through” (Harris, 1990, p. 4). According to the Schools Council (1992) “no greater need exists in Australian education ... than that of a dramatic improvement in the experience of and successful outcomes in the early years of schooling for Australia's Aboriginal and Torres Strait Islander children” (p. 36).

Indigenous Australian students continue not to achieve “educational levels at similar levels to other Australian students” (Department of Education, Training and Youth Affairs, 2000c). “Indigenous people, themselves, must be provided with opportunities ... so that they may be equal participants at all crucial levels of decision-making” (Council for Aboriginal Reconciliation, 1995, p. 32). Indeed, for the learning outcomes of Indigenous Australian students to improve:

- they must be given respect;
- their culture and its relevant implications must be respected;
- they must be taught well;
- and they must attend consistently.

(Department of Education, Training and Youth Affairs 2000a, p. 2)

Linda Burney [Past-President, NSW Aboriginal Education Consultative Group Inc] has stated that overcoming inequity for Indigenous students in schools requires change (Personal communication, 1994). However, such change “can only be achieved through more effective partnerships” (NSW Department of School Education, 1996, p. 3), including research partnerships. A collaborative research partnership amongst Aboriginal and non-Aboriginal participants and the researcher was fundamental to this study. This collaborative partnership involved participants and the researcher working within a context of consultation and negotiation throughout the study (Cutmore & Howard, 1995). The intended outcome of this research is for a non-Aboriginal researcher to work in partnership with Aboriginal and non-Aboriginal participants in sharing and reporting their expressed beliefs of the issues involved, for rural Aboriginal students, in the learning and teaching of Year 5-6 mathematics. It is intended that through such reporting more appropriate teaching strategies for Aboriginal students can be introduced to mathematics classrooms.

There is a need for strong links to be established between schools and Aboriginal communities in order to improve the educational outcomes of Aboriginal students (Department of Education, Training and Youth Affairs, 2000b; NSW Department of School Education, 1996; Schools Council, 1992). The development of such links requires time, genuine consultation and discussion to identify the held beliefs, attitudes and values of those within the school and the community. These links have to be established in the early years of education for “the holding power of the secondary school and, more importantly, the achievement of students is strongly related to the success of students in the early years of school” (Schools Council, 1992, p. 4).

The educational difficulties experienced by many Aboriginal students stem from cultural conflicts or mismatches between Aboriginal students and Western schools (Bishop, 1994; Howard, 1994). Ngarrirri Kessaris (1994) identified belief systems and the mismatch of
school and home experiences as major factors contributing to the anxiety and confusion faced by Aboriginal students in school. In talking of her own experiences, Ngarrity-Kessaris (1994) wrote:

School processes and attitudes of teachers and students that purvey middle class western values as right in all contexts, are explicitly and implicitly disparaging of Aboriginal people. The school curriculum provided a hidden curriculum in terms of my Aboriginal identity. Much of the norms and values portrayed in what I read and heard from White teachers bore little relation to what I experienced at home. This meant that at school I was continually thrust into a state of confusion and anxiety. (p. 5)

In trying to overcome such states of confusion and anxiety West (1994) has suggested that educators require an understanding of where the school conflicts originate for Aboriginal children in order to implement effective pedagogy. Such conflicts and mismatches between school and home experiences are critical elements in the reasons why Aboriginal students are not achieving their learning potential in mathematics (Bayles & O’Brien, 2001; Kemp, 1999). This is a telling issue for one of the critical elements in school success is competency in mathematics in general, and numeracy skills in particular (Department of Education, Training and Youth Affairs, 2000b). A much greater effort is required “by primary schools, systems and teachers to improve their performance in relation to Aboriginal and Torres Strait Islander students” (Schools Council, 1992, p. 5).

There has been little Australian mathematics education research conducted with rural Aboriginal communities (Frigo & Simpson, 2000). Indeed, Australian mathematics education research related to Aboriginal people overall is not vast and has focussed on the influences of language and culture on the learning of mathematics in geographically remote communities (Frigo, 1999; Graham, 1988a, 1988b; P. Harris, 1991; Watson, 1988a). Watson (1988a) reported that there were language and learning factors that led to difficulties for Aboriginal students in developing understandings of Western mathematical thinking. Such factors continue to be acknowledged (French, French, Matthews, Stephens & Howard, 1994; Jones, Kershaw & Sparrow, 1995), particularly for Aboriginal students where mathematics “concepts and practices are more culturally embedded” (Department of Education, Training and Youth Affairs, 2000b, p. 92). Atweh et al (1992), cited Watson's view as follows:

mathematics meanings are value-laden and thus the learning of mathematics is emotionally arousing. She contended that Aboriginal learners have good reason to feel suspicious about, and resist, learning which will induct them into a society for which they have mixed feelings, particularly when the learning involved mathematics, a subject which is highly valued in a society that devalues Aboriginal culture and knowledge.

(Atweh, Cooper & Kanes 1992, p. 45)

People hold views of what mathematics means for them and have personal beliefs about the learning and teaching of mathematics. However, little effort has been made to access the views and beliefs of Aboriginal people. There remains little research available on the cultural influences in the learning of mathematics by Aborigines in rural communities (AEC, 1991; Frigo, 1999). In order to identify and come to appreciate the espoused beliefs of Aboriginal people, researchers need to become involved in listening to and learning
from them (P. Harris, 1991). Through the identification of such beliefs, specific factors that affect Aboriginal children's learning of mathematics can be identified, leading to more appropriate teaching strategies, mathematics materials and mathematics curricula being utilised.

Mathematics curriculum documents: considering the affective domain

Mathematics curriculum documents often list explicitly the content to be covered and suggest that learning activities should foster positive attitudes towards mathematics (NSW Department of Education, 1989; NCTM, 2000). There is often little mention of the beliefs which students or teachers may hold towards mathematics. Yet, students and teachers hold strong beliefs about mathematics and themselves as learners of mathematics that affect the learning and teaching of mathematics (Southwell & Khamis, 1994). Gross (1988), reporting on high school students' performance and participation in mathematics, found that "attitudes influence students' ability or willingness to perform in the curriculum, and performance and participation in the curriculum ultimately influence students' mathematics achievement" (p. 19).

Much of the mathematics education research investigating beliefs has focussed on teachers and students (Garofalo, 1989a; Perry, Howard & Tracey, 1999; Southwell & Khamis, 1992; Weissglass, 1992b). Yet, within the social context of learning mathematics, students, teachers and parents hold beliefs towards the learning and teaching of mathematics that have been generated over many years of learning in mathematics classrooms. As they are all intimately involved in the students' learning of mathematics, their beliefs are relevant to mathematics teaching and learning.

One of the Professional Standards for Teaching Mathematics, Knowing students as learners of mathematics, suggests that teachers need to continue developing their knowledge of "the influences of students' linguistic, ethnic, racial, and socioeconomic backgrounds and gender on learning mathematics" (NCTM, 1991, p. 144). The NCTM (1991) has acknowledged that:

*teacher expectations have significant impact on what happens to children in school. Teacher expectations are founded on knowledge and beliefs about who their students are and what they can do ... Changed perceptions about what their students can and cannot do affect teachers' attitudes and beliefs about their students and about their teaching strategies.* (p. 145)

"All teachers hold beliefs, however defined and labelled, about their work, their students, their subject matter, and their roles and responsibilities" (Pajares, 1992, p. 314). These beliefs may not be consciously held and, therefore, may be difficult to identify (Jacobs, Yoshida, Fernandez & Stigler, 1997). However, the investigation and consideration of teacher beliefs will assist in providing "insights into the relationship between beliefs, on the one hand, and teacher practices, teacher knowledge, and student outcomes on the other" (Pajares, 1992, p. 327). For, to bring about educational change, teachers have to be supportive of new ideas and policies that they believe are in the best interests of their students (Australian College of Education, 1992; Bright & Vacc, 1994). Qualitative descriptions of teachers' beliefs will further the knowledge of the significant impact that
beliefs and conceptions may have on the classroom teaching and learning of mathematics (Boero & Szendrei, 1998).

Further, "[Students' feelings about the utility of mathematics and importance of doing well in school result in large part from parental expectations and pressures, and to a slightly lesser extent from the school environment" (Gross, 1988, p. 10). Enhancing the involvement of Aboriginal parents in school education is essential (Ministerial Council on Education, Employment, Training and Youth Affairs, 1996). For such involvement has the potential to increase "the capacity of schools to understand better and work more effectively with Indigenous students" (Harslett, Harrison, Godfrey, Partington & Richer, 1999a, p. 61). Yet, there is no available research on the beliefs of parents of Aboriginal children towards the learning and teaching of mathematics.

There may be conflicting beliefs held by students, parents and teachers towards aspects of the learning and teaching of mathematics. Thus, it is important to investigate the beliefs of Aboriginal students, their parents and teachers of Aboriginal children about the learning and teaching of mathematics. Such beliefs need to be supportive of the current directions of change in mathematics education for there to be change evident in mathematics classrooms (Weissglass, 1992a). On this basis, "the politics of mathematics education, which focus on a difference in community members' socio-cultural beliefs about what should be learned and how it should be learned" (Dillon, 1993, p. 73) should be examined.

Mathematics in Australian schools "has tended to emphasise values and concerns which are more middle class than working class, and to draw on experiences which are more relevant to children of Anglo-Celtic descent than those of Aboriginal" (AEC, 1991, p. 9). The beliefs of Aboriginal groups concerning the content and implementation of a school's mathematics curriculum have to be investigated. More particularly, due to reported educational and social injustices towards Aborigines, the beliefs about learning and teaching of Aboriginal students, their parents, Aboriginal educators and non-Aboriginal teachers of Aboriginal children need to be heard. It is through the use of qualitative studies "that we can better understand how students in different cultures ascribe meaning, not only to the words they use, but also to their unique school experiences" (Bempechat & Drago-Severson, 1999, p. 289). This will identify social and cultural factors that impact upon Aboriginal students' learning of mathematics (Aboriginal and Torres Strait Islander Commission, 1995; Australian College of Education, 1992; Schools Council, 1992).

**Research questions**

The purpose of this study is to investigate the expressed beliefs about the nature and learning of mathematics of a group of Year 5 and 6 Aboriginal children, their parents, Aboriginal educators and their non-Aboriginal teachers, living in a rural community in New South Wales, Australia. The pedagogical consequences of these beliefs are considered. The research questions for this study are:

1. What are the beliefs expressed by Years 5 and 6 Aboriginal students, in a rural community, about mathematics and the learning of mathematics?

2. What are the beliefs expressed by parents of Years 5 and 6 Aboriginal
students, in a rural community, about mathematics and students' learning of mathematics?

3. What are the beliefs expressed by Aboriginal educators, in a rural community, about mathematics and students' learning of mathematics?

4. What are the beliefs expressed by non-Aboriginal teachers, in a rural community, about mathematics and students' learning of mathematics?

5. How do these sets of beliefs compare and contrast?

6. What are the pedagogical consequences for the learning and teaching of mathematics based on these expressed beliefs?

The study reported in this thesis was a collaborative investigation that sought to access the espoused beliefs of rural Aboriginal and non-Aboriginal people concerning the learning and teaching of mathematics. The results of this study are limited to the field site in which it took place. However, they provide a lens through which affective aspects of the learning and teaching of mathematics and their impact upon the mathematical learning outcomes of Aboriginal students in other settings may be considered.
Chapter 2

Review of the Literature

Beliefs and the learning of mathematics: a focus on socio-cultural issues

The beliefs about the nature, teaching and learning of mathematics which Aboriginal children, their parents, Aboriginal educators and non-Aboriginal teachers bring to the Years 5 and 6 mathematics classrooms form the focus of this study. This chapter addresses these beliefs in three parts. Part One considers the complex nature of the connectedness of knowledge, beliefs, attitudes and values and their relationship to the individual's belief system. Part Two discusses some of the current issues pertaining to the nature and learning of mathematics and reviews the literature concerning beliefs towards these. Part Three discusses key issues related to the socio-cultural environment of the mathematics classroom.

PART ONE - Belief systems: a conceptual framework

The initial part of this review considers the concept of belief systems through a discussion of the components of knowledge, beliefs, attitudes and values and their inter-relatedness. Knowledge is learnt within social and cultural contexts. It is through this knowledge that personal beliefs are generated. Several beliefs built around one construct generate an attitude. Beliefs, when acted upon through evaluative, comparative and judgemental thoughts [or actions], become one's values. Individuals make decisions leading to particular action based upon one's belief system: knowledge, beliefs, attitudes and values. These are difficult constructs to define and challenging to separate (Pajares, 1992).

Knowledge and beliefs

It is difficult to separate knowledge and beliefs since they tend to be entwined rather than sequentially connected (Pajares, 1992). Beliefs are based on personal knowledge and may be viewed as the affective outcome of thought (Ernest, 1989a, 1989c). Pajares (1992, pp. 313 - 314) cites Rokeach (1968) to define the concept of belief as "any simple proposition, conscious or unconscious, inferred from what a person says or does, capable of being preceded by the phrase, 'I believe that...". A belief is "an individual's representation of reality that has enough validity, truth, or credibility to guide thought and behaviour" (Harvey, 1986). Beliefs have cognitive [personal knowledge], affective [emotion] and behavioural [action] components (Rokeach, 1968). In trying to identify observable differences between knowledge and beliefs, Pajares (1992) suggests that there appears to be an acceptability that "belief is based on evaluation and judgement; knowledge is based on objective fact" (p. 313). This co-existence is emphasised by Lewis (1990, cited in Pajares, 1992) who states "that the two constructs are synonymous, that the
most simple, empirical, and observable thing one knows will, on reflection, reveal itself as an evaluative judgement, a belief" (p. 315).

Beliefs "have their foundations in four human activities; thinking, feeling, behaving, and interacting with others" (Bem, 1970, p. 2). The earlier that beliefs are established the more entrenched they become and the more difficult they are to alter. The beliefs that one is able to modify more readily are those that have been more recently established. "Beliefs differ from one another in the degree to which they are differentiated, in the extent to which they are broadly based, and in their underlying importance to other beliefs" (Bem, 1970, p. 12). They are very difficult to change even when reality and logic suggest that they should be changed. It has been suggested that there exists a 'self - fulfilling prophecy' with people more accepting of perceptions, knowledge and influences that support held beliefs (Païares, 1992).

There is an interplay between knowledge and beliefs, where beliefs contribute to knowledge and in turn are influenced by gained knowledge. However, an individual's beliefs appear to be more influential than knowledge in determining one's organisational and behavioural responses (Païares, 1992). "It is an implicit assumption of education that one of the most significant ways of affecting ... beliefs is through the acquisition of knowledge" (Woodrow, 1989, p. 232). People's beliefs about themselves influence their behaviour, their decision making and their actions.

**Linking attitudes, beliefs and values**

Attitudes form a substructure of beliefs (Païares, 1992). They can be viewed as likes and dislikes, affinities and aversions, positive and negative evaluations or favourable and unfavourable responses towards objects, events, people or, indeed, any aspect of our environment (Bem, 1970). Pratkanis (1989) suggests that "attitudes are excellent predictors of conceptual cognitive processes, reliably determining how individuals make sense of their social world" (p. 92). Attitudes are cognitive abstractions based on one's beliefs and are a component of one's belief system. Attitudes can be defined as "an individual's predispositions to respond favourably or unfavourably to an object, person, institution, or event, or to any other discriminable aspect of the individual's world" (Ajzen, 1989, p. 241). They are the feelings that cause people to react in certain ways to different stimuli (Rosenberg & Hovland, 1960). Further, they have been defined as "abstractions, or generalisations, about functioning in the environment, especially the social environment, that are expressed as social predispositions to evaluate an object, concept, or symbol" (Kahle, 1984, p. 5). This definition focuses on the environment and infers that the contexts in which interaction take place affect attitude formation.

The framework of belief systems postulated by Fishbein and Ajzen (1975) is based on the view that, "attitudes are not merely related to beliefs, they are actually a function of beliefs, i.e. beliefs are assumed to have causal effects on attitudes" (Ajzen, 1989, p. 247). In other words, the strength with which we hold our beliefs will have a direct influence on the strength of our attitudes (Ajzen, 1989).

There is a direct link between attitudes and behaviour (Ajzen, 1989). That is, attitudes towards an aspect of our environment will have a direct influence on our behaviour...
whilst “in some cases attitudes are actually postdispositions derived from responding rather than predispositions to respond” (Bem cited in Kahle, 1984, p. 4). Greenwald (1989) argues that attitudes are “a powerful determinant of evaluative responses to the source and content of influence... and ... a powerful determinant of behaviour in relation to novel (ordinary) objects with which the person has had direct experience” (p. 438).

It is suggested that attitudes are dependent upon beliefs through “a causal chain in which behaviour is determined by intentions to perform the behaviour, intentions follow from overall evaluations or attitudes, and these attitudes are a function of salient beliefs” (Ajzen, 1989, p. 248). The power, influence and functionality of an attitude depend on its accessibility. Fazio (1989) argues “that attitudes that are highly accessible from memory are much more likely to guide the processing of relevant information and behaviour than attitudes that are less accessible from memory. In so doing, highly accessible attitudes also have much more functional value for the individual” (p. 154).

Functional theories of attitudes “posit that people hold and express certain attitudes and beliefs because doing so meets psychological needs, which vary from one individual to another” (Abelson & Prentice, 1989, p. 361). Attitudes can serve various functions: a knowledge function in organising our world, a social interaction function related to relationships, a social identity function and a function in maintaining self-esteem (Breckler & Wiggins, 1989; Shavitt, 1989).

People's attitudes evolve. They “are not static and fixed but rather are often growing and being adjusted. As we interact with an attitude object more and more, our attitude becomes more complex” (Kahle, 1984, p. 41). Attitudes may undergo change through the accession and processing of new information and knowledge. It is thought that the processes of attitude formation and modification follow those of conceptualisation (Kahle, 1984).

Values are not a focus of the overall study, but they do comprise a critical component of one's belief system and consideration is given to them in this review. Values are, perhaps, the most abstract type of social cognition within one's belief system and “are important because of their centrality to other beliefs and attitudes” (Bem, 1970, p. 17). Because of the abstract nature of values the implication is that an individual may have very few values (Kahle, 1984). Values have been defined as "an idea or concept about the worth of something" (Swadener & Soedjjadi, 1988, p. 197). They may vary from individual to individual within a community and vary from one community to another (Swadener & Soedjjadi, 1988). Individuals within one community may have a different set of values or share the same values to varying degrees.

**Linking knowledge, beliefs, attitudes and values**

People's beliefs are generated through knowledge acquired in the environment in which they live. Several beliefs together can generate an attitude. The beliefs, when acted upon through evaluative, comparative and judgemental thoughts, establish a person's set of values. Knowledge, beliefs, attitudes and values form a person's belief system. Knowledge and beliefs are entwined, with beliefs evolving as a cognitive abstraction of personal experiences within the environment.
The “understanding [of] beliefs requires making inferences about individual's underlying states. Inferences are fraught with difficulty because individuals are often unable or unwilling, for many reasons, to accurately represent their beliefs. For this reason, beliefs cannot be directly observed or measured but must be inferred from what people say, intend, and do” (Pajares, 1992, p. 314). Beliefs can be categorised into espoused beliefs: - belief statements which people express - and enacted beliefs: - those which can be observed and inferred from what people do. The espoused beliefs of teachers can differ from their enacted beliefs (Ernest, 1989b).

The development and change of attitudes are interactive processes involving both the person and the situation (Kahle, 1984). The strength of attitudes and values within the belief system “may be interpreted by their functional connections to other beliefs and structures, and this connectedness permits one to infer their importance and predisposition to action” (Pajares, 1992, p. 318). Knowledge, beliefs, attitudes and values seem to be strongly connected to the dominant social influences in a person’s life (Bem, 1970).

This section provides a basis for appreciating the place of beliefs within the overall framework of the complex nature of belief systems. In the mathematics classroom, teacher beliefs are critical influencing factors related to the learning and teaching that takes place (Garofalo, 1989b). When student teachers enter university they already have a set of personal beliefs that identify what makes an effective teacher and how students should behave. As they proceed through their teaching “efforts to accommodate new information and adjust existing beliefs can be nearly impossible” (Pajares, 1992, p. 323).

It has been suggested “that investigating the educational beliefs of teachers should become a focus of current educational research” (Pajares, 1992, p. 322). Such investigation can provide knowledge of teacher beliefs and their relationships with teacher practices, teacher knowledge, and student outcomes. However, teachers are but one group of stakeholders in the mathematics classroom. Barnett & Sather (1992) note that “beliefs about mathematics teaching and learning in general are difficult to influence because they are so deeply ingrained and reinforced within the school culture and throughout our society (p. 2).” The investigation of teacher, student and parent mathematical beliefs would provide a more complete view of the complexity of the espoused beliefs of the stakeholders involved in the learning and teaching of mathematics. Such investigation would identify similarities and differences amongst espoused beliefs that may conflict with or support the teaching and learning strategies which impact upon student's learning of mathematics.

**PART TWO : Learning mathematics: considering people’s beliefs**

**Beliefs about mathematics**

Common beliefs about mathematics hold it to be a dull, depersonalised, formal and abstract subject which does, however, affect most human concerns (Burton, 1989; Ernest, 1989b, 1991; Stigler & Baranes, 1990). It is often seen “as socially neutral and its content is held to be independent of the material world” (Jenner, 1988, p.72). Beliefs in mathematics education are multidimensional, dependent upon how mathematics is taught
or on whether mathematics is seen to be rule-orientated or concept-orientated (Underhill, 1988). Mathematics curricula are often structured and sequenced “as if the knowledge exists, as a body, out there to be discovered and learned by students” (Tobin & Inwold, 1992, p. 19).

There are contrasting views about the nature of mathematics. One view sees mathematics as “a body of knowledge and skills which needs to be transmitted to the next generation” (Rice & Mousley, 1994, p. 7). In contrast, A National Statement of Mathematics for Australian Schools (AEC, 1991) states that “mathematics is a living and rapidly growing enterprise, done by people for people (p. 17).” A ‘formalist’ view of mathematics sees the subject in terms of formal systems and rules. Others may view mathematics ‘as infallible truth’, made up of right or wrong answers, possessing a correct set of methods and valued words to be taught (Maxwell, 1989).

If mathematical knowledge is by definition pure and unadulterated, then the task is to see that it is received as such and that it should not be tampered with. This in turn suggests that any intervention in the mathematics curriculum to accommodate cultural differences of learners (if it takes place) is unlikely to be of a very fundamental nature; on the contrary, it will necessarily be of a superficial kind. (Nickson, 1989, p. 23)

A sociological view of the learning of mathematics, where a focus is on the participants' interactions, can assist in unravelling the complexities and relationships involved in mathematics learning and teaching. “Different cultures embrace different beliefs, attitudes and values with respect to education, and with respect to mathematics. These aspects of the wider culture lead to different instructional practices, and ultimately to different consequences for learning” (Stigler & Baranes, 1990, p. 260). School mathematics, itself, is a cultural practice based upon participants' beliefs, attitudes and values interacting with the participants' knowledge and understanding of mathematics (Dawe, 1995; Ellerton & Clements, 1994). It has been suggested that teachers arrange mathematics instruction differently depending upon what they are teaching (Stodolsky, 1988) and that a context related to the learning of a mathematics concept supports student's language use and construction of meaning (Moschkovich, 1996).

More thought on the social nature of learning mathematics and the implications for learning is required in developing a mathematics curriculum to meet the needs of diverse groups of students. Aboriginal students are part of the diversity of students in many Australian primary schools. The contexts within which they learn mathematics are affected by social and cultural influences. This study, by investigating the espoused beliefs of Aboriginal educators, Aboriginal children, their parents and teachers, can help identify such influences, raising participant awareness of such influences and enhancing the school mathematics learning opportunities for Aboriginal children.

The view that mathematics and mathematics learning is context and value-free in both its nature, content and practice has been challenged (Barton, 1992; Bishop, 1994; Mtewa & Jai, 1992) with the acknowledgment that the continuing evolution of mathematics takes place in socially and culturally laden contexts (Zevenbergen, 2001). A National Statement of Mathematics for Australian Schools (AEC, 1991) emphasises the importance of students having the right to know the mathematics involved in their heritage. “This mathematical
heritage includes the mathematics of various cultures of origin of Australian children. Students should have the opportunity to apply their mathematics in settings which reflect the multicultural nature of Australia" (AEC, 1991, p. 9). This more “multicultural approach might help expand pupils’ mathematical experiences beyond a simple deterministic approach to a more realistic exploration of mathematics in life, which would also promote a more positive attitude towards diversity” (Jenner, 1988, p. 74).

**Learning and teaching school mathematics**

School mathematics is constructed in a social context governed by rules. These rules reflect the social and cultural rules of the wider society. The purpose of school mathematics is to “enable students to see the relationship between mathematics and its use so that it makes sense in their world and has relevance to the solution of their problems” (AEC, 1991, p. 10). School mathematics, though taught within social and cultural practices, may not acknowledge the mathematics of the student's cultural origins. Such mathematics may not reflect the mathematics that is seen as appropriate by the parents, children and teachers involved in the learning and teaching of mathematics. “The ‘one mathematics’ curricula common in our schools must be seriously questioned because it limits the possibility of mathematics, it does not reflect our present understanding of mathematical development, and it curtails the debate of the nature of mathematics” (Barton, 1992, p. 9).

Educators make decisions about what mathematics content should or should not be included in school mathematics. A school mathematics curriculum “is frequently a deliberately chosen model, with details suppressed as appropriate” (Griffiths & Howson, 1974, p. 3). Suppression in mathematics relates to the dominance of one cultural view of mathematics to the exclusion of others (Barton, 1992; Bishop, 1988a, 1988b; D'Ambrosio, 1984, 1986). The determination of the importance of certain mathematics knowledge, usually based on social, cultural, political and economic considerations, is one expression of this. As a particular example, the mathematics curriculum studied by the Year 5 and 6 Aboriginal children in this study contained no specific mathematics content or activities related to the cultural backgrounds of Aboriginal children (New South Wales Department of School Education, 1989).

During the 1990s, there were more focused moves towards facilitating and enhancing student’s mathematical learning rather than simply having children recall content and perform skills (AEC, 1991; National Council of Teachers of Mathematics, 2000). Students learn mathematics through constructing and reconstructing their knowledge in a social context (Malone & Taylor, 1995). There is a growing number of educators who believe that such constructivism is an appropriate epistemological basis for the learning of mathematics. Constructivism is “a set of beliefs about knowing and learning” (Lindenskov, 1992, p. 155) which, inter alia, encourages teachers to listen to children talk about and explain their mathematics. Teachers know that “when learners are challenged to work at their own learning, they reveal far more sophisticated strategies and understandings than when they are constrained to reproduce inert knowledge from which the challenge and creativity has been removed” (Burton, 1993, p. 12). That is, individuals internalise their knowledge through their actions, discourse and reflection.
Constructivism "shifts the focus from teacher delivery of 'knowns' to learner investigation of 'unknowns'" (Burton, 1993, p. 8). The implications of reforms in mathematics education are that "teachers need to be able to view the learning situation from the perspective of the student, for teaching goals to be determined through a process of interactive communication, for the mode of learning to be predominantly active, and for the curriculum itself to be the outcome of negotiation between students and teachers" (FitzSimons & Sullivan, 1993, p. 10). Teachers need to acknowledge the social and cultural contexts in which learning takes place and the importance of language discourse in developing and negotiating meaning. Such reforms in mathematics education may require a significant shift in the beliefs of many children, parents, educators and teachers.

A major theme which emerged from Lo, Wheatley and Smith's (1994) study was that "a student's participation in class discussion is influenced by his [sic] mathematics knowledge, beliefs, social competence, and how other students see him [sic] as a participant both socially and mathematically" (p. 32). It is through group interaction that students can reflect on their thoughts, reconstruct their thoughts and realise that what they have to offer may be quite different from others within the group. Teachers know, that often, children's thinking differs amongst themselves and can be quite different from that of the teacher even though all may be working on the same mathematical task (Tobin & Inwold, 1992). Teachers need to offer "learners the opportunity to interpret, to negotiate meaning, to be challenged and thereby to construct some new understanding of their own which might, or might not, be matched by the understandings of other learners in the same class" (Burton, 1992, p. 9).

Each mathematics class is unique in the knowledge and beliefs brought to it by the children and teacher (Nickson, 1994). In mathematics classes where the children and the teacher come from diverse cultural backgrounds there may well be conflicts in their espoused beliefs about mathematics and the learning of mathematics. It is through talking with and observing the actions of children that teachers can learn what they are thinking and enhance both the teacher's and the children's learning.

Mathematics in Australian schools "has tended to emphasise values and concerns which are more middle class than working class, and to draw on experiences which are more relevant to children of Anglo-Celtic descent than those of Aboriginal descent or those from non-English speaking backgrounds" (AEC, 1991, p. 9). For a mathematics class containing Aboriginal children, there are implications for the teacher in appreciating mathematical language issues, appropriate learning styles and personal backgrounds of the Aboriginal children.

**Learning mathematics: considering teacher's espoused beliefs**

Pajares (1992) has suggested "that beliefs are the best indicators of the decisions individuals make..." (p. 307). In attempting to define and clarify distinctions between a teacher's knowledge and beliefs, Clandinin and Connelly (1987) use the term 'personal practical knowledge' which they suggest emerges through the lives of teachers in their daily professional encounters. In mathematics classrooms, teachers make decisions constantly including whether or not to emphasise mathematics relevant to the students, to introduce reflective practices and to emphasise student interaction and discourse in the
learning of mathematics. If teachers are going to adjust their mathematics classrooms they will need to modify their beliefs about teaching, initially through reflecting on their teaching (FitzSimons & Sullivan, 1993). Teachers who view mathematics as rule-learning rather than thinking and reasoning and “are accustomed to implementing the traditional, procedural-behavioural curriculum have not needed much knowledge of how children learn mathematics” (Battista, 1994, p. 467). One’s ability to do mathematics is more than the knowledge of facts and formulas:

*Other factors, such as the decisions one uses in the control and regulation of one’s actions...the emotions one feels while working on a mathematical task...and the beliefs one holds relevant to performance on mathematical tasks, influence the direction and outcome of one’s performance.* (Garofalo, 1989a, p. 502)

Garofalo (1989a) categorises beliefs about mathematics, mathematics learning and mathematics teaching into “beliefs about mathematics and the nature of mathematical tasks; and beliefs about oneself and others as doers of mathematics” (p. 502). Such beliefs influence “how one studies mathematics and how and when one attends to mathematics instruction” (Garofalo, 1989a, p. 502). They “establish the context in which mathematics is done” (Schoenfeld 1985, p. 45). Garofalo (1989b) believes that students’ beliefs about mathematics and themselves as mathematicians affect their learning of mathematics. They evolve slowly, with the main source of experiences being the classroom, “what goes on in the classroom will strongly influence the mathematical beliefs of the students in that classroom” (Frank, 1988, p. 33).

Teachers’ mathematical beliefs are complex and varied. Sanders’ (1995) study involved interviews with and observations of 10 teachers to identify their beliefs about the nature and teaching of mathematics. Rating scales, interviews and observations were used to gather data. Sanders (1995) found that teachers did not fall neatly into philosophical categories; did not have a clearly defined notion of mathematics; thought school mathematics was heavily influenced by the syllabus and their teaching was influenced by their beliefs about what they thought mathematics to be.

Teachers’ beliefs play such a critical role in both what and how teachers teach that any reform will fail if teachers’ beliefs are not aligned to reform (Battista, 1994; Stipek & Byler, 1997). Change will not take place because of the release of a document or curriculum that says it should take place (Weissglass, 1992a). For any proposed change to take place in mathematics classrooms, there has to be a degree of personal transformation.

The espoused beliefs of Australian secondary mathematics and primary teachers towards mathematics, mathematics learning and mathematics teaching are reported to vary across a number of factors which influence the learning and teaching of mathematics (Tracey, Perry & Howard, 1998). This study supported the earlier work of Weissglass (1992a) who reported on the wide ranging nature of espoused beliefs held by American mathematics teachers towards mathematics learning and teaching:

- you must master the content before you can use your brain to think mathematically;
- people learn mathematics by listening to someone talk about it and from doing homework problems;
• competition is necessary to motivate learning;
• practice makes perfect;
• mathematics is too difficult to understand on one's own - students need to be told;
• making mistakes is a sign of weakness;
• mathematics is best developed linearly;
• it is OK not to be good at math;
• students are incapable of deciding what to learn;
• it is cheating to get help from another person;
• it is rude to challenge adults;
• we have the ability to accurately measure what students understand;
• feelings are not part of the academic environment;
• the system is OK (after all I succeeded). (p. 2)

These espoused teacher beliefs highlight the complex nature of the beliefs that a teacher brings to the mathematics classroom: the formal context in which children learn mathematics. White and Frid (1995) investigated secondary and tertiary students' views towards mathematics and concluded that educators' "capacities are restricted whilst they persist with neglecting school and community contexts and a view of mathematics that virtually ignores students' views" (p. 10).

Thus, Weissglass (1992a) has suggested that the investigation of teacher beliefs about mathematics itself, as well as those concerning the learning and teaching of mathematics needs to be part of professional development programs. Such time to work "through their feelings about mathematics learning and teaching will increase the likelihood of teachers developing new understandings, challenging beliefs and assumptions and changing rigid and unproductive practices" (Weissglass, 1992a, p. 9). The importance of time and appropriate professional development activity are seen as factors in modifying teachers' mathematical beliefs.

Teachers should employ teaching strategies in coming to know their students' beliefs. Such strategies need to be reflective in nature for these "allow the student and the teacher to return to their previous experience, eliminate negative feelings, emphasise positive ones and integrate new knowledge and understanding with their existing understanding" (Southwell & Khamis, 1992, p. 229). Teacher beliefs about the learning and teaching of mathematics are seen to be critical factors influencing the ways in which mathematics is taught in the classroom (Pajares, 1992). Across Australia, Aboriginal children are not achieving to their potential in their learning of mathematics (Human Rights and Equal Opportunity Commission, 2000). Identifying the espoused mathematical beliefs of teachers of Aboriginal children will provide data for teachers to reflect upon and evaluate their own teaching practices. Further, such data can provide source material in modifying teachers' mathematical beliefs and practices through professional development programs (Weissglass, 1992a).

**Learning mathematics: considering children's espoused beliefs**

The beliefs that people hold about themselves influence their behaviour, their decision making and their approach to actions that may affect themselves and others. Forgasz's (1994) study reported that "individual's perceptions of their mathematical achievement are
allied to their self-confidence as learners of mathematics" (p. 51). Research into students' mathematics beliefs has emerged from teachers' suggestions that there has been a lack of tangible improvement of students' achievement or enjoyment of the subject despite major curriculum initiatives (Southwell, 1995a). Nebres (1994) in reporting on Stevenson and Stigler's (1992) cross-cultural studies in the United States of America, Japan and China states that "the major variables that differentiate achievement lay in the areas of beliefs, values and motivation" (p. 1).

Some studies have examined children's beliefs about mathematics but most have concentrated on children's attitudes towards mathematics (McLeod, 1992; Perlmutter, Bloom, Rose & Rogers, 1997). Children's views about mathematics begin developing as soon as they are exposed to the subject, but their importance begins to be more evident during the latter years of primary school. Definite attitudes towards mathematics are established in students by age eleven (Bell, Costello & Kuchemann, 1983) and negative attitudes toward mathematics become especially noticeable about the age of eleven to thirteen. Some children are identified as not liking mathematics by Year 3 (Helfers, 1986). "Whether the increase in negative attitudes at this stage of development is due to greater abstractions of the mathematical material to be learned, to social/sex preoccupations, or to some other factor is not clear" (Cheung, 1988, pp. 209-210).

Children recognise the everyday importance of mathematics (McKnight, Travers, Crosswhite & Swafford, 1985), particularly in how it relates to future employment (Jones, 1986). Generally, children rate their liking of mathematics as lower than other subjects (Carpenter, Corbitt, Kepner, Lindquist & Reys, 1980; Heck, 1980; Joffe & Foxman, 1988). Children who feel that they are good at mathematics seem to like the subject, while others find mathematics to be hard work and dislike the subject (Helfers, 1986). Dungan and Thurlow (1989) suggest that "little evidence exists that favourable attitudes necessarily lead to higher achievement. Rather, higher achievement in mathematics may result in more positive attitudes towards the subject which, in turn, may encourage higher mathematical achievement" (p. 9).

Some children experience mathematics anxiety, accompanied by feelings of panic, confusion and helplessness, when faced with a mathematical problem (Hunt, 1985). Further, children do not like repeating mathematics topics that have been taught, they dislike the unchanging routine of some mathematics classes and they like new and challenging mathematics activities (Dungan & Thurlow, 1989). There is support for a link between children's attitudes and the influence of their parents (Jones, 1986), and those of their peer group (Bell, Costello & Kuchemann, 1983).

It is important to continue to investigate children's beliefs about mathematics for the beliefs that "students hold about mathematics as a discipline and about themselves as mathematicians have a profound effect on their mathematical achievement" (Southwell, 1995a, p. 1). Perlmutter et al (1997) interviewed 79 Kindergarten to Year 3 children about the value and usefulness of mathematics as taught in their classrooms. School mathematics was seen as an end in itself as the "children do not seem to automatically take the mathematics learned in school and use it as a tool in their everyday lives" (Perlmutter et al, 1997, p. 67). Most of the children (83%) saw mathematics as easy. They knew that they had to do well in mathematics but were unsure of the reason. The
children did not see much relevance for mathematics.

In the later primary grades many children experience a 'waning effect' towards mathematics, when mathematics becomes more complex and their confidence lessens (Eccles, Wigfield, Harold & Blumenfeld, 1993). Perlmutter et al. (1997) suggested this might occur as a result of mathematics not being contextualised and taught more as paper-and-pencil calculations. Further, they suggested that parents and teachers needed to provide positive experiences in assisting children to value the usefulness of mathematics. In investigating student perceptions of their use of mathematics outside of school it was found that "the students' perceptions of mathematics are generally their perceptions of school mathematics" (Masingila, 1995, p. 9). They have a narrow perception of mathematics as being school mathematics and look for instances of this in their everyday lives.

Southwell and Khamis (1994) investigated the beliefs of 1149 female and 990 male Australian secondary students. For the students, mathematics was seen to be facts and procedures that had to be memorised. Almost half of the students only learnt mathematics when it was shown to them and two thirds relied on memory in learning mathematics. Less than half saw an application of mathematics to real life situations. Both the males and females believed that good results in mathematics were achieved through hard work, while the girls believed luck played a part and the boys thought that being good at mathematics was important.

Through the use of the mathematical experiences and funds of knowledge that students bring to school, teachers can make connections between school mathematics and the students' world, making mathematics more meaningful and relevant (Bishop, 1988a; Masingila, 1995). However, for teachers of mathematics to link and integrate aspects of mathematics they "need to have a clear understanding of the beliefs and values which underpin the mathematical thinking of their students as well as being aware of their own" (Southwell, 1995b, p. 1).

Children view mathematics in differing ways. Some may spend their time memorising facts and formulae having based their learning on a process of recall. Those who are dependent upon the textbook for their learning will try to recall methods used in the textbook to solve problems. Children who are dependent on the textbook "view mathematics as a highly fragmented set of rules and procedures, and they therefore approach the subject accordingly" (Garofalo, 1989a, p. 503). Children who focus on the mathematics examination are continually evaluating the mathematics they are learning on the basis of whether or not it is going to be tested. Some children believe that the teacher and the textbook have all the mathematics to be dispensed and that they will only be "copiers and reproducers of other peoples' mathematics. They cannot imagine doing or producing mathematics on their own" (Garofalo, 1989a, p. 504).

Southwell and Khamis (1992) investigated "the beliefs of students and teachers concerning mathematics and themselves as learners and teachers of mathematics" (p. 220). A survey was administered to 4th Year students in a Bachelor of Education course, the children in Years 4-6 whom these students taught and children in Years 7-10. The Australian children involved in this study provide insight into their beliefs about the learning and teaching of mathematics. They provide teachers of mathematics with student
belief data for consideration when implementing classroom reforms to the learning and teaching of mathematics. The most commonly reported beliefs were:

1. Good grades in mathematics are the results of hard work and not because of any element of luck or teacher attitudes.
2. Careless mistakes contribute to poor grades.
3. Mathematics that children learn at school consists mainly of facts and procedures that have to be memorised.
4. Students have to think hard to provide answers to questions and that occasionally there would be a number of right answers.
5. Students generally believe that people are just good at mathematics and that there are correct procedures to follow in order to get the right answers.
6. Primary and secondary students felt that 'good' teachers showed their students the exact procedures to solve problems.
7. Remembering rules is considered the most important thing required to do well in mathematics. (Southwell & Khamis, 1992, p. 222)

In summarising the major outcomes from studies on children's beliefs about the learning and teaching of mathematics McLeod (1992) found children:

- believe mathematics is important, difficult and based on rules;
- believe mathematics is useful, but involves mainly memorizing and following rules;
- tend to think, in primary grades, that mathematics cannot be easy;
- continue to view mathematics as difficult and confusing as they grow older and relate it to doing something, often algorithmic;
- view mathematics as a skill-orientated subject.

The reported studies indicate that children do hold beliefs about the learning and teaching of mathematics and that they can espouse them. Children's beliefs about mathematics are wide ranging and impact upon how they view mathematics learning. Teachers need to appreciate children's mathematical beliefs as they make decisions about appropriate teaching strategies (Southwell, 1995a; Weissglass, 1992a). Within Australia, there has been no reported study on the espoused mathematical beliefs of primary Aboriginal children living in rural communities. This study rectifies this situation.

**Learning mathematics: considering the parents**

Parents hold beliefs towards mathematics which impact upon their children's learning and teaching of mathematics. Teachers need to consider parents' beliefs towards the nature and learning of mathematics (Dillon, 1995) because as teachers introduce new pedagogical strategies they may be adding to a mismatch between the expectations of the school and the home. A degree of mismatch in beliefs amongst the students and the teacher may well occur in any classroom, but more often when there is a diversity of cultural backgrounds (Cataldi & Partington, 1998). Such mismatch may become a challenge for the children. This may lead to confusion and anxiety in the classroom (Ngarrigar-n-Kessaris, 1994). Indeed, "lower socio-economic status and minority students may be more influenced by teacher expectations than students from more powerful social positions" (Hart & Allexsahlt-Snider, 1994, p. 20).
Dawe (1991) suggests that “teachers who deliberately set out to encourage children to think for themselves, who adopt a problem solving approach with an emphasis on language, could well be in conflict with the expectations of parents” (p. 50). Based on their own experiences, parents may expect their children to learn by rote, through practice and imitation. The current reforms in mathematics education emphasise students' thinking for themselves, constructing mathematical knowledge, using mathematical language, working in groups and problem solving. This may be in conflict with what parents think. Efforts have to be made to identify the beliefs and expectations of parents about school mathematics. It is important that “the family comes to understand the value of different approaches to learning and the implications of this in what the children do in the mathematics lessons” (Dawe, 1991, p. 50).

If there is a mismatch amongst parents, children and teachers in the set of beliefs about the learning of mathematics and the interactions within the mathematics classroom, mathematics anxiety for all three parties may occur. The teacher may feel anxious about teaching mathematics, the children may feel anxious about doing mathematics and parents may feel anxious for the children learning mathematics.

In appreciating the mismatch that may occur between school and home, with regard to Aboriginal children's learning of mathematics, this study seeks to identify the beliefs of parents of Aboriginal children. The issues of student confusion and anxiety as well as a potential mismatch between home and school expectations about mathematics learning, particularly for children and parents from varying cultural backgrounds, make it essential to seek the espoused mathematical beliefs of parents of Aboriginal children. The reporting of such beliefs will assist teachers, children and parents in collaborating for more appropriate mathematics curriculum and teaching strategies to enhance the mathematical learning outcomes of Aboriginal children.

The affective domain plays a crucial role in the learning of mathematics (McLeod, 1992; Robitaille & Gordon, 1989). Curriculum documents suggest a focus on the affective domain in learning mathematics emphasising the need to change perceptions of mathematics (AEC, 1991; National Council of Teachers of Mathematics, 2000; New South Wales Department of Education, 1989). This section has reported literature that has considered the wide range of espoused beliefs of teachers, children and parents about the learning of mathematics. This literature refers to a time of ongoing pedagogical and curriculum change in mathematics education. These findings begin to identify the complex nature of people’s beliefs about mathematics.

*If researchers are to make progress in building theory and gathering relevant data about the role of the affective domain in the learning and teaching of mathematics, they need to provide data on a wide range of issues. Some of these issues (for example, beliefs and attitudes) can be analysed through the use of traditional quantitative techniques, but qualitative data will add substantially to the completeness of our understanding of these issues.* (McLeod, 1992, p. 588)

Such analysis is of particular importance for Aboriginal children and their learning of mathematics because, currently, they are not achieving to their learning potential and this is of concern to both the Aboriginal and general Australian community (Kemp, 2001).
Mathematics education research conducted in cross-cultural settings has emphasised the influence of the broader social context, including the significant role of the family, on children’s beliefs about mathematics (Parsons, Adler & Kaczala, 1982; Stevenson, 1987; Stevenson, Lee, & Stigler, 1986; Stigler & Mao, 1985; Stigler & Perry, 1988). Qualitative data, where the voices of Aboriginal children, their parents, teachers and Aboriginal educators are heard can play a critical role in Aboriginal children’s learning of mathematics.

**PART THREE: Socio-cultural issues in the mathematics classroom**

This section reports on mathematics education research that shows the importance of the social context of instruction, and cultural factors, on the learning of mathematics (Bishop, 1988b; Lave, 1988; Lester, Garofalo & Kroll, 1989). Each individual has a system of beliefs, attitudes and values. In particular, each individual holds views towards the nature, learning and teaching of mathematics which are brought together in the social and cultural contexts of the learning of mathematics. Such contexts influence students’ affective responses and metacognitive acts (Lester et al, 1989). “Teacher attitudes and beliefs about the objective and culture-free nature of mathematics and the genetic origins of differences in ability, the cultural context of mathematical development” (Crawford, 1989, p. 23) has been and continues to be largely ignored in schools. Recognition of these is now being given consideration by mathematics educators (Clarkson, Bishop FitzSimons & Seah, 2000; Howard, Perry & Fong, 2000).

The view of mathematics as being algorithmic, formula based and remote from people suggests that it is a cold and isolated subject. For some children, school mathematics is seen as separate to their lives, tending to isolate mathematics in the minds of many. Indeed, it seems divorced from the social, political and cultural context in which it is being explored (Ernest, 1989c). For mathematics to be more relevant and meaningful for children, more teacher emphasis has to be placed on the children’s experiences of mathematics in their everyday lives.

*Although many mathematics educators will assert that mathematics is a universal language and that there is no evidence that children from different cultures learn mathematics differently, there is increasing evidence that cultural factors play a role in how meaningful mathematics is to children from diverse cultural backgrounds.*

(Brenner, 1995, p. 6)

Most Australian mathematics classrooms comprise a teacher and a group of students of varied cultural and language backgrounds (MacGregor & Moore, 1991). The student diversity of school populations requires a multicultural focus in all subjects, including mathematics (Ahlquist, 1998). Increasingly, children in Australian schools come from diverse backgrounds yet “the teaching of mathematics still rarely accounts for … the wide variety of social and cultural talents and needs” (Rice & Mousley, 1994, p. 6). This variety of cultural backgrounds “has an enormous impact upon the expectation of how mathematics should be taught and learned” (Dawe, 1991, p. 58). In the context of the mathematics classroom, the similarities and differences in beliefs, together with the cultural backgrounds of the students and teacher are managed, primarily, by one person—the teacher.
Children learn to identify the social and academic norms of the classroom, initially set and often maintained by the teacher (Cobb, Yackel & Wood, 1993). As well, the teacher adapts to the children and learns what they will deliver in the way of achievement and work performance. Once in the classroom, the children and teacher form a social and cultural context unique to that classroom but influenced by external social and cultural factors. Within the classroom "the attempt to convey ideas and concepts to the learner must take place using the metaphors and imagery available to the learner, and these are clearly the consequence of the society and culture within which the learner lives" (Woodrow 1989, p. 229).

Directions in mathematics education (AEC, 1991; HMSO, 1982; NCTM, 1989; 2000) have emphasised reforms to curriculum content, the environment of the mathematics classroom, as well as learning and teaching strategies. Within the mathematics classroom, the interplay between teacher and students is based usually on the teacher's beliefs towards mathematics and mathematical learning. Pedagogical change, within mathematics classrooms, is occurring in the learning and teaching of mathematics. However, changes in the mathematics beliefs of teachers occur slowly (Pajares, 1992; Weissglass, 1992a: Burkhardt, Fraser & Ridgway, 1990).

Teachers have to be more aware of, and sensitive to, alternative views of how students learn mathematics, for the "ultimate goal is to provide children with high level thinking skills, the ability to select appropriate processes and apply them to the problem at hand" (Dawne, 1991, p. 50). Though such issues as children's affective characteristics, cultural background and the social context of learning are being given stronger consideration (McLeod, 1992), the focus remains on the cognitive domain of the mathematics classroom. There has been a continuing call from Aboriginal people for a culturally appropriate curriculum and teaching strategies acknowledging the learning styles of Aboriginal children (Human Rights and Equal Opportunity Commission, 2000; National Aboriginal Education Committee, 1985).

**Cultural diversity: implications for mathematics learning**

Since the late 1970s, there has been a growing awareness amongst mathematics educators of the social and cultural aspects of mathematics learning (Gerdes, 1996). Mathematics and mathematics classrooms are not culturally-neutral nor value-free (Bishop, 1988b). Mathematics teachers need to recognise the significant contributions of many cultures to the development of mathematics (Dawne, 1991). It is essential for teachers to ensure that, in the learning of mathematics, children do not experience unconscious prejudice in the content emphasised or in the ways that the content is presented.

Often teachers have a limited view of the rich cultural heritage of mathematics that can be relevant to the students in their classes. Woodrow believes that "such chauvinistic attitudes are at the very centre of the issue of multicultural and anti-racist mathematics, and concern the views and attitudes of teachers rather than pupils" (1989, p. 231). In mathematics classrooms, students should feel free to talk about the mathematics that they experience in their lives. This infers that they should feel comfortable to bring into the classroom the mathematics of their culture and know that this mathematics will be acknowledged, respected and valued by those within the class (Woodrow, 1989).
In mathematics, as in other areas, traditional views and knowledge are passed from one generation to another while at the same time new knowledge is acquired. This is referred to as the difference “between enculturation, ‘the process of generational continuity’ and acculturation, ‘the process of individual and group change’, caused by contact with various cultural systems. It is the dynamic aspects of acculturation which are relevant in multicultural classrooms” (Presmeg, 1988, p. 166).

The cultural diversity within Australian schools requires a review of the teaching and learning strategies used (MacGregor & Moore, 1991). Many mathematics curriculum developers respond to cultural diversity by looking for culturally-based activities and content that can be included in the mathematics curriculum. Yet, many of these topics belong in mathematics curricula anyway. More than just addressing the mathematics content, mathematics educators and curriculum developers should value the mathematics of other cultures by including appropriate culturally based mathematical content in curricula through teaching and learning activities. However, such an approach appears to be too simplistic (Nickson, 1989). The activities may have little relevance or meaning for the student. Indeed, they may well add to the confusion of students if they see the activities as unrealistic and not part of their world (Jenner, 1988). The introduction of culturally-based mathematics activities may also be viewed as tokenistic or perhaps disadvantageous to the cultural group for it is not the mathematics of the dominant group and, thus, not viewed as worthwhile.

Since the mid 1980s the notion of mathematics being culture-free and value-free has been questioned. Efforts to make mathematics available to all have been made and the social dimension of the mathematics classroom has become a focus of research (Bishop, 1994; Dawe, 1995). Bishop (1994) has stated “that all formal mathematics education is a process of cultural interaction, and that every child experiences some degree of cultural conflict in that process” (p. 16). “Every child” includes Indigenous “minorities in Westernised societies” (Keitel, Damerow, Bishop & Gerdes, 1989). Langdon (1994) reinforces this view stating that,

[T]he student’s culture ... is concerned with the people, their history and their values, as well as aesthetics and particular issues which the society faces. In general, the mathematical knowledge to which we give attention in schools does not concern itself with these wider considerations. Because it does not consider wider cultural matters, the mathematics curriculum is sometimes in conflict with them. (p. 6)

Moore (1994), opines that “The differences in culture are so vital that it behoves every mathematics teacher to make the necessary effort to understand any cultural diversity that may exist between the teacher and students” (p. 13). The notions of enculturation and cultural consonance have been accepted perhaps too easily and it may well be time to investigate cultural dissonance in mathematics education and the associated teaching, learning and curriculum implications (Bishop, 1994).

The learning and teaching of mathematics is dependent upon the cultural and social contexts in which they take place. Thus, educators need to appreciate the cultural and social backgrounds of their students. In learning more about the mathematics of other cultures, students are given the opportunity to learn more about the nature of
mathematics, themselves as mathematicians and their own cultural identity. "If mathematics is to empower learners to become active and confident problem-solvers, they need to experience a human mathematics which they can make their own" (Ernest, 1989b, p. 228). As educators become more aware of the cultural diversity in the community "a key problem ... is how to accommodate these differences within the curriculum so that the learning of mathematics can be enhanced for all" (Nickson, 1989, p. 236).

There is a need to acknowledge the diversity of children and the related impact on the mathematics learning of all students (D'Ambrosio, 1986). Children in Australian schools bring with them a diversity of mathematical skills, concepts, languages (both verbal and symbolic), personal experiences, understandings and approaches that need to be recognised and accepted by teachers. The development of a mathematics curriculum recognising such cultural diversity should start from the skills of the children, include the use of a variety of materials and emphasise classroom discussion (Dawe, 1991).

There is the view that mathematics curricula are structured in the interests of the dominant group within the community (Gerdes, 1988) and that curricula can be "used as a barrier to social access reinforcing the power structure which prevails in the societies" (D'Ambrosio, 1983, p. 363). As educators become more aware of the cultural diversity in our community a major task is to accommodate cultural differences within the one mathematics curriculum (Nickson, 1989). The development of such a culturally relevant mathematics curriculum continues to be a challenge. A sharing of views about the learning of mathematics in schools between mathematics educators and the many cultural groups within Australian society could benefit all Australian students.

Enhancing mathematics learning for minority groups

A number of reports have identified factors that impact upon the under achievement in mathematics by minority groups in culturally diverse populations (Graham, 1987; Smith, 1996; Valverde, 1984). The complex relationships between these factors have to be considered in order to "give rise to reform actions that recognise contemporary reality" (Planti & Walsh, 1996, p. 53). The emergence of the 'information society' emphasises the importance of one's ability at functional mathematics for employment and opportunities in later life (Mayo, 1994; Mesa, 1999). The children of minority groups will enter a national economy which is highly informed and demands better educated workers (Mesa, 1999). The under achievement of minority groups in mathematics creates employment and equity issues (Secada, 1992a) since children who do well at mathematics will have opportunities that others will not (Belkhir, Yarnevich, Shirley & Charlemaine, 1995).

"Mathematics is so much a part of the way we communicate that if a student fails to understand western mathematics they may fail to understand much of western society" (Kepert, 1991, p. 41).

The concepts of Deficit and Cultural Difference dominate the research on the problem of under achievement in minority students (Allexsaht-Snider, 1992). The Deficit model assumes that the child comes to school with a deficit. Such a model presents an "inaccurate and invidious view of non-dominant groups and their cultures" (Planti & Walsh, 1996, p. 42). The Deficit model has been refuted by Allexsaht-Snider (1992) who...
has proposed that the underachievement of minority students may well be as a result of:

1. motivational and socio-cultural factors emerging from students' family or community context;
2. motivational and socio-cultural factors emerging from the interaction of the home culture and school contexts;
3. individual emotional and cognitive factors;
4. language-related factors and mathematics as a language. (p. 5)

The Cultural Difference model views children from minority groups as different, with "a shift of belief about the source of the problem, from the student and their homes to the school" (Mesa, 1999, p. 4). This model requires schools to be more culturally responsive to children. A problem with this model is that a simplistic view of culture is considered. It does not recognise that transfer of competence from home to school is not easy. Further, the school is seen as the source of the problem, without consideration of other sources (Mesa, 1999).

Allexsaht-Snider (1992) reported that the causes of children's learning problems could be categorised as teaching inadequacies, emotional difficulties (the stress of home and failure), and conflicts between the learning styles of the children and the teaching style of the teacher. Such findings negate the idea of a cognitive deficit amongst minority students and direct us to investigate further motivational, social and cultural factors affecting the learning and teaching of mathematics.

"Our teaching and assessment of minority students in mathematics fails to recognize the mathematical knowledge a student may have gained through outside work and community experience" (Allexsaht-Snider, 1992, p. 12). A lack of role models for minority students within schools, low teacher expectations and the tracking of students into lower level classes are all factors which can be considered when studying the mathematics attainment of minority students. "Teacher attitudes play a large part in the academic success of at-risk children. Teachers who have low expectations for at-risk children, or who believe that at-risk parents don't care about their children and don't want to be involved in their education may contribute to children's failure" (Liontis, 1991, p. 1).

Other reported factors that affect achievement levels include discipline, attendance and the organisation of the coursework sequence. As teachers are a crucial influence on children's learning, there is a need "to obtain a more elaborate picture of teachers' knowledge, beliefs, judgements, and decisions as they apply to their diverse student populations and as related to their notions of equity" (Secada, 1992b, p. 22).

A holistic research paradigm for investigating differences in mathematics achievement has been suggested. Reyes and Stanic (1988) identified aspects of societal influences, teacher attitudes, school mathematics curricula, classroom practices and student attitudes as belonging to such a paradigm. In extending this model, Pianta and Walsh (1996) proposed a Contextual Systems Model [CSM]. The CSM involves two systems, the Child/Family and the School/Schooling. They are related and account across time for "relationships between child and family, and schooling and the other individuals and institutions involved in schooling" (Pianta & Walsh, 1996, p. 54). The CSM proposes better communication amongst the players in developing knowledge of the children and the development of overall systems which ‘wrap and sustain’ children “understanding the
sources of the conditions, instead of ignoring them or pretending to change them" (Mesa, 1999, p. 9).

Civil (1995) raised the issue of teachers recognising the ‘funds of knowledge’ which children possess and utilising these in classroom activities. Many children have experienced rich mathematical opportunities but may not see what they have done as relevant to school mathematics. Hart and Allexsaht-Snider’s (1997) work (cited in Mesa, 1999) proposes issues of “success, belongingness, resistance, curriculum, and instruction as socio-cultural phenomena that have different definitions according to the particular school setting and socio-economical contexts outside of school” (p. 13). As discussed later in this section, these factors are of significant import for Australian Aboriginal students.

It has also been recognised that power relationships exist between parents and teachers when mathematics reform is introduced with parents seen to be lacking content knowledge (Peressini, 1996). This relationship is borne out in the expressed beliefs of the parents of Aboriginal children (Chapter 6) when they talk about their confusion and frustration in trying to help their children with mathematics. They talk about the differences in the ways they do mathematics compared to those of their children. The frustration can lead to conflict between the parents and their children.

There is an increase in the disparity in mathematics achievement amongst diverse groups which has been identified through the reliable testing of students (Secada, 1992a). "Research about the nature of these disparities is needed to help schools better educate a portion of the population that is growing and for whom schools have not been successful" (Secada, 1992a, p. 623).

Secada (1992a) stated that the investigation of race, ethnicity, social class and achievement in mathematics has “a marginal status relative to mainstream mathematics education” (p. 654). He believes that this is “unconscionable and untenable” (Secada 1992a, p. 654). Mathematics curriculum needs reform and mathematics teaching needs reconsideration because there are children who have low achievement in mathematics, disengage from the subject and drop out of school. These children should not be labelled as disadvantaged and disabled. The reality is that such children are often poor and from ethnic minorities where the economic support for children’s learning of mathematics may not be available and where mismatches between school and home expectations may exist.

What should be puzzling is not the low achievement, but the social forces that coerced other students ... to learn in spite of such a sorry state of affairs. If reform is to matter, it must begin with the populations for whom we have drawn these special categories. Curriculum and instruction should first be effective with these students and then applied to other populations. Finally, the notions of disadvantage and compensatory education that are linked to these populations should be replaced with notions that acknowledge their competence. (Secada, 1992a, p. 654)

Schooling, and thus, learning and teaching, “that reflects liberal, middle-class values and aspirations is to ensure the maintenance of the status quo, to ensure that power, the culture of power, remains in the hands of those who already have it” (Delpit, 1988, p. 285). Teachers cannot devise appropriate educational programs for marginalised children.
on their own. They have to be "devised in consultation with adults who share their culture" (Delpit, 1988, p. 296). For, as Millroy (1992) suggests, "[h]ow can anyone who is schooled in conventional Western mathematics 'see' any form of mathematics other than that which resembles the conventional mathematics with which she is familiar?" (p. 1). If collaboration and change are to occur then the voices of parents, teachers and students have to be engaged (Sarason, 1994). "Change will occur when teachers', parents', and students' attitudes and practice about race relations education addresses institutional as well as individual inequalities" (Ahlquist, 1998, p. 17).

Curriculum documents have recognised the need to increase the achievement levels of minority students. Families can make an important contribution to children's mathematical learning “when parents or family members understand the purposes of the school mathematics curriculum and show an interest in what their children are learning, progress in mathematics at school is enhanced” (AEC, 1991, p. 29). Though not typical of all underachievers, “some family characteristics tend to inhibit academic achievement: households in which the parent or parents do not often interact with their children, ones whose composition frequently changes, non-English speaking households, and families whose cultural traditions sharply vary from the school’s” (Peterson, 1989, p. 1). Similar characteristics apply to some of the Aboriginal children in this study.

Positive support from parents towards schooling is important for the progress and achievement of their children. However, most parents from low socio-economic backgrounds have little involvement with schools (Lionitis, 1992, p. 16). These parents “may have feelings of inadequacies, failure, and poor self-worth, as well as negative experience with schools” (Lionitis, 1992, p. 1). Long histories of unpleasant school memories as children and feelings of not being specifically welcomed in the schools influence parental involvement. Parents need to feel welcome in schools and believe that their opinion is truly respected. Several factors influencing parental involvement in schools include:

- Feelings of inadequacy, failure, and poor self worth.
- Negative attitudes or bad experiences with schools.
- Suspicion or anger that schools are not treating them equally.
- Cultural and language barriers.
- Economic, emotional, or time constraints.
- Logistical problems: child care, transportation, scheduling.
  (Lionitis 1992, pp. 24-26)

Lionitis (1992) believes that parents need to become people "more able to influence those individuals and organizations that effect their lives and the lives of those they care about" (p. 32). For this to happen there needs to be careful planning, co-operation and collaboration between teachers, parents and community agencies.

**Learning mathematics: issues of Indigenous peoples**

It is useful to provide some background context to the mathematical issues confronting Indigenous peoples outside Australia before focusing specifically on issues within Australia since there are similarities for both Australian and international Indigenous
peoples regarding the issues that their children face in the learning and teaching of mathematics. Indigenous people may hold differing views of mathematics from other groups within the community. In some communities there may well be several views of mathematics held by differing groups, since each culture develops that mathematics which they need. Following his work in Cameroon, Langdon (1992) believes that "for many Indigenous peoples or ethnic minorities in developed countries, the mathematics which is presented through institutionalised education is part of an alien culture" (p. 40). As a result, there are social and political implications for cultures that do not own the mathematics as prescribed in a given curriculum.

Cultural world views evolve with time and differ amongst cultures. This, too, can be the case with mathematics where each culture may develop its own view and concepts of mathematics. For example, the Maori people, of New Zealand:

... bad this belief [and still do] that they are a total part of the whole cosmos... The Maori believes in a holistic approach to all processes pertaining to life and learning, and so it is quite difficult to sectionalise, compartmentalise or define Maori mathematics as it is understood in western and educational language terms. Whatever is being analysed and discussed, is looked at from all aspects i.e. physical, emotional, social and spiritual.
(Rinni & Rinni, 1992, p. 19)

Gerdes (1988) suggests that the mathematics of many Indigenous peoples is hidden or frozen from view. It has not been identified, acknowledged or respected by non-Indigenous peoples. The mathematics is there and can be identified. However, such mathematics, once identified, will only be used in mathematics curricula “if the teachers themselves are conscious of hidden mathematics, are convinced of the cultural, educational and scientific value of rediscovering and exploring hidden mathematics, and are aware of the potential of ‘unfrosting’ this ‘frozen mathematics’” (Gerdes, 1988, p. 141). Thus, it is important to build effective bridges in schools from the “indigenous mathematics to the new mathematics” (D’Ambrosio, 1984, p. 6). The writings of these mathematics educators (D’Ambrosio, 1984; Gerdes, 1988; Langdon, 1992; Rinni & Rinni, 1992) suggest that the development of such bridges will require an appreciation of:

- the social, cultural and historical diversity of Indigenous communities,
- Indigenous people’s views of learning,
- the importance of recognising Indigenous people’s views of mathematics,
- how Indigenous people relate to mathematics, and
- how Indigenous people use mathematics.

Barton (1992) has discussed the differences between mathematical conceptions and mathematical practices of Indigenous people. The practices can be easily subsumed by a dominant view of mathematics, the conceptions behind those practices may be easily lost or not even considered. If one dominant culture does not understand and appreciate the mathematical conceptions of another culture then the dominant view of one mathematics will evolve. “The result is an intellectual ‘black hole’ into which all other practices fall and are accommodated and from which it is impossible to see the existence of independent conceptions. This exactly is what has happened in mathematics” (Barton, 1992, p. 5). Conflicts between different views of mathematics may be identified by one group and not
accepted or even seen by the other (Barton, 1992). Such conflicts can give rise to one view of mathematics and one approach to teaching mathematics being seen as superior to the other.

This has occurred, often, in colonised countries where little value is given to Indigenous peoples' views of mathematics, leading to students being disadvantaged in the development of their own ideas and patterns of mathematical thinking (Mteywa & Jaji, 1992). If one dominant culture does not appreciate the mathematical conceptions of another culture, there can be a loss of the richness of that mathematics. In providing an example of the world view of a group of Melanesian science students, Waldrip (1994) argues that “unless students can relate the school view of the natural world to their own well-established world views then teaching strategies are likely to be less than effective in enhancing the permeability of students' world views to their school views” (p. 3).

All cultural groups have developed their view of mathematics and its relationship to the events that happen within their lives (Lave 1988; D'Ambrosio 1985; Bishop 1988; Mteywa & Jaji 1992). Tate (1995), discussing the situation of African American students, believes that not providing a mathematics curriculum “centred on their experiences, culture and traditions is a major obstacle to achieving equity in mathematics education” (p. 168). The view that students bring “with them different competencies in, and conceptions and beliefs about mathematics” (Mteywa & Jaji, 1992, p. 7), questions the notion of a universal mathematics. Thus, it is suggested that:

... all cultural groups including Aboriginal and traditional societies have developed their own notions and patterns of mathematics and mathematizing. This world view is more consistent with a constructivist theory of cognition rather than ... the world where mathematics was seen as the medium par-excellence for describing the essence (Pure Form) of objects. (Mteywa & Jaji, 1992, p. 7)

The socio-economic situation of Native American students is similar to Australian Aborigines in that they experience the poorest quality of life of minority groups, highest school dropout rate and lowest school attendance (Charleston, 1994). American Indian students are under-represented in careers involving mathematics knowledge (Nelson-Barber & Estrin, 1995). Mathematics reforms emphasising a constructivist approach to learning and teaching are compatible with American Indian ways of teaching which involve modelling and observation. Nelson-Barber and Estrin (1995) believe that academic success will grow as the perspectives of American Indian students are acknowledged.

In comparing the urban/rural school experiences of students in an American Indian teacher education program, several culturally-based school issues arose. The American Indian student teachers talked about the lack of American Indian parental involvement in schools and attributed this to the parents and grandparents' experiences with 'the White man's schools'. "A minority culture's historical experiences with schooling clearly can impact present day relationships" (Smolkin & Suina, 1999, p. 580). However, positive outcomes were reported. There was a physical proximity of the Indian children to the Indian teachers in the rural schools. The teachers gave the children hugs, as though everyone knew each other. The non-Indian student teachers talked about the observed reticence of the Indian student teachers to get involved quickly within the classroom. The
non-Indian student teachers came to realise that there were cultural differences in how they approached their teaching. The American Indian student teachers needed time to adapt to the new situation, whereas the non-Indian student teachers prized “the ability to assess and act quickly” (Smolkin & Suina, 1999, p. 582).

The non-Indian student teachers recognised that such cultural differences could be reflected in the actions of the children that they taught. The Indian students “needed less to learn about the ‘what’ of the dominant culture than about the ‘how to’ or processes for negotiating successfully within that world” (Smolkin & Suina, 1999, p. 583). Anderson (1976) suggested that the American Indian students possessed a declarative knowledge, knowledge that could be discussed, as contrasted to the often implicit procedural knowledge of how to do things. Their lived experiences, shared family stories and the media had taught them much about the dominant culture.

Teaching American Indian students in the same way as mainstream students is rarely successful (Davison, 1992). American Indian students possess different languages, cultural backgrounds and learning styles to mainstream students. Davison and Schindler (1988) recommended that culturally relevant material, recognition of preferred learning styles and the deliberate teaching of English language focussed on the learning of mathematics would enhance the mathematics learning opportunities of native American Indians.

Indigenous students need to relate mathematics to their culture just as mainstream students do. However, a “local focus can become limited to the mathematics the students want to study, which they see related to either their traditional or emerging roles. While it is important not to ignore this local perspective, such an approach can overlook the organisation of mathematical ideas and preclude the development of a structured curriculum” (Davison, 1992, p. 23). Students need to have their cultural backgrounds acknowledged but they also need to succeed in the school environment. McCarty, Wallace and Benally (1991) reported native American students were eagerly involved in lessons where talk was shared, student ideas valued, curriculum activities involved the students’ experiences and where they were encouraged to use their cultural and language resources to solve problems. Appreciating the mathematics education issues encountered by Indigenous students from differing contexts provides a knowledge base in considering factors which may influence Australian Aboriginal students learning mathematics.

**Australian Aboriginal students: weaving schooling, learning and mathematics**

*Any attempt to understand minority students’ attitudes towards learning and schooling and participation in mathematics must be broadly conceived and situated in an understanding of the sociocultural context of the overall schooling experience.* (Hart & Alexsahl-Snider, 1994, p. 7)

**Schooling**

Australian Aboriginal and Torres Strait Islander peoples have been identified as a group who do not participate equally with non-Indigenous Australians at all levels of education. Further, it has been found that “low rates of educational participation and attainment contribute to the perpetuation of socio-economic inequalities” (Australian Bureau of Statistics, 1992, p. 134). Aboriginal children have not had achievement or retention rates
at the same level as non-Aboriginal children (Christie & Harris, 1985; Guider 1991; Kemp, 1999; McInerney, 1992b). This situation still occurs (Human Rights and Equal Opportunity Commission, 2000).

Many Aboriginal children continue to be affected by poverty (Kemp, 1999) and suffer health problems which impact upon their school learning (Sherwood & McConville, 1994). Australian Aborigines have higher levels of infant mortality, more infectious diseases and a life expectancy that is likely to be 15 to 20 years lower than non-Aboriginal Australians (Australian Bureau of Statistics, 1997). Thus, educational equity for Australian Aboriginal children, where they can achieve similar learning outcomes to non-Aboriginal children, has been identified as an educational priority for Australia (Elson-Green, 1999).

A significant problem of Aboriginal education in Australia has been the failure to recognise the Aboriginal identity of children – their Aboriginality. "Being Aboriginal has nothing to do with the colour of your skin or the shape of your nose. It is a spiritual feeling, an identity you know in your heart. It is a unique feeling that may be difficult for non-Aboriginal people to understand" (Burney, 1994). Identity is the basis upon which Aboriginal children grow, develop and relate to those about them, including their teachers. Too often, the results have been that the strengths Aboriginal children bring to education, such as their autonomy, their caring, their sharing, their co-operative learning style have accounted for little and resulted in Aboriginal children’s behaviour often being perceived as troublesome.

Cultural identity is a major issue for Aboriginal people. No matter where Aboriginal children live, many will identify with aspects of Aboriginal culture (Gibson, 1993; Guider 1991). How one person recognises their Aboriginality is personal, it will vary from one person to another and evolves as individuals grow in the knowledge of their cultural backgrounds and as they respond to varying places and circumstances (Groome, 1995). One of those places is school.

The links between school education and the perpetuation of social injustice have been acknowledged (Hicks, 1999). Australian Aboriginal children are educationally disadvantaged and not achieving to their learning potential. This situation has to be challenged. At a time of Reconciliation between Aboriginal and non-Aboriginal Australia, the challenge of educational equality is to listen and to act. For,

\[ \text{When] a system of interactions and transactions produces and distributes more benefits and scarce resources to some of its members than others, and correspondingly more losses and disadvantages to some than others, then that system is oppressive; its beneficiaries are oppressors, its losers are oppressed. (Richardson, 1990, p. 133) \]

Many Aboriginal people, in the community involved in this study, held the view that the school curriculum is inappropriate for Aboriginal children in that it does not recognise the importance of Aboriginal learning styles and the socio-historical backgrounds of Aboriginal children.

The content element of curriculum development is given much attention by sensitive
non-Aboriginal teachers as well as Aboriginal educators. There is a constant need to evaluate the quality, accuracy and appropriateness of the content of material used to teach about Aboriginal society and to teach Aboriginal children. A critical analysis must be maintained at all costs. It needs to be recognised that curriculum is shaped by the dominant society, which in Australia is now Anglo-Saxon. (National Aboriginal Education Committee, 1985, p. 8)

Across all curriculum areas Aboriginal peoples have called for greater appropriateness and relevance. These aims are held within a context of the realisation of Aboriginal self-determination and revision of the views of the history of Aboriginal and non-Aboriginal contact. Schools must develop "an educational theory and pedagogy that takes into account Aboriginal epistemology" (National Aboriginal Education Committee, 1985, p. 4). Aboriginal children’s beliefs and practices may be in conflict with those of the school (McConnachie, 1982). However, it is essential “that schools are places where Aboriginal students feel a sense of belonging” (NSW Department of School Education, 1996, p. 6).

For Aboriginal children to survive in 'white' society “they need to feel positive about being black and understand that it is all right to be black” (Smith 1993, p. 29). In schools there exists a “profound and uncomfortable dichotomy in the notion of identity which is the bicultural experience of Aboriginal Australians” (Watson, 1987, p. 2). Ogbu (1993), in discussing the issue of school resistance amongst African American, Mexican-American and Native American students, suggests that they do not see value in school. As a result, students “develop an oppositional culture that frames their interactions with teachers and other representatives of the school” (Hart & Allexsahnt-Snider, 1997, p. 5). The issues of the degrees of cultural difference, conflict and discontinuity may well be significant in appreciating the varied school performance levels of Indigenous children (D’Amato, 1993).

Davison (1992) suggested that Indigenous children who found little value in school may not find much relevance in the school mathematics presented to them. Children are often presented with a fragmented mathematics curriculum that does not make evident connections between aspects of mathematics, the relevance of learning mathematics or reasons for learning mathematics (Hart & Allexsahnt-Snider, 1997). Such issues of connectedness, relevance and purpose influence how children may choose to be involved in mathematics classes (Koehler & Prior, 1993).

One description of an Aboriginal ‘world view’ considers co-operation and co-existence amongst people whilst a non-Aboriginal ‘view’ sees the individual as the focus and competition as a crucial element (Christie, 1985). While, at the same time, evidence suggests, “[T]he view that a competitive style of learning is destructive for a lot of students who change their view of mathematics, and of their potential to learn the subject, when placed in a climate which encourages them to work together, listen and learn from each other, explore and respect different perspectives” (Burton, 1989, p. 18). On the other hand, a mathematics classroom that fosters affection and respect and personal decision making can generate a context for meaningful learning (Wood, 1994). Many Aboriginal children thrive in a school climate of collaboration and connectedness.

Aboriginal children come from generations of resistance to the inhumanity of official policies - a cultural resistance - including a resistance to Western education (Parbury,
1986). To move towards the achievement of Aboriginal children's learning potential it is important that Aboriginal culture and language are accepted in the classroom and children have a sense of belonging (French, et al, 1994). Aboriginal children need to feel that schools belong to them as much as to any other child. McInerney (1992a) has suggested that to improve retention rates for Aboriginal students greater development of school confidence, self reliance and the valuing of schooling is required. At the Australian Indigenous Education Forum [1999] the three pillars of school success for Aboriginal children were seen to be "cultural appropriateness, development of requisite skills and adequate levels of participation" (Elson-Green, 1999, p.12). In discussing factors related to school success, the child's characteristics, the learning situation and the community beyond the school need to be considered (Muir, 1984).

Learning
Groome (1995) provides an overview of purposeful teaching strategies to be implemented for Aboriginal children to achieve their learning potential, insisting that "[i]f teaching of Aboriginal students is to be successful then purposeful issues of power in the classroom must be recognised and addressed" (p. 95). Indeed, without reform to the school environments where Aboriginal children learn "and to the structures that split curriculum control from pedagogical responsibility, ...methodology will tend to reproduce social inequalities of achievement and subordinate individual development to social domination" (Teese, 2000, p. 8).

Aboriginal children respond best when there are positive personal relationships with teachers as, "it is often more important who does the teaching than what is actually taught" (Collins, 1993, p. 7). Andrews and Hughes (1988) have argued that teaching methodologies which include strong teacher-pupil relationships, reducing competition, restricting verbal communication; limiting direct questioning, emphasising practical experience and group co-operation will benefit Aboriginal students. For all students, "learning is fundamentally a social process and the recognition of the social purposes of learning as well as the social learning processes through which such learning is achieved is important" (Gray, 1990, p. 135).

Several writers have identified learning characteristics of Aboriginal children. Often Aboriginal children are skilled observers, helpers of those younger than themselves, assertive in conflict, emotionally stoic, independent, self-sufficient, self-reliant, possessing many practical competencies and with an ability to laugh at themselves (Malin, 1990). Aboriginal children's learning is often based on observation and imitation rather than verbal and written approaches (Harris & Malin, 1994). Traditionally, Aboriginal learning is informal and non-verbal whereas school learning is largely focussed on two-way verbal interactions (Harris & Harris, 1988). Aboriginal children need to be learning how to use language to learn at school (Graham, 1988a, 1988b) and they may feel shame if they are focussed on to answer questions (Malin, 1990). Shame is a "deep feeling of personal embarrassment in which the individual feels completely exposed and very conscious of being on public display" (Groome, 1995, p. 72). Aboriginal children prefer to try things in private and demonstrate in public when they have acquired the skill (Harris & Harris, 1988). Aboriginal people are learners in two worlds (Watson, 1987). Competing world views "must be addressed in every school providing educational programs for Aboriginal students, when considering strategies that may be used to improve attendance and
performance" (Parish, 1991, p. 18). Aboriginal people consider that there are external factors affecting their lives and directing their progress (Harris, 1990). Parents, teachers and students need to come together to generate educational programs "which both recognise and actively utilise the Aboriginal child's skills and knowledge" (Guider, 1991, p. 51). Aboriginal people have the "source of knowledge of their own needs, their learning process and the ways in which learning takes place and the most effective ways and environments in which ... [they] learn" (Sherwood & McConville, 1994, p. 40). Educational decisions that affect Aboriginal children's learning are best made through consultation between teachers and Aboriginal people.

Teachers need "an appreciation of the cultural, social, environmental and economic factors that can seriously impair the academic potential of Aboriginal children" (Collins, 1993, p. 3). One example is that some Aboriginal children who are seen to be achieving do not want to stand out from the others, deciding to stay at the level of their friends (House of Representatives Committee on Aboriginal Education, 1985). Often, the mathematics tests that are used to gauge student performance levels stem from a different cultural view of learning from those held by Aboriginal people. Without considering the language and other cultural issues involved in mathematical testing, Aboriginal children will not perform well in tests "until they start to perceive the connection between tests and achieving their ultimate goals in the Western domain" (Harris & Harris, 1988, p. 76).

It has been suggested that the poor achievement performance of Aboriginal children can be attributed less to innate ability, levels of school absenteeism, "lower IQ, inadequate home environments, and poor parenting" (Guider, 1991, p. 42) and more to a complex range of classroom issues which many teachers do not appreciate. "Our education systems need to devise interactions which are sensitive, respectful and sympathetic to the plight and culture of urban Aboriginal children" (Gibson, 1993, p. 46).

Teachers should know the students' abilities, the history of the students as well as appreciating the role that language, culture, experiences, expectations and physical factors play in student learning (Forbes, 1994; Roberts, 1990). "The ethnic and cultural experiences of the knower are epistemologically significant because these factors influence knowledge construction, use and interpretation" (Banks, 1993, p. 6). Teachers require appropriate training when they are placed in schools where children have different cultural backgrounds from their own. They need to be culturally aware and appreciative of children's learning needs (Bourke, Dow & Lucas, 1995). Increased levels of involvement can result from established positive relationships between Aboriginal children and a teacher who is sensitive to alternative behaviour (Richards, 1994).

Aboriginal societies are both person-oriented and information-oriented, emphasising the need for personal connections between teacher and learner. Christie and Harris (1985) cited three significant areas of difference between a group of Aboriginal students from traditional backgrounds and their non-Aboriginal teacher: the language of the classroom; the learning styles of Aboriginal children; the differences in "perspectives, expectations, understandings and interpretations" (p. 82) of what happens in the classroom. Good teachers will value different learning styles and appreciate the context and the ways in which children learn (Schools Council, 1992, p. x). It has still to be determined how teachers acquire these skills and apply them in mathematics classrooms to enhance the
mathematics learning potential of Aboriginal children.

Generally, Aboriginal children are holistic learners preferring to observe and discuss before and as they work through a topic. Many are kinaesthetic learners preferring to handle objects and learn through doing. Often, Aboriginal children are visual learners who appreciate lessons that are contextualised and experiential and involve modelling and reflection. Such lessons help make learning meaningful and relevant to their lives. Co-operative learning strategies support Aboriginal children in their learning. Aboriginal children learn through personal trial and error, persistence and repetition (Graven, 1996a; 1996b; S. Harris, 1984). These are general characteristics of indigenous pedagogy, which may not hold for every individual Aboriginal learner but provide a basis for educators to consider in their teaching.

The introduction of Aboriginal learning styles into mathematics classroom needs to be considered (S. Harris, 1984). This needs to be done in co-operation with Aboriginal people so that the community, students and educators can help bridge the difficult social and learning experiences that many Aboriginal students face in the classroom. Though there will be individual differences amongst Aboriginal children, one example of the gap to be bridged is evident through a comparison of the views of success held by the overall society to those of Australian Aborigines.

1. Overall Society
   
   The excellent child at school then successfully proceeds from grade to grade, performs well academically, is called upon by people in authority to perform tasks for them. This child conforms to the rules, accepts the teacher’s answers as ‘gospel’, never questions the classroom milieu, and competes, striving to be the best in the school or class.

2. Aboriginal People
   
   The excellence in Aboriginal society is therefore not individually based, it is not competitive. The measures of excellence are few. The criteria are set by the whole. Performance is not measured during a pregnant pause or during a moment of triumph. It revolves around a person’s place in that community. It revolves around a person’s family. (Blair (1986) cited in Perry, 1990, p. 458-459)

There may be communication difficulties within any cross-cultural educational context (Christie & Harris, 1985). The mismatch in belief systems, between school success of the overall society and that of Aboriginal people results in confusion. An example of a possible mismatch in beliefs, for learners from varying cultural groups, occurs in the meaning of ‘success’. Mathematics success is measured often as a result of examinations. When success is judged through the personal engagement in a mathematical task the student gains confidence (Gattuso, 1994). The notion of student success suggests a notion of failure and for some students this can be devastating (McLeod, 1992), particularly if the accepted view towards success held by one cultural group reinforces failure in another. The reality is that mathematics can drive children towards school failure and that “When mathematics acts as a filter, it not only filters students out of careers, but frequently out of school itself” (National Research Centre, 1989, p. 7). There are Aboriginal children who just do not know where to start with mathematics and that brings about a high level of anxiety, worries of failure and feelings of inadequacy.
Teachers rarely admit to poor teaching or confusing explanation for lack of success in mathematics learning, being more inclined to blame inattention or lack of hard work on the student’s part (Maxwell, 1989). Yet people with mathematics anxiety “attach much blame to those teachers whom they have found to be impatient and unsympathetic, who shout or rely on fear or physical punishment to motivate their students” (Maxwell, 1989, p. 225). Perhaps, this indicates a mismatch of beliefs about the meanings of success and failure in mathematics. Indeed, anger could result amongst the students, parents, teachers and the wider community, particularly, as one cultural view of success is perceived to be accepted and another not considered.

Predominantly, Aboriginal children are autonomous learners, bicultural and prefer oral communication (Watson, 1987). Harris and Harris (1988) suggest that Aboriginal children do not take a conscious personal responsibility for learning at school. Rather they see school as a ritual process whereby they become ‘schooled people’. It is a place where knowledge is bestowed. This contrasts with a view that has “knowledge conferred upon particular individuals at particular times in indigenous societies” (Schools Council, 1992, p. 19).

Mathematics

The learning and teaching of mathematics takes place in schools established by the society to achieve shared meanings amongst their members (Bauersfeld, 1980). Within mathematics classrooms, teacher beliefs directly influence their actions (Raymond, 1993), affect student belief systems (Kloosterman & Stage, 1992) and have a profound influence on both teaching and children’s mathematics learning (Thompson, 1984, 1992).

“One of the most disturbing aspects of the schooling of Aboriginal children in Western Australia is to discover how poorly they perform in mathematics” (Currie, Kissane & Kemp, 1989). Across Australia the situation remains where Aboriginal children are not achieving the same mathematics learning outcomes as non-Aboriginal children (Kemp, 2001). Conventional mathematics education presents a mismatch between a traditional Aboriginal learning approach which emphasises oral, collaborative, practical and holistic learning with one emphasising written communication, acknowledging errors, competition and compartmentalising the subject.

There is emotional conflict implicit in being a bicultural Aboriginal person and mathematics gets caught up in that conflict. Conflict over notions of identity, and ways of valuing, makes the notion of objective value even more emotionally arousing for Aboriginal people than for European-Australians. (Watson, 1987, p. 14)

Though speaking in a more traditional Aboriginal context, Hunting (1987) has suggested that “advancement of the cause of mathematics learning of Aboriginal people lies at the intersection of research into mathematics learning processes and understanding Aboriginal world-views” (p. 5). He states that Aboriginal children will attain higher access to mathematics if educators make the effort to fit mathematics “around the beliefs, values, thinking patterns and problem solving processes contained in Aboriginal cultures” (Hunting, 1987, p. 10).

The teaching of mathematics takes place in a mixture of ‘natural’ English and
`mathematical' English and teachers need "to be sensitive to the particular linguistic needs of students" (Dawe, 1995, p. 231). Mathematics has a number of language registers: "those styles and patterns of language use which involve the use of number names or other formalised and precise concepts" (Watson, 1987, p. 4). Learning mathematics depends on access to these language registers in both oral and written forms. If Aboriginal children are to see the relevance of mathematics, "teachers must provide 'hands-on' experiences which convey the social meanings of mathematical ideas. The connections between symbols on paper and their representation of real-life situations must be explicitly made" (Dawe, 1995, p. 243).

Within Australia, success in mathematical learning has been and still is significantly dependent on one's ability with the English language and the specific language of mathematics. However, there is a growing number of children attending Australian schools where 'school English' is not their first language. Instead, this language could be language other than English or a dialect of English, such as Aboriginal English or Creole. The language that Aboriginal children use is a significant aspect of Aboriginal identity (Eades, 1988). The conflict in understanding that can occur in the classroom between 'school English' and the student's first language can lead to learning difficulties (MacGregor & Moore, 1991). The specific language of the mathematics classroom can create a barrier to the learning of mathematics. The language barriers and cultural conflicts that occur in mathematics classrooms continue to be part of the struggle for educational equity (Bishop, 1994).

Aboriginal children have to learn both the language of the subject as well as "the special ways language is employed in order to negotiate learning about these subjects in schools" (Gray, 1990, p. 106). The 'white' education system will help Aboriginal children when teachers learn and appreciate the nature and role "of classroom language and learning and the perspectives on knowledge and schooling which underlie this" (Christie & Harris, 1985, p. 90). In a study involving Aboriginal people and classroom language it was reported that the Aboriginal people were "lost for words in the white context of the school and are genuinely afraid ... of censure, ridicule and being wrong! ... It was a common complaint that the teachers had employed 'big words' and talked 'above the heads' of Aboriginal pupils" (Malcolm, 1982, p. 166). This has particular importance for mathematics learning where abstract terms and symbols have to be used by Aboriginal children as they learn.

Much of the present teaching of mathematics, particularly in the primary years, has Aboriginal students doing mathematics that is not related to their world and their everyday experiences. As a result, by the time many Aboriginal students have reached the later years of primary school they have been alienated from mathematics. They can do algorithms involving the four operations but do not feel in control of the mathematics and, particularly, the language of mathematics being used (Graham, 1988b). Often student success is dependent upon and measured by how well they grasp the meanings of this language of mathematics. "Hence for children from traditional societies, acquiring a mathematical education involves learning a second language in which these mathematical meanings and relationships can be realised, or adapting their mother tongue so such meanings can be conveyed" (Graham, 1988b, p. 120).
In mathematics classrooms, a new symbolic language is introduced. For some children, this is introduced at the same time as they are learning the dominant cultural language of the classroom. It has been argued that there are more language difficulties experienced in the mathematics classroom than in any other (MacGregor & Moore, 1991). Dawe (1991) has argued that the introduction of mathematics language must be done in a direct and planned way. In some mathematics classrooms, children could be involved in learning at least three languages: the language of home, the language of school and the language of mathematics. There may be a lot of language switching where a child receives the content in one language, interprets and thinks it through in another and then switches back to report the answer in the original language. There is much room for error in this process (Dawe, 1991). As this can happen at the same time as children are learning their mathematical concepts, many learning issues are raised. The language that is used in mathematics classrooms has to be a primary consideration of the teacher (NSW Department of School Education, 1989).

Aboriginal children need to understand mathematical language and come to feel in control of what they are learning. This has implications for the school’s language program and, particularly, the language used in learning mathematics. The influence of the language of mathematical words, signs and symbols on the learning of mathematics by Indigenous students has not been given sufficient emphasis in mathematics curricula and mathematics classrooms. Without an appreciation of the importance of the children’s use and control of language teachers may see students as ‘slow’ in mathematics. Graham (1988b) suggests that:

learning language involves ‘learning how to mean’ and hence learning the language of mathematics involves learning how to make and share mathematical meanings using language appropriate to the context, which is more than recognizing and responding to words in isolation. Unless teachers of mathematics become more aware of this difference it seems that many second language learners will continue to be disadvantaged in school. (p. 125)

Aboriginal children must be provided with a mathematics curriculum that allows access to further education while maintaining and strengthening their Aboriginal identity. This has implications for the overall mathematics program and the development of appropriate teaching strategies that address the Aboriginal child’s learning of mathematics.

Aboriginal people live in a culture in which they interact and relate to all about them. This view of the world needs to be recognised by teachers in the mathematics classroom. Graham (1988b) has suggested that classrooms need to resemble mathematical homes with teacher and child interacting and relating to one another in ways which take into account the social and cultural influences. It is suggested that teachers move away from a focus on content and the use of materials that may not be relevant to the lives of Aboriginal children. The focus should be on teachers providing opportunities for the learner to develop their understanding of mathematics through the social context in which they find themselves.

It is too simplistic to suggest that language and cultural factors are the only reasons that Aboriginal students are not achieving to their potential in mathematics. "Aboriginal
children are being taught mathematics in our schools, but they are not learning the things that matter. Such knowledge is not just to do with getting sums right, though that is part of it. Rather, it is to do with the way people talk and think about what they know" (Graham, 1988b, p. 132). Time needs to be provided for children to develop mathematical meaning through action in real life experiences, discourse about those experiences, and reflection on what they have learnt.

Aboriginal people want to learn mathematics and they want to maintain their identity (Hudspith & Williams, 1994). Too often the role of mathematics in the maintenance and strengthening of identity is not considered by teachers and curriculum developers. For this to occur, firstly, the existence of Aboriginal beliefs about mathematics and mathematical learning need to be recognised. The identification and reporting of the mathematical beliefs of Aboriginal people would inform teachers and the community as to changes required in mathematics teaching. Secondly, the expressed beliefs of Aboriginal people need to be incorporated into making mathematics curricula relevant for Aboriginal students. Appropriate curriculum development would enhance the mathematics achievement of Aboriginal children through its relevancy, appreciation of the complexity of the mathematical language and in the presentation of practical mathematical learning activities. One suggested area of research in reaching this goal is "to obtain a more elaborate picture of teachers' knowledge, beliefs, judgements, and decisions as they apply to their diverse student populations and as related to their notions of equity" (Secada, 1992b, p. 22). Within Australia, such a goal should be reflected in seeking the espoused mathematical beliefs of Aboriginal children, their parents, teachers and Aboriginal educators.

**Mathematics reform: setting the challenge**

Watson (1987) supports the use of collaborative action research between school participants and involved 'outsiders' to improve our understanding of the social context of the learner and the teacher. Similarly, Harris' (1991) study undertaken with Aboriginal communities in geographically remote regions of the Northern Territory of Australia sets the challenge for mathematics education researchers to:

> work for long periods in close co-operation with groups of Aboriginal people to discover together ways of conducting schooling and of teaching mathematics so that the integrity of both the Aboriginal and the White Australian world views are preserved. (P. Harris, 1991, p. 12)

The present study responds to this challenge.

Despite pressure to reform mathematics education, many mathematics teachers are reluctant to change (Crawford, 1994; Weissglass, 1992a). In a serious indictment of mathematics teacher education, Crawford (1994) believes that most beginning teachers have experienced the teaching of mathematics as transmissive. They "generally do not have experiences that substantially challenge their attitudes and beliefs about the nature of the schooling context and the ways in which teachers manage the collective learning activity of a mathematics class" (Crawford, 1994, p. 5). Teachers find it difficult to relate school mathematics to real world situations and they depend on the textbook for
appropriate exercises (Crawford, 1994).

Raymond and Santos (1995), in a study involving pre-service elementary teachers found that when they experienced innovative teaching their beliefs were more likely to be affected than when they attended lectures on innovative teaching. Many beginning teachers who encounter difficult teaching contexts – low socio-economic status areas, ethnic diversity and educational disadvantage – resort to traditional transmission approaches to mathematics teaching which are inconsistent with the beliefs espoused in their pre-service teacher education (Perry, Howard & Tracey, 1999). This was exemplified in the current study where a number of beginning teachers were appointed to a rural school with a significant Aboriginal student population. They experienced difficulties in socially adjusting to teaching and the school. Comments are reported which support Raymond and Santos’ (1995) study.

“Teaching reforms cannot take place unless changes to teachers’ deeply held beliefs about mathematics and its teaching and learning take place” (Ernest, 1989d, p. 99). Weissglass (1992b) believes that change will only come about “in the context of identifying and discussing values and beliefs about school practices” (p. 198). The espoused beliefs of all participants involved in Aboriginal children’s learning of mathematics–teachers, educators, parents and the children–have to be considered by teachers, in order for Aboriginal children to access school mathematics and achieve their learning potential.

Listening to voices

This study emphasises the voices of Aboriginal educators, Aboriginal children, their teachers and parents of Aboriginal children. Voice refers to people speaking for themselves. It contrasts with others speaking on their behalf. It stands in opposition to silencing (Secada, 1995).

The struggle for voice should be seen as an effort to increase the likelihood that we really listen to how diverse groups perceive their educational status in general and their mathematics education in particular. How students of diverse backgrounds recount the experiences, beliefs, and values embedded in their stories should be regarded as important. (Secada, 1995, p. 157)

Adler (1998) raises the concern of whose voices are being heard in the increasing collective discourse of mathematics education research within Australia. Though admitting that she does not know the “newcomers and oldtimers, its peripheral and full participants, the marginalised and the dominant” (Adler, 1998, p. 79), Australian Aboriginal voices are rarely heard in reports of Australian mathematics educational practice. Indeed, mathematics education research with and by Aboriginal people “is minimal and still considered marginal” (Zevenbergen, Atweh, Kanes & Cooper, 1996, p. 32).

Watson (1987) suggests that there are two different discourses about education: that of mainstream Australia which is written and that of the Aboriginal society which “is constituted by the production of texts in the oral mode” (p. 1). This is the case with the Aboriginal community involved in this study. Both discourses are “involved in reproduction of social processes, but they are the social processes of different social
orders" (Watson, 1987, p. 2). Mathematics educators should not transform the discourse into psychological terms “and place social concerns at the margins of the field” (Secada, 1995, p. 159).

Gordon (1991) has suggested that if teachers are to change in their work with students from diverse populations they have to come to appreciate perspectives other than their own that might challenge their assumptions and beliefs. Jones, Kershaw and Sparrow (1995) believe that through teachers and community people working together an acceleration in “the urgent reforms necessary in our quest to provide effective, culturally sensitive programs for Aboriginal children” (p. 58) will occur.

This thesis is a means through which the voices of a ‘minority equal’ can be heard so that a shared discussion can occur. The Aboriginal participants in this study act as voices or ‘cultural advisers’ to mathematics educators in the learning and teaching of mathematics to Aboriginal students. The study is based on cross-cultural partnerships that were developed and continue to endure. The study emphasises listening to the voices of others and identifying the emerging concepts and theory from the data related to the context within which that data were collected.

Through listening to the voices of the Aboriginal children, teachers can appreciate the difficulties children experience in learning mathematics. The parents of Aboriginal children can voice the concerns and frustrations they experience in trying to support their children's learning of mathematics. The Aboriginal educators, who work in schools and are members of the Aboriginal community, can voice perspectives about Aboriginal children's learning of mathematics that, to date, have not been reported in the mathematics education literature. Teachers can voice their personal beliefs related to their experiences of teaching mathematics, with the purpose of sharing them and informing others.

Through listening to each other all groups can gain a greater appreciation of the socio-cultural contexts in which Aboriginal children learn mathematics. In the struggle for educational equity for Aboriginal children, the language barriers and cultural conflicts that occur in mathematics classrooms can be discussed. The hearing of voices can assist teachers in making connections between school mathematics and the Aboriginal child's world, making mathematics learning more meaningful and relevant.

**Summary**

The student populations of mathematics classrooms are culturally diverse. Such diversity raises questions for teachers, curriculum developers and parents about appropriate mathematics content and relevant teaching/learning strategies to enhance student learning. The prime focus of the mathematics classroom is on children's mathematical learning that takes place within a social and cultural context. Those involved bring with them their own social and cultural backgrounds together with personally held beliefs towards the nature and learning of mathematics.

The learning of mathematics takes place in the social and cultural contexts of the mathematics class, the school, the home and the wider community. There is support for researchers to investigate the socio-cultural contexts and personal interactions through which mathematics learning occurs in order to enhance children's learning outcomes.
(Secada, 1992a; Bishop, 1988; Cocking & Mestre, 1988; Orr, 1987).

Aboriginal people have been described as the most educationally disadvantaged group of people within Australia (Aboriginal and Torres Strait Islander Commission, 1995). Many still live in geographically remote regions of Australia but most are urban and rural dwellers living in multicultural communities. “[In terms of the past research, the needs of this group with respect to mathematics education do not feature in the literature” (Watson, 1987, p. 6).

Many Aboriginal adults and children have become alienated from schools (Human Rights and Equal Opportunity Commission, 2000). Within Australian Aboriginal education, it has to be recognised that, in providing education for Aboriginal children, schools “must work within these histories in reforming and transforming culture and history through nurturing the development and growth of individuals” (Watson, 1988b, p. 4). Empowerment and self-determination through education is absolutely fundamental to social justice principles and reconciliation for Aboriginal peoples. Such work has to be based upon consultation and negotiation between educators and Aboriginal people. To achieve purposeful and effective consultation and negotiation a special type of active listening needs to occur.

... a very special kind of listening, listening that requires not only open eyes and ears, but open hearts and minds. We [educators] do not really see through our eyes or hear through our ears, but through our beliefs...we must learn to be vulnerable enough to allow our world to turn upside down in order to allow the realities of others to edge themselves into our consciousness. In other words, we must become ethnographers in the true sense. (Delpit, 1988, p. 297)
Chapter 3

Methodology

The purposes of this chapter are to outline some of the critical issues of ethnography as a methodology in mathematics education research and to describe its use in this study. Emphasis is given to the selection and description of the school site, reporting on the evolving nature of the study, the interactive nature of the cross-cultural research, including negotiation and consultation and personal research issues, and procedures for data gathering and analysis. A general discussion of ethnography, including the important role of language in ethnographic studies, is interwoven with particular issues around the planning, implementation and data analysis of the present study.

Introduction

Over the last 15 years a process of reform in mathematics education (AEC, 1991; NCTM, 1989; 2000) has acknowledged that children, teachers and parents are involved in the learning process (Wood, Cobb, Yackel, & Dillon, 1993), and has given increased consideration of the social and cultural contexts in which mathematics learning takes place (Arweh, Cooper, & Kanes, 1992; Arweh, Forgaz, & Nebres, 2001). At the same time, there has been a call in mathematics education for the use of a variety of research methodologies in the investigation of children's learning in the mathematics classroom (Eisenhart, 1988; McLeod, 1992). One appropriate method is ethnography.

As mathematics education research comes to consider and examine the complex nature of the mathematics classroom and the links between cognition and affect, more use of ethnographic research approaches is becoming evident (Nickson, 1992; Zevenbergen, 1998). This study uses ethnographic methodology to investigate the beliefs of Aboriginal children, their parents, Aboriginal educators and non-Aboriginal teachers towards Aboriginal children’s learning of mathematics in Years 5 and 6.

This chapter:

- discusses the place of ethnography in mathematics education research;
- addresses issues related to undertaking ethnography in cross-cultural communities;
- identifies the researcher’s competencies to undertake the study;
- discusses the overall study context;
- details on-site procedures and processes involved in the study;
- reports on the data collection tools, and,
- addresses the initial analysis and coding of collected data.
**Ethnography and mathematics education research**

Ethnography is a research methodology for “describing and analyzing practices and beliefs of cultures and communities (as consistent wholes)” (Tesch, 1990, p. 50). It can help show the cultural viewpoints of the oppressed and marginalised, evidencing their knowledges (Willis, 1997) and leading to liberatory strategies (Skeggs, 1999). Ethnography “provides the space for exploring how theories and concepts can work to understand how we are located and move through social space” (Skeggs, 1999, p. 41). Ethnography allows understanding to evolve across time, paying attention to the complexities and enabling a range of interpretations to be tried within the site (Skeggs, 1999). The researcher acts as a witness who is both responsive to, and responsible for, the interpretation of issues encountered in the site (Phelan, 1998; Skeggs, 1999). There is a focus, with ethnography, on analysing the whole phenomenon of a particular context, primarily through observation and interviewing.

Ethnography is a powerful research methodology that explores the complexities of life and relationships in a range of social settings. It has an explanatory power that requires the researcher to be careful, rigorous and complete. “It is the only methodology that can show how complex processes are lived together and in contradiction. It should make us think about our relationships with others” (Skeggs, 1999, p. 48). Its application is supported in mathematics education where it is “particularly useful for identifying and understanding social and cultural norms” (Zevenbergen, 1998, p. 20). An ethnographic approach consciously tries to take into account the people and the context in which the study occurs. Social contexts are intricate and complex, and qualitative researchers know “that change is a constant feature of social life but that its specific directions need to be accounted for; they also place social interaction and social processes at the centre of their attention” (Strauss, 1987, p. 6). For the researcher it implies “a commitment to a search for meaning, a suspension of preconceptions, and an orientation to discovery” (Ball, 1990, p. 157). The purpose is to investigate and identify human behaviour in a given context from which the findings can be applied by the researcher and others, such as practitioners, in their own social and cultural contexts (Miles & Huberman, 1994; Solis, 1990).

One such context is that of the classroom which exists within the wider school and community settings. The use of “educational ethnography provides rich, descriptive data about the contexts, activities, and beliefs of participants in educational settings” (Goetz & Le Compte, 1984, p. 23). Ethnography in mathematics education research focuses on the mathematics classroom, the school and the community in which the participants live. It aims to provide a rich data collection about the context of the study, the events that take place within that context, various interactions, the actions of the participants and the thoughts of those involved with the study (Goetz & Le Compte, 1984). It is concerned with providing an overall picture of the many interactions and impacts upon the participants that occur within the mathematics classroom in a given time frame and with a particular focus.

**Ethnography in a cross-cultural community: collaborative research with an Aboriginal community**

Researchers who appreciate differing world views, the importance of personal
relationships, the emancipatory nature of ethnography and differing views of time will be able to work more effectively in many cross-cultural contexts. Researchers who contemplate cross-cultural studies appreciate that time given to participant/researcher relationships and the development networks based on mutual respect, clear purposes and mutual ownership will enhance successful implementation and completion of the study. Ethnography conducted in cross-cultural settings may cause some participant hostility and suspicion. Some participants may feel that a researcher should be from their own cultural background and they might object to the research. In dealing with this, those becoming involved in cross-cultural research should do so only after long consideration and the seeking of advice from appropriate people.

Important in any cross-cultural research are researcher sensitivity and integrity. Genuine researcher sensitivity to the issues, context, people and the cultural values involved in the research is needed. The cultural knowledge, awareness and sensitivity of researchers towards research issues are paramount in negotiating the establishment of an ethnographic study within cross-cultural contexts. The researcher needs to be experienced with relating to the cultural group or be willing to spend time establishing the integrity, trust, honesty and mutual respect needed to achieve valid and reliable study findings. The researcher must come to understand, as best one can, the other cultural group's world view of the issues being investigated.

Research related to Aboriginal issues needs to be carried out within Aboriginal communities so that the data can be gathered directly (Cutmore & Howard, 1995). Hence, this ethnographic study had to be conducted in an appropriate field in order that cultural, language and community concerns and Aboriginal 'voices' were heard. Therefore, it was undertaken in a community in which a significant number of Aboriginal people lived. There were non-Aboriginal teachers, parents of Aboriginal children, Aboriginal children and Aboriginal educators involved in the participating schools and other Aboriginal people across the community who were interested in the purposes and processes of the study.

Aboriginal people know what things they would like investigated within their communities. They wish to have a say in directing the research, be actively involved in planning research and be consulted as, and before, any research takes place (Brady, 1997). Too often, in the past, this has not occurred. Aborigines have wanted control of research decisions involving their culture (Roberts, 1994). The National Aboriginal Education Committee’s (1985) policy was that “research should be substantially conducted for and by Aboriginal people, and not on them” (Harsett, Harrison, Godfrey, Parington, & Richer, 1999b, p. 17). Research concerning Aboriginal issues must involve direct consultation and participation of 'grass roots' community-based Aboriginal people.

For researchers, this raises the issue of what 'community' means in Aboriginal research. The issue of community needs careful consideration and input from Aboriginal people when research is being discussed and implemented. Although Aboriginal people may share many similar experiences, there is diversity amongst the different communities and their cultures. Research findings for one community, while able to help inform the situation in other communities, cannot be generalised to another. Research carried out in one community may have little bearing on what transpires in another.
As researchers work with Aboriginal communities, they need to grow in their awareness and sensitivity of the people and context in which they are working. Often, the contributions of Aboriginal people to research have not been recognised. Research undertaken with little or no consultation and negotiation with Aboriginal people has often led to a distrust and a cynical view of Western-based research approaches. Mathematics educational researchers undertaking collaborative research with Aboriginal communities need to consider such issues.

There is a need to distinguish between who should conduct the research and who should own the research done in Aboriginal communities. Some Aboriginal people express the following view:

_I see non-Aboriginal people coming into schools doing a quick research, taking Aboriginal ideas and knowledge making a big name for themselves and then leaving without acknowledging the input of the Aboriginal people involved. Aboriginal people are getting jack of it. Why should I be supporting researchers who are feathering their own nests often at the expense of Aboriginal people?_ (Aboriginal educator, personal communication, 1994)

Often such research is viewed as non-Aboriginal people making a name for themselves 'on the backs of blacks'. The issue of whether there is a place for a non-Aboriginal researcher working in an Aboriginal community is contentious (Nakata, 1997; Osborne, 1995; Williamson, 1997). Aboriginal people are re-shaping research frameworks and determining how they will engage with non-Aboriginal researchers (Brady, 1997). For ethical reasons and the credibility of research, Aboriginal people believe they have the right to control the focus and direction of research undertaken in their culture (Harslett, et al, 1999b).

Aboriginal people's participation in research may benefit from collaboration with non-Aboriginal researchers, "to do justice to the complexities that are indigenous education" (Osborne, 1995). In this study, working in close consultation with Aborigines and making research decisions based upon advice has given the study relevance and authenticity. Aborigines must feel a sense of ownership and be involved in generating the research undertaken in their communities. Research undertaken by non-Aboriginal researchers with Aboriginal communities takes time and is dependent upon continued consultation and negotiation with the research authorisation and ownership invested with the participants. These are critical factors for valid and reliable research to take place with Aboriginal communities.

This study, therefore, required cultural authorisation from Aboriginal educational groups at a state and local level. Consultation was undertaken seeking agreement on what was to be researched - in this instance the beliefs of Aboriginal people towards the learning and teaching of mathematics by Aboriginal children in Years 5 and 6. It was agreed that it was important for Aboriginal voices to be heard in investigating why Aboriginal children do not reach their learning potential in mathematics. Further, it was agreed that the most effective way to collect the data was through ethnographic methods involving speaking with Aboriginal people not through surveys and quantitative analysis. The cultural authorisation and integrity of this study continued in the field with the involvement of
Aboriginal people from the community as they worked within the school. This was particularly the case with the Aboriginal educators.

**Research issues in the field**

Fieldwork is at the heart of ethnographic research. Observers, in the field, must remember that they “are not there to change views, but to learn what the subjects’ views are and why they are that way” (Bogdan & Biklen, 1992, p. 99). Ethnographic methodology is dependent upon the development and maintenance of positive relationships between the researcher and participants. The term ‘trustworthiness’ is used to describe the values of discretion, integrity, honesty, respect and trust that need to be established in such relationships (Lincoln & Guba, 1985). Such research values give rise to significant methodological issues that focus on the development of mutual trust between the researcher and participants. The evidence of such personal values within the researcher can strengthen researcher credibility and the participants’ support for the study.

In undertaking this research involving school and community groups, consideration had to be given to the fact that it was a rural site. Time was taken to travel to the site to establish relationships with teachers, Aboriginal and non-Aboriginal groups and other participants. There was a personal determination made to spend a considerable time in the research site making every effort to become involved in ‘the life’ of the site by attending sporting, school and community functions. It was a case of considering how the researcher’s presence ought contribute on a personal level to the lives of the participants and others aware of the study.

During the establishment of an ethnographic study the researcher needs to consider two significant methodological issues.

- Who has to give permission for the researcher to enter the field?
- Who owns the study?

Researchers have to identify all the involved parties, meet with them and discuss the proposed study. Such discussions may often be undertaken at the convenience of the participants, rather than that of the researcher. The study requires time to evolve, continual clarification of its purposes and reflection on the degree of involvement of all participants.

For this study, there was considerable personal reflection on undertaking the study because of my close personal relationships with many of the Aboriginal participants. This was a personal struggle that was overcome only through discussions with individual Aboriginal people. The purpose and direction of the study was strengthened through these discussions while potentially inappropriate actions, which could jeopardise it, were avoided.

Identifying the agencies and individuals involved in the study, establishing the people networks and the maintenance of effective consultation and feedback processes must be part of the researcher’s planning. Such planning should enhance collaboration throughout the study, provide ownership to those involved, negate potential criticism of secrecy during the study and provide opportunities to validate the analysis of collected data. The establishment and maintenance of effective processes assist the setting of research goals and outcomes. Throughout the study such processes allow for the development of
Methodology

negotiated and shared meaning about its purposes and the significance of the research findings.

Continued consultation and feedback reinforces a shared ownership of the study and continued participant support. The findings of any ethnography are not only a result of the social interaction between the researcher and the participants but also a political event involving ethical considerations and actions (Hall, 1983). In this cross-cultural study an understanding of the inter-relatedness amongst Aboriginal people within the study's rural location assisted in developing networks of contacts. The information entrusted to the researcher from all participants had to be respected and their wishes regarding what could and could not be reported, and the ways in which they wanted comments reported, faithfully followed.

Throughout an ethnographic study the rights of the participants have to be respected for there exists a power-based relationship between the observer and the observed which must be recognised by the researcher.

"Ultimately, the researcher has power over what will be observed; what will be asked in the interviews; how the observations, data, or both will be used; who will gain most from the research; and what discourses will be used to frame the research, observations, and data. (Zevenbergen, 1998, p. 31)"

The initial stage of gaining access to a context is crucial in the establishment and development of observer and participant trust, rapport and understanding (Zevenbergen, 1998). If permission is needed to enter a site those who will give permission need to be identified. Within school communities, these people, referred to as gatekeepers, include the principal, teachers, students, parents and community groups. Each gatekeeper exercises power in influencing the degrees of access, and thus the data to be collected.

At times research applications have to go through one or more committees of the central agency or school community before permission is granted. Even then, the progress of the research is not assured for, “while you may get official permission your study may be sabotaged by the subjects. It [research] involves laying the groundwork for good rapport with those with whom you will be spending time” (Bogdan & Biklen, 1992, p. 82).

Meetings need to be organised with participants to provide an outline of the research and the procedures involved in the study. Such meetings provide opportunities to answer questions, outline ethical considerations, discuss anonymity, present expectations of the study and allow participants to provide informed consent, to be involved or to withdraw (Sowder, 1998; Zevenbergen, 1998). Participants need to remain informed throughout the study of their roles and those of the researcher as explained and clarified through negotiation. Participants have the right to know that they will remain anonymous and have their confidences protected (Glesne & Peshkin, 1992).

Confidentiality has to be paramount in research considerations for “preserving anonymity during data collection is usually not possible” (Sowder, 1998, p. 438). Gaining informed consent and protecting the participants from harm are prime issues (Bogdan & Biklen, 1992). Participants should be treated with respect, their identities protected, the intent of the study explained and the truth reported (Delamont, 1992).
Ethnographers are participant observers and, while in the field, have to become involved in the specific community without becoming overly involved and 'going native' (Delamont, 1992). In sites comprising different social, academic or cultural groups the observer’s comments and observations cannot be seen to favour a particular group (Bogdan & Biklen, 1992). The researcher needs to relate to the school community positively with reference to the time span and context of the study (Delamont, 1992). Researchers need to spend time in negotiating access and entry to the study site, disengaging participant relationships on leaving, ensuring all negotiated responsibilities are completed and arrangements are made for follow-up.

Language

In an ethnographic study the observer tries to record what is seen and heard and then to make sense of it (Tesch, 1990). Often many of the data are based on the collection, interpretation and analysis of language, through communications that the observer has heard, material that the observer has read and interactions that have taken place during the study. Language in ethnography can be viewed as “a means of communication or a manifestation of the culture in which it serves as the communication instrument” (Tesch, 1990, p. 60). In collecting, interpreting and analysing language the social and cultural context of the study needs careful consideration by the researcher.

One way of analysing language both as communication and as a window on the social and cultural context is to identify the characteristics of the language, discover regularities, comprehend the meaning of the language and reflect on what it represents. When the researcher reflects on the language data it is best done “holistically, allowing the analysis to build on intuition and on insights that are achieved through deep immersion in and dwelling with data” (Tesch, 1990, p. 60). The triangulation of data sources helps validate these ‘intuitions’ and ‘insights’.

A major task of the researcher is to seek patterns and regularities in the language and to identify the views of the participants in the study and the way in which these are expressed. “Researchers (also) need to be alive not only to the constraints and challenges of research settings and research aims, but to the nature of their data” (Strauss, 1987, p. 8). The context in which language is uttered, who speaks it and the purposes of its use, as well as language modifications in the presence of an observer, are issues for a researcher to consider in collecting, analysing and interpreting data.

When people participate in research, they may reveal things about their lives that have to be treated with respect by the researcher. In research with Aboriginal people, the emphasis is often on when Aboriginal people speak, what they say and how it is said. Actions and body language of the speaker are as important as the talking itself. For these reasons, researchers have to know and be known by the people with whom they are collaborating and learn from them appropriate ways to conduct research with them.

Researchers have to listen, and listen carefully, to what is really being said by the participants. Often what is important is not the words heard, at the time, but how they link to something else that may have been shared with the researcher at another time. As Aboriginal people come to trust non-Aboriginal researchers more the researchers may be
told and allowed to know more about the complexities of issues that Aboriginal people face in their daily lives.

**Negotiation and consultation**

There are several ways in which researchers enter a school site to carry out a study. School-based research can be community initiated, system initiated, school initiated or researcher initiated. Whoever initiates the research, negotiation and consultation with relevant participants are critical issues. In planning for purposeful negotiation and consultation, researchers need an appreciation of what these terms mean for the other participants. Researchers cannot assume that their definition and the values that they espouse are the same as those of the participants. This is particularly so in cross-cultural studies where participants with differing world views may perceive the processes of negotiation and consultation quite differently to the researcher.

For this study, ‘negotiation’ refers to talking and conferring with others to reach mutual decisions and understandings whilst ‘consultation’ refers to keeping people informed and seeking their advice. The onus is on the researcher to maintain a high level of negotiation and consultation throughout the study. They are not the responsibility of the participants although they will influence the levels of achievement of both.

Consultation continues throughout an ethnographic study with the researcher informing appropriate people and groups about the progress of the study, validating initial interpretations of the data and maintaining researcher credibility in the eyes of the participants. It is necessary to identify and maintain the necessary participant networks and to seek advice from relevant people. This assists in the development of consultation processes that are meaningful to the participants, not in ways that are only appropriate to the researcher. Judgement of the type of consultation, the degree of clarification needed and the amount of listening required are dependent upon the knowledge, skill and expertise of the researcher in the field. Consultation necessitates the development of networks and the provision of feedback processes to all participants involved in the study. These processes are carried out both formally and informally as opportunities arise.

The establishment of participation, rapport and collaboration through the processes of negotiation and consultation takes considerable time but is crucial for gaining access to the field and making possible a "reflexivity between the researcher and the participants" (Zevenbergen, 1998, p. 26). Establishing mutual trust and respect are essential factors in research involving Aboriginal communities. Networking with the community is essential, both before the research begins and as it is implemented.

Researchers have to be careful not to allow stereotypic views of Aboriginal people to influence the study, nor set about collecting data or biasing findings that validate and support preconceived views. Building one's knowledge of, and relationships with, Aboriginal people is often seen to be too difficult for many researchers. However, non-Aboriginal researchers have to accept that if they work in the domains of Aboriginal people, it is they who have to appreciate the needs of Aboriginal people. Openness, sensitivity and awareness of the traditions, ways and thinking of another culture are essential attributes for any researcher working collaboratively with Aboriginal communities.
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Non-Aboriginal researchers often feel that they have to have the research study completed in a set time. Aboriginal people, at times, recognise the importance of this but they may not recognise the same urgency with research timelines as non-Aborigines. All research will raise the hopes and expectations of Aboriginal people. Hence, the outcomes of any research have to be clear. As far as possible the research should be reported in the words of the participants, even the way in which they are said so as to safeguard their intent. These then are significant methodological issues that I, as a researcher, had to be aware of and consider before entering into consultation with Aboriginal communities in conducting this collaborative research (Cutmore & Howard, 1995; Harslett, et al, 1999b; Osborne, 1995).

Support for this study was gained through purposeful and continuing consultation, planned access negotiation and the positive assistance of various Aboriginal and non-Aboriginal people. This was an involved process, which included New South Wales Aboriginal Education Consultative Group Inc. [AECD] at the state level, at the regional level and at the local community level. There were also local Aboriginal Community Groups involved in education, medical and community based activities whose permission was gained. For all schools, permission from the Aboriginal Student Support Parent Association (ASSPA) had to be obtained and the members of this association remained informed throughout the progress of the study.

As the study was conducted in a government school, approval from the NSW Department of School Education Regional Research Proposal Committee was required. The local Director in charge of a cluster of schools within the district approved access. The Principal and school staff had to approve the study and meetings were arranged with Parent and Citizen groups to access parent involvement as well as informing them of the purposes of the study. Ethics approval for the study was obtained from the Ethics Committee (Human Subjects) of the University of Western Sydney, Macarthur.

Ethnography and this study

Aboriginal communities are interested in being involved in mathematics education research related to their concerns at local, national and international levels (French, French, Matthews, Stephens, & Howard, 1994; P. Harris, 1991; Watson, 1987). Though it is recognised that mathematics education research needs to be undertaken in Aboriginal communities, relatively little has been done to achieve this (Frigo, 1999; P. Harris, 1991).

The ethnographic approach used in this study involved the researcher residing in the community over an extended period of time. This was essential in developing the trust and respect of people so that they would become involved in the study and be direct in their responses. This required coming to be accepted by the people, coming to know them in their communities and working over a protracted period of time to come to an appreciation of the context in which they live (Cutmore & Howard, 1995). Living in the community involved with the study allowed the researcher to grow in personal awareness and sensitivity of the structure and context in which the study was being conducted. Such time allowed links to be made with participants and growth in the researcher's personal knowledge and understanding of the community. Time spent living within the community provided participants with the opportunity to know and trust the researcher. This was
only achieved through listening, talking and being seen by people.

This study was set in a rural township where Aboriginal and non-Aboriginal people lived. It was undertaken with the support of both Aboriginal and non-Aboriginal community members. Personal involvement within the town for six years prior to the study enabled positive relationships to be developed with Aboriginal and non-Aboriginal parents, teachers and Aboriginal educators. During this time the researcher gained awareness and knowledge of many of the issues pertinent to living in this rural town and incorporated these into the study, thus enabling the voices of the Aboriginal children, their parents, Aboriginal educators and non-Aboriginal teachers to be heard.

The overall study

In 1993 I began a negotiation and consultation process involving Aboriginal and non-Aboriginal communities, as well as relevant educational agencies such as the NSW Aboriginal Education Consultative Group Inc, North-West Regional Aboriginal Education Consultative Group and New South Wales Department of Education, to undertake a study focusing on the nature and the learning of mathematics. This was a detailed process clarifying the purposes of the study and seeking approvals to enter the field.

Four primary schools were involved in the study. All the school names used are pseudonyms. One suburban Sydney school, Ember Road Public School, provided a pilot study context where interview protocols were trialled with Year 6 children, teachers and parents and the ethnographic skills of the researcher honed. In the initial study titled “Peoples’ Beliefs about the Learning and Teaching of K-6 Mathematics” the researcher spent four weeks in this school before presenting a report to the Principal and Year 6 teachers at the completion of the study. The final report of the study’s findings was presented to a general school staff meeting. This pilot study provided the school with information concerning the expressed beliefs of Aboriginal educators, children, parents and teachers towards the nature and learning of mathematics.

The major study was conducted in a remote rural town, Tremayne, in north west New South Wales, Australia. There were three primary schools within the town, two government and one Catholic. The two government schools, Ellen Road Public School and Ellen Road South Public School, had relatively high percentages of Aboriginal children (58% and 23% respectively). Fewer Aboriginal children (10%) attended St Mary’s Primary School. It was difficult to make a decision about which school or schools would be involved in the study. This was a personal dilemma because the researcher’s presence and credibility within the community would be of benefit to all the schools. I decided, finally, to be involved in each of the three schools but to focus the investigation for this thesis in the school that had the highest percentage of Aboriginal children (46%) in Years 5 and 6. Thus this study reports specifically on the investigation undertaken at Ellen Road Public School. St Mary’s Primary School acted as an entry site to the community and establishment of the study. Ellen Road South Public School was the site for a final overview investigation and acted as the exiting site of the study. Table 3.1 provides a list of the schools involved, the phase of the study undertaken in each and the focussed time spent within each school.
Table 3.1

<table>
<thead>
<tr>
<th>School</th>
<th>Study Phase</th>
<th>Time on site [1994]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ember Road Public School</td>
<td>Pilot: Honing research skills</td>
<td>1 month [Feb-March]</td>
</tr>
<tr>
<td>St Mary's Primary School</td>
<td>Entry school site</td>
<td>1 month [April]</td>
</tr>
<tr>
<td></td>
<td>Establishment</td>
<td></td>
</tr>
<tr>
<td>Ellen Road Public School</td>
<td>Focus school site</td>
<td>5 months [May-Sept]</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td></td>
</tr>
<tr>
<td>Ellen Road South Public School</td>
<td>Final school site</td>
<td>1 month [Oct-Nov]</td>
</tr>
<tr>
<td></td>
<td>Exiting</td>
<td></td>
</tr>
</tbody>
</table>

During the establishment phase I was able to settle into the town, become better known by the teachers and Aboriginal parents and become involved in the activities about the town. It was during this time that I adjusted to living in a remote location and established further personal links and relationships with Aboriginal and non-Aboriginal people. I felt that to be effective in undertaking this study, I had to play a part in both the educational and community life of the town. Thus, going to football matches, attending the art gallery, chairing meetings and generally being seen were activities that helped me become involved in the town's life. This assisted in developing purposeful links with people that helped reinforce the value of the study for their community.

During the exiting phase commitments to the three schools within the town were completed. This time included the provision of feedback to all schools, follow up of participant comments and the completion of previously negotiated requests from the schools. Involvement in each of the schools was dependent upon meetings with and approval by the Principal, school staff, community groups and teachers.

The rural context

Tremayne is a rural community in New South Wales, Australia. It is a farming town dependent upon wheat, wool and cotton. The town's population comprised thirteen ethnic groups though the two most significant groups of people can be described as Aboriginal and non-Aboriginal. Prior to the time of the study there had been a four year drought and the town's population had decreased from a high of 12,000. The population at the time of the study was 10,000 with 40% being Aboriginal. Many people faced economic hardship and employment opportunities within the town were limited.

The Aboriginal community comprised people employed full-time in government agencies and private industries, some employed part-time or on annual contracts and a further group who were unemployed and dependent upon social security payments. The non-Aboriginal people ranged in their socio-economic status from wealthy to working class with some dependent upon social security payments.

The town had a difficult history, with recurring conflicts between Aboriginal and non-
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Aboriginal people. Some Aboriginal people would suggest that the overt racism within the town had been replaced by a more subtle, covert form of racism which affected how Aboriginal people were accepted in the town. During the late 1980s and early 1990s there was significant progress in the educational, legal and medical facilities provided for Aboriginal people and administered by Aboriginal agencies. These years saw a number of Aboriginal people attending university and entering schools as teachers and Aboriginal Education Assistants.

A primary exploratory approach

The major study undertaken in Tremayne was, personally, a difficult study. As mentioned, I had worked closely with the Aboriginal community over the previous six years and did not want the Aboriginal community to perceive that their friendship and professional collegiality was being misused in my undertaking the study. This was a personal struggle for quite some time and the advice of a number of Aboriginal and non-Aboriginal people was sought as to whether the study should proceed. "Aboriginal people are experts in researching researchers" (Peters-Little, 2000, p. 3) and those in Tremayne had developed a personal trust in and respect for me. They understood that my intention in conducting the study was to enable them to voice their concerns to help benefit Aboriginal children in their learning of mathematics. It was through my conversations with the stakeholders involved in this research that I came to appreciate more fully that it was my personal connection with the Aboriginal people within this community that allowed me to undertake this study but I did not want to exploit this.

During a meeting with executive members of the NSW AECG issues were raised relating to the proposed study and my personal concerns. They supported the direction of the study and advised that the study should be undertaken in a community where I was known and respected. It was due to this advice that my idea of negotiating with the community in Tremayne was confirmed. Before seeking access to Tremayne, I prepared myself by informing other Aboriginal groups of the proposed study. One was the Aboriginal Education Unit, at the University of Western Sydney (UWS) Macarthur, the tertiary institution through which the study was conducted. Several meetings with the unit's Director were held to discuss the purpose of the study, provide information about the relevance of the study and answer questions.

Another opportunity arose in Tremayne. I had worked there over the previous six years and was due to return to complete some tasks in late August, 1993 and to attend a Regional Aboriginal Education Advisory Committee meeting of the NSW Department of School Education. I drove to this meeting with Michael and Andy, members of the local AECG. We talked about many issues relating to Aboriginal Education. It was during this trip that I raised the idea of the research proposal. I had taken a long time to ask them, for it is not easy to ask friends for advice and support. There was immediate support for the idea.

In the following two days I approached the Principal of Ellen Road Public School to discuss the proposal and to gain a feeling for the degree of support for it. There was a positive response that indicated I could now seek official approval from the NSW Department of School Education regional research committee. I also visited other
Aboriginal and non-Aboriginal people and agencies in Tremayne.

Shortly after my return to Sydney I received a telephone call from the Secondary Mathematics Adviser at the Tremayne Educational Resource Centre. He was ringing on behalf of the Cluster Director. It eventuated that one of the Aboriginal community had spoken to the Cluster Director and suggested that he ask me to talk to some of the Principals and teachers concerning Aboriginal children and mathematics. The Cluster Director, later, indicated that any of the government schools in that cluster could be used for the study if the proposal was approved by the NSW Department of School Education. These calls further strengthened my resolve to undertake the study.

A further meeting was held with the staff of the Aboriginal Education Unit of UWS, Macarthur to discuss the proposed study. On the same day the study was discussed with the NSW AECG research officer. Over the next two months, contact with key individuals in both Sydney and Tremayne was maintained. Follow up discussions were held with representatives of the NSW AECG, the Aboriginal Education Unit at UWS, Macarthur and the Executive chair of the NSW Department of School Education research committee.

In November 1993, a trip to Tremayne focussed on clarifying the study and research procedures with school Principals, members of the Aboriginal community, the Cluster Director, staff at the Education Resource Centre, Ellen Road Public School staff, Aboriginal community agencies and staff at the Tremayne regional office of the NSW Department of School Education. Official approval from the NSW Department of School Education to undertake the study at Ellen Road Public School was given in December. By February 1994, Aboriginal community people, relevant district educational personnel and school staff had approved the study.

**Ellen Road Public School**

Ellen Road Public School was a two stream primary school, with two classes in each grade and a staff of nineteen teachers [18 non-Aboriginal; 1 Aboriginal] and an enrolment of four hundred and twelve students. The school had three full-time Aboriginal Education Assistants with specific roles and responsibilities in the area of Aboriginal Education. An Aboriginal community centre had been established one kilometre from the school and a significant number of Aboriginal people, primarily Darruk and Gamilaroi, lived nearby. There were a number of assisted Housing Commission homes within the community and there were many children who came from single parent and de facto family backgrounds. Many families had more than two children with most of these children being primary school age or younger.

**Participants**

Forty three participants were interviewed during the reported study at Ellen Road Public School. After seeking approval for the study from the school Principal, a meeting was arranged with the Year 5 and 6 teachers to explain the purpose of the study and to seek their participation. All teachers agreed to be involved. Consent forms and an explanatory letter were forwarded to parents and guardians seeking permission for Aboriginal children to be interviewed. The consent forms were distributed through the teachers and the
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Aboriginal educators. Aboriginal children were interviewed based on the return of these forms granting consent. Requests to interview parents of the Aboriginal children were distributed through one of the Aboriginal educators at the school. Though the Aboriginal educators at the school knew about the study, from previous discussions and the work undertaken at St Mary’s, a meeting was arranged to discuss and clarify any issues of concern. They all agreed to be interviewed.

Teacher interviews involved only the teachers on the specific Year 5 and 6 classes participating in the study. As a critical core of participants 11 Aboriginal educators within the town agreed to be interviewed. This group comprised eight Aboriginal Education Assistants, including three from Ellen Road, two Aboriginal teachers and one Home School Liaison Officer. All the parents of Aboriginal children who were interviewed also had their child/children interviewed. Student interviews involved all Aboriginal students in Years 5 and 6 who were given parental permission to be part of the study. Thus, the participants interviewed in the study were:

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aboriginal students - girls</td>
<td>13</td>
</tr>
<tr>
<td>Aboriginal students - boys</td>
<td>8</td>
</tr>
<tr>
<td>Aboriginal parents</td>
<td>6</td>
</tr>
<tr>
<td>Aboriginal educators</td>
<td>11</td>
</tr>
<tr>
<td>Non-Aboriginal teachers</td>
<td>5</td>
</tr>
</tbody>
</table>

Pseudonyms were used for participants throughout the reporting of this study. Aboriginal educators are identified using first names as are the children. Teachers are referred to by their surname. Parents varied, some are identified by a surname, others by a first name depending on how they introduced themselves during the interviews.

On-site procedures

There were four stages to my involvement within the school. They are identified as the (1) initial approach, (2) implementing the study, (3) follow up report and (4) exit. The initial stage involved two levels of approach in seeking the school’s permission to undertake the study. They can be categorised as a ‘primary exploratory approach’ (discussed previously) and a more formalised ‘secondary approach’. Both approaches were complex and involved time in creating links with school personnel, clarifying the purpose of the study, developing within-school procedures for the study, becoming known by the staff and coming to know the school better.

The ‘formalised secondary approach’ refers to the contacts and negotiations that occurred as well as the time spent and interactions between the researcher and community members before the commencement of the school contact aspect of the study. During this time a number of meetings took place, including:

- initial meeting with the Principal;
- meeting with the Principal and executive representatives;
- meeting with Principal and Aboriginal educators;
- other such meetings with staff as required;
- a general school staff meeting;
• meeting with Year 6 teachers;
• meetings with parent groups: P & C, ASSPA committee;
• meetings with children and groups of children as appropriate;
• informal meetings with the teaching staff: about the school, in classrooms and staffroom;
• informal meetings with the administrative staff: in the office area, staffroom;
• telephone conversations with teaching and administrative staff;
• the explanation, clarification, distribution and collection of teacher confidentiality forms;
• the distribution and collection of parent consent forms.

The week before the implementing phase of the study, the intensive time in school, teachers distributed the parent consent forms and collected the returns. I visited the school to collate and begin to organise interview times for teachers, parents and children. Records of these meetings were maintained through the use of a diary. Entries and initial analysis were made to identify the stages of researcher access to the school and other issues, related to the study, raised by teachers and parents.

‘Implementing the study’ refers to the actual in-school involvement of the researcher. This is the period after formal discussion and procedures of the initial stage have been finalised where the collection of in school data takes place. During this stage there is a change in the degree of developed interpersonal relationships. As people come to know each other somewhat better through initial and shared experiences within the site the approaches tend to enter a level of professional relationship which could be called a tertiary level. These relationships strengthen over time with interpersonal approaches being made at a more open and responsive level.

The initial weeks in the school involved the researcher in establishing a presence and organising interviews with children, teachers and parents, as determined by the returned consent forms. The following procedures took place during the time spent in the school.

(i) Conversational interviews were arranged with children, Aboriginal educators, teachers and parents. These interviews comprised confidential one on one or one to small group interviews as determined by the participants. The interviews took place in a suitable location in the school. With interviewee approval, interviews were audiotaped. When approval was not granted a paraphrase of the responses and pertinent issues was made by the researcher. The presence of an Aboriginal educator was appropriate with some children and parents to lessen the participants' anxiety and in order to elicit more information.

(ii) Unplanned, informal, conversational interviews with children, Aboriginal educators, teachers and parents did occur. The essence of these was recorded in the form of fieldnotes by the researcher.

(iii) The researcher maintained fieldnotes during the development and implementation of the study.

Several steps were taken to obtain valid and reliable data.

1. Five months were spent formally associated with Ellen Road Public School
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whilst the researcher lived in the community for nine months.

2. The researcher spent time with participants and in classes to establish relationships directly with both teachers and students and indirectly with parents through formal and informal meetings. The initial weeks in the school were spent interviewing parents, teachers and some of the students. This supported the establishment of a relationship of trust and integrity between the participants and the researcher.

3. Visits to classrooms and arrangements for interviews were negotiated with each teacher.

4. In discussions with all participants and through consent forms the critical issue of confidentiality continued to be emphasised.

5. Reflective meetings with the Principal, teachers, Aboriginal Education Assistants and students were undertaken during the progress of the study.

6. Detailed fieldnotes of the research process were maintained during the study.

The initial stages of implementing the study involved the maintenance of links that had been established with individuals and the further expansion of suitable networks of contacts with appropriate people. There were several meetings with Year 5 and 6 teachers to clarify the process of the study, to check on variations to the school organisation and to further strengthen relationships. There were informal meetings with school-based community groups and school administrative staff. Parental consent letters were distributed and collected. Once on site, an overall timetable of action, identifying specific purposes, was developed.

Two critical tasks during the intensive time of the implementing phase were to establish rapport with children, school staff and parents and to negotiate interviews with children, Aboriginal educators, teachers and parents. Contact had to be maintained with all the school staff - teachers and administrative staff - to establish my presence within the school. Similar links had to be established and maintained on a daily basis with the Year 5 and 6 children. Invitations to visit classes were accepted to assist in developing links with children and teachers. Attendance at relevant parent and community meetings [Parents & Citizens; Aboriginal Student Support Parent Association; Aboriginal Education Consultative Group] established links with parents. Relevant school documentation was gathered.

Shortly after interviews began, the transcription of audiotapes began. This enabled initial data analysis and coding to begin. Many weeks were spent in conducting interviews, transcribing them and developing an initial analysis of participant views. Towards the conclusion of the time spent at Ellen Road Public School an initial draft of findings was presented to the Principal, at a school staff meeting and to the ASSPA and P & C groups. The findings were discussed with regard to how they could be incorporated into the teaching of mathematics at the school and the school’s mathematics curriculum.

The ‘follow up’ stage of the research can be researcher- or school-directed, or both. This stage involves follow up work that may come from the study itself and the involvement of the researcher within the school. In this study it involved further visits to the schools to report, present findings, to validate emerging ideas and to respond to requests for school staff meetings and staff professional development sessions in the form of mathematics
workshops. Not all requests were specifically directed to the purpose of the study but came about because of my presence within the school community. In the case of Ellen Road Public School this involvement included staff meetings, ASSPA meetings and a three day Parent Workshop developing an Aboriginal Education strategic plan for the school.

The exit stage provided continued feedback to the school and the completion of previously negotiated school requests from the Principal, school staff and Aboriginal community.

**Data collection tools**

Data were collected using a number of conventional techniques for ethnographic studies. These were participant observations, interviews, school documentation and fieldnotes. A broad description of each and their role in the study are given in the following.

**Participant Observation**

In mathematics education research the purpose "of the observation is to develop an understanding of the ways in which a mathematics culture is being constructed and reproduced within the context of that school" (Zevenbergen, 1998, p. 21). In the current study the researcher took the role of overt participant observer entering the study "without specific hypotheses or preconceived notions...[for, to do so would]...impose preconceptions and perhaps misconceptions on the setting" (Bogdan & Biklen, 1992, p. 26). The study gathered evidence to build up a grounded theory related to the expressed mathematical beliefs of the participants.

The presence of an observer, as a participant but an outsider to the situation, may well affect the interactions and the processes that occur in the observed situation (Sowder, 1998). How the participants view the observer will affect the data collected. If the participants are anxious, worried or concerned about the observer's presence there may well be a different mode of interaction in the site from that of a participant who is comfortable and supportive of the observer's presence. It is important for the participants to know the role and the purpose of the participant observer.

The observer's tasks include recording events, interactions, comments and other happenings that occur in the site. The practicalities of the observer addressing how data is to be collected, through the use of either audio and/or videotape, and the development of observation schedules appropriate to the specific context of the study need to be considered. Though observations are time consuming and can only be used to study the present event, they are a means of comparing and validating verbal or written information given in an interview or questionnaire. It is essential that after an observation period the observer take time with key 'actors' to reflect on what occurred to further validate the observer's interpretations.

However, there are difficulties to be considered with participant observation. A researcher can become too close to the action occurring within the site and may become too involved (Delamont, 1992). The participant observer has to appreciate when and how to step back from the action to place observations in perspective.
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Interviews
In this study of Aboriginal and non-Aboriginal people's views towards the nature and learning of mathematics it was considered appropriate to use conversational interviews with interviewees. Each interview is an unique experience with supports and constraints peculiar to that situation. The most crucial skill of the interviewer is listening (Bogdan & Biklen, 1992). For, "ultimately it is the researcher's decision as to what will be included...it is vital that the voice of the participants be heard and represented, rather than being subjugated to the voice of the researcher" (Zevenbergen, 1998, p. 29). Talking with, listening to, answering questions and clarifying the intentions of the study will help participants decide whether or not they will participate in the study and to what degree.

This use of conversational interviews provided participants with the opportunity to express themselves as fully as possible when discussing issues that were of direct concern to them. The interviewer utilised the interviewee's comments asking 'flow on' questions seeking further information in clarifying and extending comments. Transcripts of all interviews were made and checked for accuracy by the researcher by testing the content against fieldnotes and in discussion of identified issues with participants. In conducting the interviews, consideration was given to resolving issues of interviewee sample bias, gender bias, peer influence when in pairs and whether or not students would be interviewed as individuals or in pairs or as a group.

Interview bias was further reduced in that all the Aboriginal educators in the town agreed to be interviewed as did all the Year 5 and 6 teachers at Ellen Road Public School. The numbers of Aboriginal children interviewed helped reduce interview bias and enabled a more comprehensive reporting of Aboriginal children's espoused beliefs. The parents of Aboriginal children were fewer in number than other participant groups and this could raise concern of interview bias. However, the comments of this group were checked with the Aboriginal educators, most of whom were parents themselves, and with my experiences gained from the time spent within the town and the school.

The role of interviews in mathematics education research is "to bring forward different perspectives in order to develop a better understanding of the mathematics classroom" (Zevenbergen, 1998, p. 220). In this study, conversational interviews sought to identify the participant's views and interpretations of events and issues they have experienced (Glesne & Peshkin, 1992). The responses were in the participant's own words and clarification of any issue from the interviewee was sought immediately by the interviewer. The interviewee could also ask the interviewer, at any time, for clarification of any question or statement.

The interviewer's tasks were to establish rapport with the interviewee, to ask questions as they arose within the interview, to clarify what had been said, to seek further information and to keep the interview flowing. Informed consent of participants was gained to audiotape the interviews. Confidentiality procedures and ownership of the material as was the fact that I was the one to transcribe the tapes were negotiated and discussed with the participants (Sowder, 1998). These procedures were negotiated and accepted by the interviewees, not developed and presented as a fait accompli by the researcher.
Throughout the interviews the comfort, privacy and personal protection of both the interviewer and interviewee were maintained. Preference was given to having the interviews visible to others, if this was not possible interviews were held with more than one person at a time. Children and adults often wanted to clarify who the interviewer was, why he was there and the purposes of the interview. These issues were explained and re-explained prior to the interview and through consent letters.

A crucial issue in cross-cultural interviews, where the interviewer is from one cultural background and the interviewee from another, is the effect that this difference may have on the interpersonal power relationships and structure of the interview. Gender and cultural issues may influence the interview process. The researcher has to be sensitive to the issue that there are times a male interviewing a female and vice versa may affect the interview relationship, the amount of detail gained from questions, the emphasis given in answers and the flow of the interview. The researcher needs to understand and be sensitive to the world view of the interviewee. Even then, the interviewer may not be able to fully understand or appreciate what the interviewee is saying because an interviewee's language and cultural perspective may be different to the interviewer's. The interviewer may need to ask for clarification and further comment from the interviewee without intimidating them or downgrading the language that they use.

The pre-interview stage is where participants are given a choice as to how they wish to be interviewed or, indeed, if they still want to be interviewed. Some interviewees may wish to be interviewed individually, in pairs or small groups. They may also wish someone else to be present during the interviews and they should be informed that this could be arranged (Bogdan & Biklen, 1992).

In most interviews there will be evidence of power relationships between the interviewer and interviewees. Such relationships need to be considered by the interviewer in the organisation of the location, the seating arrangements, the welcoming of the interviewee, the flow of the interview and the closing of the interview. Children and adults can feel nervous and anxious when asked to participate in an interview. An interviewer needs to be sensitive to these concerns and adjust the length of the interview or the way in which questions are asked to cater for the signs that an interviewee may give in their body language or responses. Interviewers require high levels of interpersonal skills for there is only one chance for most interviews and a trusting relationship needs to be established almost immediately.

During an interview, the issue of 'wait time' once a question has been asked needs consideration. If this is not done and the interviewer controls the interview too rigidly, prompts or answers the question, the interviewees may feel that their opinion is not valued, may not give a full answer to the question or give an answer they think the researcher wants.

**Fieldnotes**

Fieldnotes of the negotiations between the researcher and various participants and groups were maintained, tracing why decisions were made, the times they were made and the means by which decisions were reached about the researcher's on-site participation. Daily fieldnotes recorded observations, reflections and analytical thoughts as they occurred in
the field. During this study, fieldnotes were written in private as soon after an event happened as possible, or as personal reflections emerged. Every effort was made to maintain the fieldnotes as events happened. Throughout the study, the researcher had to be aware of his personal biases and values brought to the site and how they may have affected what was written down and how it was written. Writing fieldnotes was a means of organising the researcher’s thoughts, clarifying issues, developing initial analysis and allowing for the possible linkage of what initially appeared to be independent, yet often connected occurrences.

The fieldnotes were descriptive of the events and people observed, reflective of the instances that occurred throughout the study and might be analytical where they began to suggest links between data and nominated categories for analysis (Howard, 1995). They aimed to be an accurate description of what was read, observed, experienced and heard. Fieldnotes helped identify the development of the study as ideas, strategies, reflections, and hunches were recorded, and patterns began to emerge from the collected data. Though difficult, time consuming and burdensome, consistency in recording fieldnotes was important to a study. Descriptions of people and locations, records of particular events and activities, summaries of conversations as well as comments related to the researcher’s personal behaviours were included.

Fieldnotes provided opportunities for reflection. Personal feelings of what were written, ideas generated and proposed connections within the data were all aspects of the reflective nature of data analysis and interpretation. The foci of reflective fieldnotes were the researcher’s ideas, feelings, suggestions and impressions. Reflective fieldnotes speculated on the themes and patterns which emerged, reflected on methodological problems encountered and possible decisions, gave consideration to ethical dilemmas and conflicts, were concerned with personal presumptions and acted as a means of clarifying difficult or confusing research issues (Bogdan & Biklen, 1992). The reflective aspect of fieldnotes focused on ideas, hunches, feelings, suggestions and impressions. The personal feelings about an event, the ideas generated and the connections made during the study impacted upon the later interpretation of the collected data and needed to be recorded.

The fieldnotes comprised the entries for the time in Ellen Road Public School. They took the form of describing events and people observed, reflecting on incidents and personal experiences that occurred throughout the study and analysing categories for interpretation as they began to emerge. Fieldnotes were analysed using organisational- and issue-based approaches. The organisational analysis related to the research process. Issue-based analysis related to specific elements affecting Aboriginal children’s learning of mathematics.

Constas (1992) suggested there are two domains concerning the categorisation of fieldnotes: ‘the components of categorisation’ and their ‘temporal designation’. The first domain involves the origin, verification and nomination of categories. The second relates to when categories were nominated: before the study (a priori), during it (iterative) or after the study (a posteriori). It is within this framework that the fieldnotes were scanned, initially, for an overall impression and then analysed in detail to identify emerging categories. It was considered that all fieldnotes were within the context of the study. Thus
they were analysed as a continuous report, disregarding the barriers of time, date and location. Three broad categories - descriptive, reflective and analytical - were used for the initial analysis of the fieldnotes. The descriptive category refers to the recordings of the site including buildings, the geography of the location and the composition of the population. The reflective category contained those fieldnotes generated from personal thoughts and feelings about people and events. Analytical refers to those initial interpretations linking data, identifying patterns and leading to initial interpretation and emerging categories for in-depth analysis.

After these three broad categories were identified, a further analysis of the reflective fieldnotes was undertaken to identify and label any independent categories. The categories that emerged originated from an investigative perspective based on the constructions of the researcher from the literature and his experiences in the field. Nominations for the categories were initially created during the study (iterative) based on a rational approach focussing on the functional consistency of the categories (Constas, 1992). There was some collapsing of the categories a posteriori.

Five major categories emerged from an analysis of the reflective fieldnotes (Howard, 1995). For each of these categories further sub-categories (dimensions) were identified. The categories were defined as fieldnotes related to:

- the planning of actions for maintenance of the study
- the researcher's interactions with others
- the impact of experiences on the researcher
- the site and location of the study
- issues related to the area of investigation

Organisational
Throughout the study, there were reflective fieldnotes indicative of organisational issues that helped to set the direction of the study, suggested possible scenarios to be considered, and identified organisational factors to be considered. Examples taken from the fieldnotes related to the overall organisation of the study, the order for interviews to be held, selection of the interviewees, the location for interviews, communicating to teachers the daily interview schedule, the writing of fieldnotes, the maintenance of approval channels within the school and procedures for leaving the site of the study.

Relational
Reflections on relations with the participants emerged throughout the fieldnotes. They concerned personal views on:

- the role of the researcher in the school;
- the need to build a trusting and respectful rapport with the staff;
- the degree of contact with the Principal;
- maintaining the momentum of relationships;
- reporting to people;
- the external evaluation of the researcher's presence within the school;
- the researcher's presence and function in the staffroom;
- relating to Aboriginal parents;
- insights into the observations of children, and,
Methodology

- the personal use of school resources.

There were more relational fieldnotes than for other categories, indicative of the intense interpersonal nature of the study. It was through recording, acknowledging and reacting to relational fieldnotes that the effective and efficient implementation of the study was maintained.

**Personal**
The analysis of any research process includes how the study impacts upon the researcher at a personal level. During this study there were reflective comments about the personal energy required to maintain the study and relationships, aspects of the site that both excited and annoyed the researcher and personal issues related to leaving the site.

What the researcher learns about and reflects on throughout the research process helps to identify personal issues to be addressed within the study, highlights personal research skills to be addressed and extends the researcher's personal skills for the future.

**Contextual**
As the study evolved and participants came to trust the researcher, comments about the actual site were more forthcoming. Such comments, reflections and observations broadened the researcher's knowledge of the site. Fieldnotes, categorised as contextual, provided an opportunity to view and interpret aspects about the site that impacted on those within it.

**Topical**
This category identified personal thoughts and participant comments about the teaching and learning of mathematics. Fieldnote examples related to the context of learning mathematics, teaching mathematics, content areas of mathematics, the use of calculators and the role of textbooks in teaching mathematics.

The analysis of fieldnotes reinforced the complex nature of ethnography. It took detailed planning and consideration of crucial organisation, contextual and interpersonal relationships factors to implement and maintain this ethnographic study. Reflective fieldnotes played a crucial role in the collection of data related to the research process. The consistent use of fieldnotes enabled the researcher to view the research process over time in detail and holistically.

**The people processes of this ethnographic study**

Four ethnographic phases of the study have been identified: establishing, implementing, interpreting and exiting. Each of these phases involved several interactive ‘people processes’ that needed to be foreseen, considered and planned for by the researcher.

The first phase - establishing - included the people processes of identifying, approaching, focussing, negotiating, reciprocating and approving. During the second phase - implementing - the issues of entering the site, raising expectations, and gathering data were identified. The third phase - interpreting - focussed on monitoring, reporting and meeting expectations. Finally - exiting - evidenced the issues of withdrawing, returning,
leaving and publishing. Across all phases the people processes of consulting and providing feedback were essential to the study.

During this study the researcher recorded what was seen, heard and told and then tried to make sense of these data. Many of the data emanated from the collection, analysis and interpretation of language. These came about through communications that the researcher heard, material that was read and interactions that took place during the study. My personal background involved in teaching and mathematics education assisted me in being able to ask appropriate questions during interviews that helped to clarify participant comments. Personally transcribing the recorded interviews enabled me to ‘re-visit’ the interviews during the data analysis. Sharing the initial analysis with the Aboriginal educators and non-Aboriginal teachers helped inform interpretations.

Ethnography involves working intimately with people and communities over a period of time. As a researcher’s presence might impact upon participants it is important in ethnography that the participants are involved ‘with’ the study and that they do not just take a part ‘in’ the study. If they are true collaborators within a study, willing to give of themselves and their life stories, researchers have an obligation to involve participants in all aspects of the study. Successful ethnography is dependent upon the participants’ continued approval and co-operation with the researcher. This includes the researcher returning to the site during the analysis of data. Further, it includes the presentation of findings to participants for feedback before the findings are presented to others.

Consultation with, and feedback to, the participants continued throughout the study. It was necessary to continually identify and maintain the necessary networks of people to talk with, to take advice from and to consult in a meaningful way with those involved to overcome power-based issues of the researcher-participant relationships (Zevenbergen, 1998).

Such consultation necessitated the development of networks and the provision of feedback loops to students, teachers, parents and community members who were seen to have ownership of the study. These processes were carried out in a planned formal agenda of meetings as well as informally, as opportunities arose. They were evidenced in Parents and Citizens Meeting presentations, staff meetings, grade meetings, Aboriginal Student Support and Parent Association meetings, local Aboriginal Education Consultative Group meetings, conference presentations and informal discussions with parents, educators and children.

The challenges of identifying the agencies and individuals involved in the study, establishing the people networks and maintaining effective consultation and feedback processes did not just happen. They had to be planned by the researcher. Such planning enhanced the collaboration throughout the study, provided ownership to those involved, negated criticism of secrecy during the study and provided opportunities to validate the initial analysis of the collected data. Initially, the establishment and maintenance of effective processes assisted the setting of goals and outcomes for the study. Throughout the study such processes allowed for the development of negotiated meanings leading to significant research findings. Throughout the study the development and maintenance of positive relationships between the researcher and the Aboriginal and non-Aboriginal participants assisted in the analysis and interpretation of the data.
Approaches to data analysis

Three methods commonly used in analysing qualitative research data are analytic induction, constant comparative and grounded theory.

*Analytic induction is an approach to collecting and analysing data as well as a way to develop theory and test it. The procedure of analytic induction is employed when some specific problem, question or issue becomes the focus of research. Data are collected and analysed to develop a descriptive model that encompasses all cases of the phenomena. The procedure has been used extensively in open-ended interviewing, but it can be used with participant observation and document analysis as well.* (Bogdan & Biklen, 1992, p. 70)

“The constant comparative method is a research design for multidata sources, which is like analytic induction in that the formal analysis begins early in the study and is nearly completed by the end of data collection” (Bogdan & Biklen, 1992, p. 73). The emphasis is on the researcher enlarging the theory by analysing data from which key issues are identified as core categories. Through sampling, coding and writing about the core categories a model emerges that enables description of basic social processes and relationships (Bogdan & Biklen, 1992).

The grounded theory approach using data intensively derived from interviews and field observations (Strauss & Corbin, 1990) emphasises the development of an emerging theory about a particular problem or issue based on the analysis of the collected data. Grounded theory methodology “emphasises the need for developing many concepts and their linkages in order to capture a great deal of the variation that characterises the central phenomenon studied during any particular research project” (Strauss, 1987, p. 7). Questions are raised and links between responses and categories begin to emerge during data analysis. Emerging theory has to be identified, developed and validated.

When grounded theory is used “then deductions are made in the form of theoretical questions, hypotheses, suggestions of theoretical sampling, possible categories and so on. They lead directly into the initial phase of collecting and analysing data” (Strauss, 1987, p. 13). As new data are collected and coded the researcher generates questions seeking answers to: How?; When?; Why?; What causes that ...? As the study progresses the researcher generates ideas seeking relationships, similarities and significant differences in the collected data. During data collection and analysis the researcher is responsible for “genuinely checking or qualifying the original data; interacting deeply with his/her own data; developing new theory on the basis of a true transaction between the previous and newly evolving theory” (Strauss, 1987, p. 14).

This study used a constant comparative grounded theory approach in gathering, analysing and interpreting data. To ensure reliability and validity the researcher used his developed personal knowledge and skills of working within schools, rural locations and in cross-cultural contexts. As discussed, the researcher maintained a field based research diary and a continuous process of ongoing reporting to participants of emerging issues for verification and further clarification throughout the study. The use of multiple data sources and triangulation in cross checking and cross-referencing the consistency of the
collected data, in comparing and contrasting espoused beliefs and in the interpretation of the data further ensure the study's reliability and validity.

**Initial analysis and coding of collected data**

Initial analysis begins, as data are collected, with the researcher developing links and patterns in the data (Zevenbergen, 1998). Understanding the complexity of a situation comes through "successively evolving interpretations made during the course of the study. It is necessary to be detailed in the examination of the data in order to bring out the amazing complexity of what lies in, behind and beyond those data" (Strauss, 1987, p. 10). As the analysis develops, complex links and patterns may emerge in the collected data. The task is to reduce this complexity by teasing out the details.

One method for recording scattered thoughts and ideas about linkages is the use of memos. The consistent use of memos helps to order and clarify both the analysis and interpretations of the data being developed. As the researcher begins to analyse and code the data it is beneficial to record the origin and labelling of particular codes (Constas, 1992). The analytic work done during fieldwork allows the researcher to test insights for analysis although it can be full of uncertainty and complexity. During data analysis researchers have to consider the possibility of their own biases in interpretations for "ethnographers are conscious of the cultural conventions that are their subject matter, but have all too often remained blissfully unaware of their own cultural connections" (Atkinson, 1990, p. 175). The effect of individual biases can be lessened with researchers sharing the results of initial and subsequent analysis with participants to verify the validity of the findings. Regular reference to the study's research questions is essential in data analysis. Throughout the analysis, questions have to be continually asked about the data, the categories, the coding system and the diagrams.

Initial open coding begins as the researcher reads through the data, making memos of possible categories and links between elements of the data asking:

* What category does this incident indicate?*
* What is actually happening in the data?*

As the analysis continues, the researcher needs to be critical of the code and not to move too quickly into accepting what has been developed. All codes and their labelling are provisional and can be modified as initial categories may not identify the data distinctively enough.

In developing a set of categories for data analysis a coding approach can be used that considers cue words like 'mathematical language', verbal interactions amongst the participants and events that occur during the study (Strauss, 1987). When one of these elements of the coding paradigm is examined in more detail, further categories and sub-categories may be identified. This process, referred to as axial coding, occurs after initial open coding as the analyst is moving towards the development of core coding categories. The development of a core category or categories evolving towards the identification of sub-categories in the analysis of the collected data allows for the integration and linkage of the different aspects of the study. The constant comparative method of category development aids this process.

A further aspect of coding, based specifically on the language of the people, context and
cultural influences involved in the study, was the identification of in-vivo codes which related specifically to the language terms used by the people in the study. Such codes have two characteristics “their analytical usefulness relates the given category to others with specific meaning, and carries it forward easily in formulation of the theory. In-vivo terms have a very vivid imagery, inclusive of much local interpretative meaning: they have ‘grab’ for the participants” (Strauss, 1987, p. 34). Such codes emerged directly from participants’ language. One such code within Aboriginal children’s comments related to the issue of ‘shame’ a feeling that Aboriginal people have when they feel embarrassed in front of others. A particular reference was the feeling of ‘shame’ that Aboriginal children have when they were unable to complete a mathematical task or answer a mathematical question when asked to do so in the front of non-Aboriginal children.

As data are analysed, interpretations are made, categories are selected and re-examination of these categories takes place. Initial categories may be discarded when more appropriate category terms are identified. More detailed category analysis will lead to the development of sub-categories. Core categories will evolve as data are analysed in terms of the researcher’s experiences, expertise and background. They identify behaviours and comments of the participants suggesting linkages throughout the collected data. A core category may evolve as central, related to other categories and have clear implications for a more general description of the context of the study. Once core or central categories have been identified some selective coding may take place (Strauss, 1987).

Summary

This study seeks to understand the classroom mathematical learning experiences of Aboriginal children in Years 5 and 6 through an interpretation of the voices of Aboriginal children, their parents, Aboriginal educators and non-Aboriginal teachers. Bempchat and Drago-Severson (1999) believe that such studies “will illuminate not only the deeper meanings that students attach to their experiences in school, but also will allow us to listen closely to the stories and narratives of their experiences” (p. 289). This ethnography utilises field based methods of interview and observation to better understand how Aboriginal students attach meaning to their school-based mathematical experiences.

The levels of cultural sensitivity, awareness and knowledge of the people processes required to maintain effective ethnographic research in a specific context require a high degree of researcher expertise. Research skills, such as, being able to relate to people, to appreciate social and cultural factors related to the context of the study, to develop mutual trust and respect with participants, and to acknowledge the worth of the people involved in the study, are acquired over time. These skills develop through personal critical reflection of previous research work and through listening to and acting upon the critical evaluations of others. It has to be recognised that there is a significant time dimension in undertaking collaborative research in cross-cultural settings. Time is a critical factor in this type of ethnography that differentiates it from other pedagogical research.

The planning and reporting of the methodological issues related to people processes within ethnographic studies enhances the importance of the research in the eyes of the wider community. The consistent and detailed use of fieldnotes is crucial in any ethnographic research. The analysis, reporting and sharing of these fieldnotes assist others
in their understanding of the research process that occur during the study. Though the emphasis of an ethnographic study is on describing, analysing and interpreting the study’s context it is also about what happens to the researcher in the field. Throughout a study researchers undergo personal changes, learning about themselves as well as the research process.

This study involved me, a non-Aboriginal researcher, working with Aboriginal and non-Aboriginal people in a rural setting. I began to work in this rural community in 1988 on an educational program that strengthened my view that Aboriginal children were not reaching their potential in their learning of primary mathematics. There were personal struggles in undertaking this research with Aboriginal people with whom I had developed a close friendship. Numerous conversations with Aboriginal people were held to clarify, for myself, the benefit of this study for the Aboriginal community in which the study took place and that I was an appropriate person to undertake the study. It was only with the support of the Aboriginal people involved in the study and those who knew me and gave me their trust that this study began.

This description of the methods used in establishing this study and the recognition of the consultation and negotiation needed in Aboriginal educational research provide a framework in which this study takes place. The following chapters provide an opportunity for the voices of Aboriginal and non-Aboriginal people to be heard as they tell their stories about their school experiences of the learning and teaching of mathematics. Their voices express their beliefs about Aboriginal children’s learning of mathematics in Years 5 and 6.
Chapter 4

Data Analysis Categories

Background to data analysis categories

The focus of this study was to investigate the espoused beliefs of Aboriginal and non-Aboriginal people towards mathematics and the learning of mathematics in Years 5 and 6. The data were gathered from one government school in a rural New South Wales community. The community is referred to as Tremayne, the school as Ellen Road Public School and pseudonyms are used for all participants. Specifically, the research questions were:

1. What are the beliefs expressed by Years 5 and 6 Aboriginal students, in a rural community, about mathematics and the learning of mathematics?

2. What are the beliefs expressed by parents of Years 5 and 6 Aboriginal students, in a rural community, about mathematics and student’s learning of mathematics?

3. What are the beliefs expressed by Aboriginal educators, in a rural community, about mathematics and students’ learning of mathematics?

4. What are the beliefs expressed by non-Aboriginal teachers, in a rural community, about mathematics and student’s learning of mathematics?

5. How do these sets of beliefs compare and contrast?

6. What are the pedagogical consequences for the learning and teaching of mathematics based on these expressed beliefs?

This thesis proposes that there need to be investigations of the socio-cultural contexts in which the learning of mathematics takes place. The research aims “to obtain a more elaborate picture of teachers’ knowledge and beliefs... as they apply to their diverse student populations” (Secada, 1992b, p. 22). Overall, it investigates the views held by Aboriginal students, their parents, Aboriginal educators and teachers about mathematics and children’s learning of mathematics and reports those views in the terms used by the people interviewed.

Coding processes

It was intended that the outcomes of this study would be grounded “in the collected data
rather than based on some a priori constructed ideas, notions or system" (Wiersma, 2000, p. 12). Through the voices of the Aboriginal and non-Aboriginal people involved, this reports participants' beliefs about how Aboriginal students in Years 5 and 6 learned mathematics in one rural context.

Interviews were transcribed and reviewed using a constant comparative method (Glaser & Strauss, 1967), involving constant interplay between the researcher, the collected data and emerging ideas. Across the study, stages of open coding, axial coding and selective coding occurred (Strauss & Corbin, 1990). Open coding occurred in reading and analysing transcripts from initial interviews. From this analysis, initial labels for participants' comments were made (see Table 4.1).

### Table 4.1

<table>
<thead>
<tr>
<th>Participant Group</th>
<th>Particular Category Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aboriginal students</td>
<td>Feelings; People; Learning; Technology; Materials;</td>
</tr>
<tr>
<td>Parents</td>
<td>Homework; Parental Involvement;</td>
</tr>
<tr>
<td>Aboriginal Educators</td>
<td>Language; Context; Family Concerns;</td>
</tr>
<tr>
<td>Teachers</td>
<td>Assessment; Teaching; Relevance; Structures; Content;</td>
</tr>
</tbody>
</table>

The concepts and ideas that were formed in this open coding continued to be modified and developed into categories which were defined in terms of their properties, as evidenced through interview transcripts. During the open coding, 15 categories were derived from and grounded in participant comments as shown in Table 4.1. During the axial coding stage, analysis of all interviews using the formed categories (see Table 4.2) was undertaken.

### Table 4.2

<table>
<thead>
<tr>
<th>Categories</th>
<th>Feelings</th>
<th>People</th>
<th>Language</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevance</td>
<td>Homework</td>
<td>Materials</td>
<td>Learning</td>
<td></td>
</tr>
<tr>
<td>Teaching</td>
<td>Structures</td>
<td>Technology</td>
<td>Assessment</td>
<td></td>
</tr>
<tr>
<td>Family Concerns</td>
<td>Parent Involvement</td>
<td>Content</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data were drawn from conversational interviews, rather than structured or semi-structured interview schedules, and consisted of open comments from the participants. When points were raised by the participants that required further investigation clarifying questions were asked by the interviewer. Each participant was interviewed once, with the length of interviews varying.

All interviews were recorded in transcripts [Aboriginal children – 21; parents of Aboriginal children – 6; Aboriginal educators – 11; non-Aboriginal teachers – 5] and analysed using the 15 categories that were formed through the open coding stage. Not all 15 categories were identified in each transcript. During the axial coding stage data were organised to better develop the interpretation and reporting of participant beliefs about Aboriginal students' learning of mathematics. The third stage of the process involved selective coding.
where the participant data and results from the open and axial coding were further refined. The continued refinement and categorisation of participant comments linked to the reporting of participants' beliefs about Aboriginal students' learning of mathematics led to an understanding of the issues and implications for Aboriginal children's learning of mathematics.

**Description of categories**

In this section each of the 15 categories is described. Selected relevant interview quotes are provided as indicators of the sources of each category and exemplars for them. Where appropriate, links are made between the formed categories and *A National Statement on Mathematics for Australian Schools* (Australian Education Council, 1991).

1. **Feelings about mathematics** relates to me and mathematics. This category identifies how an individual feels and thinks about mathematics.

   *Mostly I like doing measurement cause you can go out from the classroom without no one else mucking about.*

   (Judy, female Aboriginal child)

   *He (Mrs James' son) said that he's no good at maths. He doesn't want to go up to high school because he's no good at it.*

   (Mrs James, parent)

The development of positive feelings and confidence towards mathematics is seen as a priority in mathematics classrooms (AEC, 1991). The quote from Mrs James is an example of the research evidence which “suggests that many people dislike mathematics and may even feel intimidated in situations in which it is used” (AEC, 1991, p. 7).

2. **People** identifies those people involved in children's learning of mathematics.

   *Mum sometimes helps me.*

   (Tom, male Aboriginal child)

   *If it's hard I ask him [Dad] because Mum, she doesn't know much about maths.*

   (Meryl, female Aboriginal child)

There are a number of different people who influence children’s views related to the nature and learning of mathematics. Parents, relatives, teachers and peers may assist or hinder the learning of mathematics.

3. **Language** identifies those comments related to the role of language in mathematics.

   *For some kids it's like learning another language and we might change things. We might call it, “add up” and the next teacher says, “we'll do these addition sums” and the next says, “addition algorithms”.*

   (Mrs Allan, teacher)

   *A lot of maths language is just too hard to understand for the kids.*

   (Carmel, Aboriginal educator)
Language is seen as a way in which students can communicate, record and reflect on what they have learnt in mathematics and a way through which such learning can be achieved. Many Aboriginal children have difficulty with the language of the mathematics classroom. “A command of mathematical terminology and verbal, symbolic, diagrammatic and graphical models of representation is essential in learning mathematics and is part of numeracy” (AEC, 1991, p. 13). This has particular importance for students from non-English speaking backgrounds including Aboriginal children where Aboriginal English is the predominant language in the home - the situation with most of the Aboriginal children living in Tremayne.

4. Context identifies issues related to the social, cultural, economic, historical and political contexts in which the learning of mathematics takes place.

Nobody expects Aboriginal kids to be anybody. They expect them to be on the dole and stay that way. Kids live up to what’s expected of them.

(Emma, Aboriginal educator)

The more assimilated you are the more accepted you are. So you be a good little jackie, you’re reliable and prompt and all these things which are requirements of the hidden curriculum.

(Dawn, parent)

Mathematics curricula have focussed on “values and concerns which are more middle class than working class, and ... on experiences which are more relevant to children of Anglo-Celtic descent than those of Aboriginal descent or those from non-English speaking backgrounds” (AEC, 1991, p. 9). Students can experience mathematics within the multicultural context of Australian society through an understanding of the variety of mathematical ideas that come from different cultures. Mathematics learning should build on students' strengths with mathematics educators avoiding “interpretations of ‘ability’ or ‘intelligence’ based on culturally narrow interpretations of important knowledge” (AEC, 1991, p. 9). Thus, the diversity of students' backgrounds needs to be recognised in the mathematical activities presented in the classroom.

The particular case of rural and urban Aboriginal learners has been recognised by the national statement. “There has been considerable research into mathematics in traditional Aboriginal communities and this has had some influence on the teaching of mathematics in these communities. Most Aboriginal Australians, however, live in rural and urban areas, but there is little research available on the linguistic and cultural influences on their learning of mathematics” (AEC, 1991, p. 9).

5. Relevance identifies comments related to how meaningful the participants find mathematics.

It's not easy to see how you will need mathematics in life itself.

(Mr Kennedy, teacher)

I reckon you can get on and get a job without doing that much maths.

(Brian, male Aboriginal child)
“The opportunity to learn what is intended from an experience is likely to be enhanced if students see its purpose” (AEC, 1991, p. 19). Students' learning of mathematics is enhanced if they can see its relevance to their everyday lives.

6. Homework identifies comments related to the role of homework and mathematics.

There's been times when they've had their maths homework. I've had to sit down and instead of just reading it and saying this is what you have to do I've had to try and decipher what they're trying to say myself.

(Mr James, parent)

I don't give it now cause I was only getting it back from five children.

(Ms Martin, teacher)

School homework often involves children completing set mathematics tasks. In many families, parents are involved in making sure that mathematics homework is given, completed and checked for correctness. It is intended that mathematics homework will support children's learning of mathematics through reinforcing the mathematics taught in class. The quotes suggest some of the mathematics homework difficulties experienced by the parents of Aboriginal children.

7. Materials identifies comments related to the use of materials, such as stencils, texts, base 10 materials, environmental materials, commercial resources and printed matter in the learning of mathematics.

Sometimes you just have to let the children play with the gear and then use it as a learning experience. They're still learning while they play with it but as soon as they've played with it they are more ready to listen to you.

(Ms Martin, teacher)

I don't get the chance to use them [Base 10 materials] in maths. We're too busy doing some things and tests and that.

(Brett, male Aboriginal child)

Classroom mathematics resources should include a wide range of manipulatives comprising environmental and commercial materials (AEC, 1991). There has to be a variety of print and manipulative materials available in the mathematics classroom. The content of such material should be examined for the possibility of gender and racial stereotyping and bias.

8. Learning identifies comments related to how people learn mathematics.

There are some kids who tune out, don't listen, and then don't know how to do something. I'd get cross because they haven't been listening.

(Mrs Allan, teacher)

Yeah. Well ...um ...I just mainly listen and keep my ears open so I can learn more than what I've already learnt cause I may think that I haven't learnt enough so I need to learn more so just listening to the teacher and stuff.

(Natalie, female Aboriginal child)
Mathematics learning is dependent upon the individual creating and building connections based upon existing understandings. Learning in mathematics "requires learners to change and expand their ways of thinking" (AEC, 1991, p. 16). The physical and social environment can stimulate learning. Learners need to act and reflect about their actions and experiences and be challenged in their thinking. "Reflection on experience is needed in order to link new knowledge to existing knowledge, leading to the expansion and refinement of ideas" (AEC, 1991, p. 17).

9. Teaching identifies comments related to the organisation and presentation of teaching and learning activities.

There has to be a good relationship with the teacher. If they (students) don’t like the teacher they are not going to learn and often the Murri kid picks up whether the teacher likes them.

(Angie, parent)

I stress with my class if you don’t understand please ask. That is why I’m here. If you haven’t been listening you must ask me. I say, it’s too late to ask me when I give you a test.

(Mrs Allan, teacher)

“The systematic and formal way in which mathematics is often presented conveys an image of mathematics which is at odds with the way it actually develops” (AEC, 1991, p. 14). When coming to school, students will bring with them a variety of personal experiences which need to be recognised and valued.

To gain access to the power of mathematics, students will need to take risks, be challenged and be given appropriate feedback. They need to experience success so that they can develop confidence and competence. They need to show their creativity and initiative. Interacting with others is a way to provide feedback, challenge our understandings and develop both the students’ mathematics and their interpersonal skills. “Discussion with others is one means of finding out that others do not share our point of view; we constantly adjust our understanding and interpretation of phenomena through our interactions with other people” (AEC, 1991, p. 19).

10. Structures identifies comments related to structures in the classroom such as the use of individual and group-based work in the learning of mathematics.

I don’t like streamed classes but I quite like that we stream for maths.

(Mrs Allan, teacher)

Martin he was in a higher class and he got dropped down cause of not learning his sums and I got put up because I was the top of the class.

(Colin, male Aboriginal child)

Schools vary how they organise mathematics classes across the grades. In Ellen Road Public School classes were streamed. Within the mathematics classrooms teachers varied in how they organised the children, the set up of the furniture and the ways in which their teaching was delivered. In many schools mathematics classrooms have changed
from teacher-centred, ‘chalk and talk’ to active student learning with the use of a variety of organisational styles being recommended including individual, small-group and whole-class activities (Clarke, 1997).

11. Technology identifies comments related to the use of calculators in mathematics.

_Yeah I like them (calculators) cause they helps you more about sums. If you don’t know something you just get your calculator and do the thing on the calculator, what the sum is._

(Susan, female Aboriginal child)

_I’d like to use it (calculator) for checking and stuff but I just don’t like it cause it’s too much trouble._

(Ms Jones, teacher)

Calculators can assist the learning of mathematics, though not all the Aboriginal children liked using them. The efficient use of calculators give students the “opportunities to investigate certain mathematical ideas and applications at a younger age than they might otherwise have done” (AEC, 1991, p. 14). Using calculators as tools in mathematics helps the students make informed decisions about their use. There were no interview comments related to the use of computers in learning mathematics.

12. Assessment identifies ways in which students’ mathematics performances may be measured.

_Yeah I got the highest points a couple of times for scores and that and the sheets are all right but some of them have got too much writing and that for me._

(Brett, male Aboriginal child)

_We say tests but should we have individual assessment? Cause as soon as you say test you do get children who stop and freeze._

(Ms Martin, teacher)

The dominant assessment strategy used in mathematics has been pencil and paper tests. More recently, a variety of alternative strategies has been implemented. The main purpose of assessment should be to improve learning. It should consider attitudes as well as mathematics content. “If some areas of the curriculum are assessed at the exclusion of other areas, teaching will tend to emphasise those, whether consciously or not” (AEC, 1991, p. 21). Thus the assessment procedures begin to direct what mathematics content is to be taught rather than the contextual or learning needs of the children.

13. Family concerns identifies expressed concerns related to the nature and learning of mathematics which emanate from the home.

_With that maths I find it hard when she’s got a problem and I said I can’t help you because I don’t know how._

(Mrs Finane, parent)
I've often told her [Michele's daughter] to ask the teacher to explain it to you. Otherwise they'll just keep going and it's just like the Murris-left down the back and forgot all about again.

(Michele, Aboriginal educator)

Parents and family play a critical role in children's learning of mathematics. Parents are able to identify concerns related to children's learning at school and provide insights related to children's development that may not be apparent to teachers. It is evident from the quotes that some parents also find mathematics difficult.

14. Parent involvement identifies comments related to the enhancement of teachers and parents' knowledge about mathematics.

We really need to have maths workshops with teachers.

(Dawn, parent)

Teachers need continued professional development throughout their careers to maintain and enhance their knowledge of educational developments. Parents and the community need to know about school mathematics to reinforce what students are learning at school.

15. Content identifies comments concerning specific mathematical content.

If they are playing a game. It makes it fun and they don't think that they have to think very hard about anything.

(Carmel, Aboriginal educator)

They thought we were doing art when we were doing symmetry and that sort of strand, your rotations and tessellations. They had a wonderful time but they thought they were doing art.

(Mrs Cotter, teacher)

The emphasis in the mathematics classroom should be on content which develops enthusiasm and interest within students “towards their involvement in mathematics, problem solving and applications, working systematically and logically, and communicating with and about mathematics” (AEC, 1991, p. 12).

These 15 categories provide the overall structure for reporting the participant's espoused beliefs about mathematics and mathematics learning. The distribution of the categories across data derived from each of the participant groups is set out in Table 4.3.
Table 4.3
Distribution of categories across participant groups

<table>
<thead>
<tr>
<th>Category</th>
<th>Aboriginal Children</th>
<th>Parents of Aboriginal Children</th>
<th>Aboriginal Educators</th>
<th>non-Aboriginal Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Feelings</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>2. People</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Language</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>4. Context</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>5. Relevance</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>6. Homework</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
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<tr>
<td>7. Materials</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
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<tr>
<td>8. Learning</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>9. Teaching</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>10. Structures</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>11. Technology</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>12. Assessment</td>
<td>x</td>
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<td>x</td>
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<tr>
<td>13. Family concerns</td>
<td>x</td>
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<tr>
<td>14. Parenti</td>
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<tr>
<td>15. Content</td>
<td>x</td>
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</tr>
</tbody>
</table>

Sub-categories

Following the identification and definition of the 15 categories and the analysis of all participant interviews according to these categories, the espoused beliefs of the participant groups towards the nature and learning of mathematics were considered. These are reported in Chapters 5-8. The next task was to compare and contrast the participant groups' espoused beliefs about mathematics and students' learning of mathematics. For this to occur a further analysis and identification of the participants' espoused beliefs was undertaken. This entailed further analysis, coding and organisation of the specific comments reported within the core categories across participant groups leading to the development of sub-categories of the main category themes.

Participant comments were further analysed into sub-categories as shown in Table 4.4. The further analysis and coding of the participants' espoused beliefs about mathematics and students' learning of mathematics into these sub-categories form the structure for the overall discussion reported in Chapter 9. The participant groups for the relevant sub-categories for each core category are identified as Aboriginal children [AC], Parents [P], Aboriginal educators [AE] and Teachers [T].

Table 4.4
Sub-categories of analysis

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub-categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Feelings</td>
<td>Likes and dislikes about mathematics [AC]; Easy and hard parts of mathematics [AC]; Good and bad parts of mathematics [AC]; Feeling bored [AC]; Feeling shamed [AC]; Feeling annoyed [AC]; Personal feelings about mathematics at school [AE]; Aboriginal children and their feelings about</td>
</tr>
</tbody>
</table>
mathematics [AE]; Feelings about the AEA’s role in the mathematics classroom [AE]; Concern for children’s learning of mathematics [P]; Self confidence [P]; About teaching mathematics [T]

2. People
At school [AC]; At home [AC]

3. Language
Mathematical comprehension [AC, AE, T]; Mathematical comprehension and problem solving [AC]; Identifying the operation in solving problems [AC]; Teacher language [AC]; Teacher questioning styles [AE]; Mathematical language [T]

4. Context
Attendance [AC, T]; Aboriginal parents and education [AC, AE, T]; Being Aboriginal children [AE]; Aboriginal children at school [AE, P, T]; Teachers’ understanding of Aboriginal children [AE]; Educational expectations for Aboriginal children [AE]; Aboriginal children and non-school contexts [P]

5. Relevance
Out-of-school mathematics [AC]; In-school mathematics [AC, T]; Importance of mathematics [AC, AE]

6. Homework
People who help with homework [AC]; Importance of homework [AC, T]; Homework and language [P]; Misinformed children [P]; Homework causing conflicts [T]; Changing times [P]

7. Materials
Stencils [AC]; Base 10 materials [AC]; Other mathematics materials [AC]; Children’s use of materials [AC, AE, T]; Textbooks [T]

8. Learning
Personal practices of learning mathematics [AC]; Learning new mathematics [AC]; Learning mathematics in high school [AC]; Aboriginal children learning mathematics [AE, P]; Aboriginal parents and children’s learning of mathematics [AE]; Aboriginal children and mathematics learning [P]; Children’s role in mathematics learning [T]; Thinking mathematically [T]; Teacher’s role in mathematics learning [T]; Learning styles [T]

9. Teaching
Mathematics classrooms [AC]; Teaching Aboriginal children mathematics [AC, T]; Managing children [AC, AE, P]; Mathematics teaching [AE, P, T]; Teacher-student relationships [AE, P, T]; Teaching the range of abilities [T]; Games [AC, AE]; Money [AE]

10. Structures
Graded classes [AC, T]; Working individually [AC]; Working with others [AC, T]; Choosing to work individually or with others [AC]; Working inside or outside [AC]

11. Technology
Calculators [AC, P, T]; Cheating [AC]

12. Assessment
Mathematics tests [AC, AE, T]; Test scores [AC]; Reporting to parents [AE]; Alternative assessment strategies [T]
Conclusion

From the conversational interviews held with Aboriginal children, parents, Aboriginal educators and non-Aboriginal teachers data related to the participants’ espoused beliefs about mathematics and the student learning of mathematics were recorded in transcripts and analysed. Fifteen core categories were formed during the open coding stage of the analysis, grounded in the collected data. These categories form the structure for the reporting of the espoused beliefs of the Aboriginal children, parents of Aboriginal children, Aboriginal Educators and non-Aboriginal teachers about mathematics and students’ learning of mathematics. Sub-categories were then formed from a further analysis of the interviews across groups to detail and identify specific espoused beliefs.

An analysis of the interview data for each participant group using the 15 core categories and sub-categories is reported in the following sequence: Aboriginal children [Chapter 5]; parents of Aboriginal children [Chapter 6]; Aboriginal educators [Chapter 7]; non-Aboriginal teachers [Chapter 8]. The emphasis in these chapters is on the participant’s comments for each category. For each category of the participant groups confirming data from the participant’s comments is presented. Within categories data is reported around identified sub-categories. The data are illustrative and descriptive of the categories and sub-categories. A summary is presented at the end of each identified category that begins with a table reporting the number of participants who commented on each sub-category. This analysis provides the organisational structure for contrasting and comparing the espoused beliefs of the four participant groups in Chapter 9. Age, gender and socio economic status differences amongst the participants are not considered in this study. This decision is made based on the size and structure of the sample and the purpose of the study. In later research, differences of age, gender and socio economic status could be investigated if an appropriate sample is accessed.
Chapter 5
The voices of Years 5 and 6 Aboriginal children

This chapter reports on the expressed comments of the Aboriginal children involved in the study. All Aboriginal children were from Years 5 and 6 at Ellen Road Public School. Thirteen girls [Sam, Cassie, Vivian, Meryl, Lynda, Judy, Tina, Natalie, Lucy, Susan, Diane, Crystal and Maggie] and eight boys [Colin, Brian, Darryl, Brett, Dennis, Tom, Charley and Richard] were interviewed. Pseudonyms have been used throughout. The Aboriginal children’s voices are presented as one group. They are not analysed according to age, gender or socio-economic background. The Aboriginal children’s analysed comments are presented as a whole, clustered about categories and sub-categories, to give them voice and to inform educators of their expressed beliefs about the learning and teaching of mathematics to Aboriginal children in Years 5 and 6. In reporting the interviews both direct quotes and paraphrasing of the participants’ comments are used. The number of Aboriginal children who commented for each of the sub-categories is reported in a table within each category summary.

Feelings about mathematics

From the expressed comments of Aboriginal children the following sub-categories concerning feelings about mathematics were identified.

Likes and dislikes about mathematics
Lucy liked going to mathematics, liked doing mathematics outside and would not change anything about it. For Lucy, mathematics was “the best subject at school because we have an hour for it and when we’re finished we play games.” Dennis thought mathematics was pretty good. He liked doing shapes but disliked “the division and multiplication.” Maggie liked mathematics because she enjoyed problem solving and being challenged, while Crystal liked multiplication, reading time and subtraction involving trading.

Colin liked mathematics “because it’s interesting with new kind of sums, when you’ve got to work things out and that.” He liked learning new things in mathematics “because when you’re an adult and you’ve got these hard questions and you’ve got to figure them out like if you get a new house and that you’ve got to know maths to do it.” He enjoyed measuring and construction though the only building of shapes that he did was at home. He was able to clearly identify when mathematics became exciting.

*COLIN: When you don’t know a question and you’re just working it out and you get excited if you do get the right answer.

Judy liked mathematics but did not enjoy it when the teacher had to admonish other
children for making too much noise. She liked measurement activities because she could go outside and not be annoyed by the Aboriginal children who misbehaved. In a conversation with one of the Aboriginal Education Assistants, Judy talked about her likes and dislikes in mathematics.

*MRS ARTZ: Do you like it when they have materials there to work with like the blocks?
*JUDY: No I only like doing times and temperature and take aways and then sometimes pluses. I like tables best.

*MRS ARTZ: Do you like measuring, building shapes?
*JUDY: Mostly I like doing measurement cause you can go out from the classroom without no one else mucking about.

Lucy expressed her likes and dislikes about mathematics topics she was learning by comparing tasks.

*I: Do you like doing graphs?
*LUCY: Yeah picture graphs are good fun.
*I: What about decimals?
*LUCY: Decimal notation is all right but not good fun.
*I: Why not?
*LUCY: Cause you have to write down numbers instead of drawing pictures like six point five two.
*I: What does that mean?
*LUCY: It might mean six wholes or six kilos. The five two might mean half a chicken or half a kilo.

Charley thought mathematics was “all right”, particularly the “sums and that.” He thought mathematics was “important because you’ve got to learn education and all that stuff.” He liked learning new things in mathematics and thought it was good because “you just learn stuff and play games and make and walk a kilometre and that.” Richard liked mathematics because “we get to do a lot of things go outside and measure up.” Tom, also, liked mathematics but not all the time particularly when he “didn’t know how to do it.”

Maggie was the only Aboriginal student, female or male, in the top mathematics class. Maggie was happy to go to mathematics. She liked problem solving, challenging work, sometimes working with her friends but at other times on her own. She spoke about being in the top mathematics class.

*MAGGIE: Sometimes it gets a bit challenging. Sometimes a bit too easy.
*I: What makes it challenging for you?
*MAGGIE: Well some of the problems, some of the strategies like we started to learn about long division last week.

Lynda, a Year 6 student, had repeated Year 4 and was now in the bottom streamed mathematics class made up predominantly of Year 5 Aboriginal children. She was adamant in her feelings about mathematics saying “I like maths but I hate the maths class I'm in.” Lynda did not like her class because “my teacher she lets everybody off and I hate the boys in that class.” She did not want to be in the top class and had decided that
the lowest mathematics class was better for her “cause you learn more in that class.” It did not worry Brian that he was in Year 5 working with Year 6 children. He liked being in his mathematics class “because most of my mates are there and I know my stuff.” Susan really enjoyed times tables and “money and like take away and what do you call it...plus.” She liked measurement and wanted to do more of it. Susan particularly liked building shapes.

Natalie liked going to mathematics everyday and never found it boring. She believed mathematics was fun because “you learn a lot, cause it’s important of life and stuff.” Generally, Brett believed mathematics was fun and good, he liked learning new things and liked mathematics just the way it was. He liked mathematics “cause I just like doing things in maths. Just like going outside and doing maths. Sometimes I like staying inside but not when it’s too cold.”

Easy and hard parts of mathematics
Meryl talked about the hard and easy mathematics that the children had to do, particularly trading and some multiplication tables.

*I: Is there any mathematics besides the trading that you find hard to do?
*MERYL: Sometimes when you do your times tables they put like on the board like a sum, a take away or something and it’s kind of hard because you’re trying to get back your tables but there’s too many of them.
*I: So it might be like five times tables?
*MERYL: They’re easy.

Cassie thought that saying her times tables and division were easy. She found money and reading large numbers difficult “like how you do twenty one thousand four hundred and eighty, like that.” Richard found mathematics pretty easy although “sometimes when I get up and I’m real tired and I just don’t feel like doing work.” Lucy found division algorithms like “two divided by five hundred and sixteen” hard. She commented that “doing sums makes it easy and problems make it hard.”

*I: Do you find anything really hard in maths?
*LUCY: Problem solving when sir writes a sum and you have to write a problem for it that gets really hard at times. We don’t do it much.

Charley identified that mathematics started to get hard for him in Year 4. He could not state why, just that it started to become hard.

*I: Do you ever find things in mathematics getting confusing?
*CHARLEY: All the time.
*I: What parts?
*CHARLEY: Just the sums. I dunno.
*I: Do you know why it gets confusing?
*CHARLEY: Too much work with numbers. There’s too much numbers and that.
*I: When did maths start to get a bit hard for you?
*CHARLEY: In about the middle of the year.
*I: Last year?
*CHARLEY: Yeah.

Colin enjoyed working out addition and subtraction though he found division hard "when you're dividing the number that you're dividing into you see if you can find the times table that equals that thing but if there's none it's hard." Sam believed herself to be 'brainy' because she was a "good speller, good at English and a lot of other things." However, when she did division she felt, "Kind of down. You just miss out. They call you and think you're dumb." Diane found division hard also. She believed she was not good at mathematics though she was able to identify the easiest parts of mathematics as "pluses" and "take aways".

Overall, Crystal thought mathematics was "good, sort of, but a little bit hard." She would sometimes become confused and tongue tied when she had to say her times tables.

*I: Why do you think that happens?
*CRYSTAL: You say them too fast... We stand up on our own. I'm on Tuesdays and that's five times tables. I've got fifteen seconds. I've got thirteen in my tens.

Natalie believed that mathematics could be hard because there was "a great deal to learn and to learn about" and you had to listen to learn. When she didn't listen attentively she had to rely on a friend.

*I: Do you ever get worried when it's hard work?
*NATALIE: Yeah.
*I: How do you feel then?
*NATALIE: I feel bad because I like haven't listened to the teacher or something about what you had to do to solve it. But... I still ask the friend next to me. She still tells me a bit.

Division was difficult for Sam.

*SAM: In maths I have problems with divided by.
*TINA: You know that thing that goes like that with them two dots.
*SAM: Yeah that's divided by. But when they set it out that way I have problems with it. I'm brainy and all that but when I do divided by that way I sort of can't get the hang of it.

Tom identified what had been hard for him in mathematics that term.

*I: Can you think of anything that you've done this term that has been real hard?
*TOM: Big, long multiplications. They're pretty hard.

Darryl thought that learning mathematics for Aboriginal children could be hard because the work itself was too hard and Aboriginal children do not understand many of the words that were used by the teacher. He sometimes became confused and upset in mathematics.
The voices of Years 5 and 6 Aboriginal children

*I:* Do you ever get confused in maths?

*DARRYL:* Yeah and I get upset because I don’t understand. If I’m sitting at a seat I go and pop over there and say, ‘This is hard work here eh?’ and they say, ‘Oh yeah.’ Not for me.

*I:* What do you do when it’s hard work?

*DARRYL:* I just put my hand up.

**Good and bad parts of mathematics**

Colin thought the best thing to happen to him in mathematics was when he came first in a test. He thought it was bad in mathematics when he could not hear his teacher talking because of other children speaking.

*I:* Why is that bad?

*COLIN:* Because I don’t know what the answer is because I never knew what the question was so I’m going to get it wrong.

For Richard, the best parts were “times tables, adding up stuff and sums.” Tom believed mathematics was great “when you get some hard work and the teacher helps you out with it.” For Brian, the best part was “when we do take away and times cause I know how do it, easy.” Even though Susan did not like mathematics she identified the best parts as “times tables and we get to play with all the thingos like the Lego.” Maggie identified multiplication as the best part of mathematics “because it’s a bit easier than division and if you know your tables you’ve got a better chance of knowing division.” Whilst Natalie believed the best parts of mathematics were stencil work and learning new things. Meryl liked mathematics and was very good at her six times tables, had not yet learnt her seven or eight times. She had two favourite parts of mathematics, “the trundle wheel how you go around measuring things and temperature.” For Judy, the best thing that had happened to her in mathematics was when she won a times tables race. Crystal identified the best part of mathematics as, “when we went outside with those things” and the worst as “when we did our test.” Meryl found subtraction involving trading the worst part of mathematics because she did not understand it.

Lynda identified the parts of mathematics at which she was good and bad.

*I:* Are you good at maths?

*LYNDA:* A bit here and there. I’m good at sums, I’m shocking at my shapes, good at problems.

*I:* What about measurement?

*LYNDA:* Yuck. I hate it cause when you have to measure things with your hands they like don’t tell you nothing like estimating. When you do your scale I’m not very good at scales. I’m not good with measuring things except for jugs.

*I:* What about times tables?

*LYNDA:* Some. I know my ones, twos, threes, fours, fives, sixes, not good on my fours don’t know any of my eights, nines and I know my tens. I’m not real good on my elevens and twelves.

Susan found mathematics to be both good and bad, though much preferred reading and would rather do that in the morning than mathematics. Crystal identified outside
measuring activities as a good part of mathematics.

*I: What are the good parts about mathematics?
*CRYSTAL: When we go out and measure stuff outside.
*I: You like being outside better than inside?
*CRYSTAL: Yeah, cause you miss a lot of maths work. There are these little things that you push and they click and that's one metre.

Colin believed mathematics was “good because it's fun, it's exciting and you learn new things.” Tom talked about measurement as one of the good things in mathematics and how he would like to have done more of it. A good part of mathematics for Brian was “free time...Sometimes we do that after we've finished all our work. We get to go and read a book.” Judy could think of nothing bad “in any mathematics, in any year.” She believed mathematics was good in a way because she could play games.

Brett identified one part of mathematics that he believed was bad and one that was all right.

*I: What's the problem with graphs?
*BRETT: It's just like too hard and you've got too much reading to do and that. It was an olden time graph and no one could learn in our class cause it was a real old one about money and all this.
*I: Do you like doing measuring?
*BRETT: Yeah that's all right ... and pouring's all right too.
*I: What makes that fun?
*BRETT: The little thing that you push [the trundle wheel].

Feeling bored
Mathematics was never boring for Colin and he looked forward to going to mathematics everyday though he knew that others did not.

*COLIN: Some people they don’t like maths and they just act really stupid and the whole class gets into trouble.
*I: Is that fair on the class?
*COLIN: That's not fair because not all the class were acting silly. The people who are just acting silly should get into trouble.

For Richard, mathematics became boring when “you have to do heaps of work. Just hard stuff.” Crystal found mathematics boring when she did not know what to do or she had to sit on the floor and listen to other Aboriginal children talk about mathematics. Sam commented that mathematics became boring “when you do the same things over and over again, sheets, and sheets.”

Tom talked about liking hard work but sometimes becoming bored with both hard and easy work.

*I: Do you ever get work that is real hard?
*TOM: Sometimes, I feel bored because you don’t know how to do it.
*I: So you're telling me that you can get bored with maths when it's too easy
and also when it's real hard.

*TOM: Yes.
*I: But you like doing hard work?
*TOM: Yeah.

Darryl became bored in mathematics when he was doing nothing and sometimes found it hard "with stuff I don't know." He did not think that he was good at mathematics but he did like mathematics because of the "sheets and all that stuff."

**Feeling shamed**

Darryl liked doing addition and subtraction and raised the issue of shame through identifying what annoyed him in mathematics.

*I: Is there anything in mathematics that annoys you?
*DARRYL: When the teacher asks me a question. When they put me on the spot.
*I: You don't like being asked a question in front of the whole class?
*DARRYL: Shame.
*I: Does the teacher ask you to come out the front to do work on the blackboard?
*DARRYL: A lot of times. I feel bad about that.
*I: Why?
*DARRYL: Cause I don't like going out in front of all the class and then just say writing something on the board finishing off a question they'll all laugh at you.
*I: So do you get a bit scared when you're asked to come out the front?
*DARRYL: Yep. I go oh miss why me.

Lynda’s comments relating to high school raised the concept of shame.

*I: Does it worry you what might happen in high school maths?
*LYNDA: Yep. There might be kids in that class a bit smarter than me and if I ask the teacher for help they might have a go at me. Shamed! I just guess it and if I get it wrong I get it wrong.
*I: That doesn’t worry you?
*LYNDA: No.
*I: It's better to get it wrong than be shamed?
*LYNDA: No I'd rather be shamed in front of my friends but it's a bit embarrassing.

Richard, too, discussed the aspect of being shamed in mathematics.

*RICHARD: Yeah. The teachers put stuff on the board and I don't know it yet they ask me and I can't do it.
*I: How do you feel?
*RICHARD: Shamed.
*I: So what do you do when you feel shamed?
*RICHARD: Just don’t answer it. Put my head down and the teacher asks someone else.

He was somewhat scared to ask the teacher when he did not understand something in
mathematics. Richard felt that his misunderstanding was linked to the speed of the teacher’s talk.

*I:* And do you sometimes get a bit scared asking?
*RICHARD:* Yep. Cause sometimes he’ll tell me what to do and I’ll forget it and I ask again and he yells at me and that.
*I:* Is it true that you weren’t listening or you just didn’t understand?
*RICHARD:* Just didn’t understand.
*I:* Why don’t you understand sometimes?
*RICHARD:* The teacher just says it real fast and you can’t understand it.
*I:* Some kids say that teachers use words they haven’t heard before.
*RICHARD:* Yeah they do. They do all the time.

He had developed the strategy of sometimes saying he was sick to avoid going to mathematics, “I just say I’m sick and I go down there to sick bay and when maths is over I go back up. I just say I’ve got a headache.”

Dennis had been in the top mathematics class and was placed in a lower class based on the poor results of his mathematics tests. The discussion led onto how he was affected by peer attitudes, behaviours and comments and how this impacted upon his actions in the mathematics classroom.

*I:* Can you think of something that has been pretty bad in maths?
*DENNIS:* Didn’t get a high enough score. Got about twenty-nine out of a hundred.
*I:* When was that?
*DENNIS:* Last year. I knew some of the answers but just put answers down.
*I:* Do you do that on purpose?
*DENNIS:* Just put the wrong answer?
*I:* Yes.
*DENNIS:* Sometimes when I don’t know them I just have a guess and sometimes I get them right.
*I:* Is there sometimes Dennis where you know the right answer but you put the wrong answer down on purpose?
*DENNIS:* Yeah.
*I:* Why do you do that?
*DENNIS:* I don’t know. To be different to everyone else. Pretend that I’m dumb and that.
*I:* Why do you pretend that, because you’re not?
*DENNIS:* Because everyone reckons around here I’m a geek.
*I:* Why do you reckon they think that?
*DENNIS:* Because they say it.
*I:* So your mates say that you’re a geek if you show that you’re smart?
*DENNIS:* Yeah.
*I:* Do you ever get put down here?
*DENNIS:* Sometimes by other kids.
*I:* What do they say to you?
*DENNIS:* They call me dumb and I get into them and they don’t say it again.
*I:* Why do they say it in the first place?
*DENNIS: *Cheap thrills out of it. They reckon they’re good and that.
He continued to talk about some Aboriginal children who felt that it was better not to try
at mathematics in the first place than to face the possibility of failure.

*I: *Do you reckon Murri kids here get a good go in maths?
*DENNIS: *Yeah some of them do and some of them just don’t want to do any work.
*I: *Why don’t they want to do the work?
*DENNIS: *Probably scared they might fail. Fail and get them wrong.
*I: *So best not to do it in the first place?
*DENNIS: *Yes that’s what they probably think. That’s what I used to think.
*I: *Up to when?
*DENNIS: *Last year.
*I: *So what changed?
*DENNIS: *Nothing. Teacher started to help me, Mrs Allan.

Though he now had the confidence, Darryl remembered a time when he was scared to
ask the teacher questions about mathematics.

*I: *Do you ever get a bit shamed to ask the teacher?
*DARRYL: *No I just get out of my desk and walk straight there. When I first came here
and I was in Miss Martin’s room up there I was too scared to go and ask
the teacher. When I was in Year 3.
*I: *So some teachers you feel a bit worried to ask?
*DARRYL: *Yeah. All the teachers I ask now.

Sometimes Susan was scared in mathematics. She blamed herself for not listening and
found it hard to ask the teacher questions. So too was Charley when he did not
understand.

*I: *Do you ever say to miss that you don’t understand or do you get a bit
scared sometimes?
*CHARLEY: *A bit scared.
*I: *What makes you feel that way?
*CHARLEY: *They might get up you.

**Feeling annoyed**
Some Aboriginal children became annoyed in mathematics and this interfered with their
learning. Vivian became annoyed and frustrated when she could not do something and
this sometimes happened in mathematics. When she became frustrated, Vivian said “I just
leave it and I don’t do it.” Brian could identify the things that he did not know in
mathematics and what annoyed him.

*I: *What does Brian think about mathematics?
*BRIAN: *It’s pretty good at times except when you do things like I don’t know.
*I: *Can you think of anything?
*BRIAN: *Decimal notation, sometimes twenty-four hour time. They get confusing.
*I: *Do you think you’ll get them one day?
*BRIAN: *Yep, one day.
The voices of Years 5 and 6 Aboriginal children

*I:* Is there anything that happens in your maths class that annoys you?
*BRIAN:* When some people look over your shoulder for answers and that.
*I:* When they take your work that annoys you?
*BRIAN:* Yeah. I don’t feel happy because if I wanted some answer off them then they wouldn’t give them to me but they want answers off me.

Colin became annoyed in mathematics when other Aboriginal children copied.

*COLIN:* I sit next to Matt, Chris, Joe and Stephen. They keep annoying me by saying across the table what the answer is. Matt tells them the answers so they can get it right but sometimes the answer isn’t right.
*I:* What happens then?
*COLIN:* The kids say they’ll smash him.
*I:* Kids say that to you, do they?
*COLIN:* No. They say it to Matt but they don’t really mean it.
*I:* They just get a bit angry?
*COLIN:* Yeah just a bit angry for when you get all twenty questions right you get a sticker and I only get three or five wrong.

Susan, too, was also able to identify what annoyed her about mathematics.

*SUSAN:* Like when I make a mistake and the teacher only got a few sheets left and I need another sheet cause I make a big mistake. She’s only got one sheet left and that’s for the person who like is away and when you make a mistake in one of your answers like how many days in a year the whole class laughs at you. Most people know it and some people don’t.

Lynda became annoyed when there was too much noise.

*LYNDA:* Yeah when people talk and yell out. I get real mad at people when they come up and ask can I use your ruler. But I don’t bit them cause I’ve got self-control. When someone teases me I just ignore them.

Aboriginal children talking in class also annoyed Brett. However, once others started he would usually join in.

*I:* Is there anything that annoys you in class?
*BRETT:* Yeah people talking. I can’t really add and take away with people talking.
*I:* Do you talk sometimes?
*BRETT:* Yeah most of the time cause they start up and I say why can’t I just talk.
*I:* So if they didn’t you wouldn’t?
*BRETT:* Yeah.
*I:* When you do maths you think it should be a quiet time?
*BRETT:* Yeah, not like...it shouldn’t be real quiet like sums off the board and miss asks you some questions like what’s this and that. I reckon you should be able to talk then.

Brett discussed his views on why some Aboriginal children become angry in mathematics.
The voices of Years 5 and 6 Aboriginal children

*BRETT: Yeah sometimes some of them just don’t listen and after that the teacher says I’m not going to tell no one after this so if I was you I’d be listening. They don’t listen and they go to put their hands up to ask miss what they have to do and that’s when sometimes they get angry.

*I: The teachers do?
*BRETT: No the kids and they go out of the classroom.
*I: Why do they get angry?
*BRETT: Cause they wouldn’t know what to do and it’s their own fault for not listening.
*I: So it’s important to listen?
*BRETT: Yeah otherwise you wouldn’t know what to do.

Sometimes things happened that made Dennis angry. He gave one example of something that happened before school but was brought into the first lesson of the morning which happened to be mathematics. Errol had stolen [shook] his money. He then went on to talk about when he became confused in mathematics and how on occasions he became embarrassed.

*I: Do you ever get angry in maths?
*DENNIS: Yes. Like this morning when Errol shook me money. Took my four dollars. I told the teacher and she didn’t do nothing.
*I: Do you ever get confused in maths?
*DENNIS: Yes. When they don’t tell you the full sentence or if they don’t give you the instructions up the top and they say, What is the something of fifty six?
*I: So if they say what is a half or a quarter of fifty six that gets confusing?
*DENNIS: Yeah.
*I: Anything else?
*DENNIS: When they say square and this other thing that I can’t remember because I get confused all the time.
*I: Has anyone ever asked you what confuses you?
*DENNIS: No.
*I: Do you ever get embarrassed in maths?
*DENNIS: Yeah when they ask me for a thingo and I say the wrong answer.

Summary

Table 5.1
Aboriginal children commenting on sub-categories of feelings about mathematics (n=21)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Likes and dislikes about mathematics</td>
<td>16</td>
</tr>
<tr>
<td>Easy and hard parts of mathematics</td>
<td>14</td>
</tr>
<tr>
<td>Good and bad parts of mathematics</td>
<td>18</td>
</tr>
<tr>
<td>Feeling bored</td>
<td>6</td>
</tr>
<tr>
<td>Feeling shamed</td>
<td>7</td>
</tr>
<tr>
<td>Feeling annoyed</td>
<td>8</td>
</tr>
</tbody>
</table>

Sixteen of the Aboriginal children expressed their likes and dislikes in learning mathematics. Overall the Aboriginal children liked mathematics, though, at times they felt annoyed, confused, embarrassed, shamed, bored, annoyed and ridiculed during
The voices of Years 5 and 6 Aboriginal children

mathematics. Individuals amongst this group of Aboriginal children liked variety in mathematics, hard work, measurement, doing shapes, learning new things and going outside to do mathematics. Many liked measuring, shapes, games, times tables, multiplication, subtraction and addition. The one Aboriginal child in the top mathematics class liked the challenging work. Aboriginal children disliked misunderstanding and not knowing how to do the mathematics. They disliked children misbehaving in mathematics, making noise, copying their answers or giving them the wrong answer. One Aboriginal child who had been moved liked mathematics but disliked her class while others liked their class and mathematics the way it was.

Even though the responses varied across individuals fourteen of the Aboriginal children expressed their feelings about the easy and hard parts of mathematics. Addition, subtraction and some times tables were seen to be easy by individual children. For others the hard parts of mathematics were trading, division, problem solving, some multiplication tables, money and reading large numbers. It is of particular interest that one Aboriginal child identified that mathematics started to get hard for him in Year 4. Even though division was particularly hard for seven of the Aboriginal children and long multiplication for four of the children, it was useful to learn to do hard mathematics for when you grow up.

Feelings about the good and bad parts of mathematics were expressed by 18 of the Aboriginal children. Eight of the Aboriginal children believed multiplication and times tables to be good. For one child, mathematics was good when you did well in a test whilst another believed mathematics games were good. For five of the children the good parts were going outside to do measurement. For some children, mathematics was bad when children could not hear the teacher, when they were not good at estimating or when some of the measurement skills or graphs were being taught.

Six of the Aboriginal children identified when mathematics was boring. For individuals, mathematics was boring when they did not understand the work, the mathematics was ‘real hard’ or too easy, you had to listen to others and you had to repeat work.

Seven Aboriginal children raised the feeling of shame in mathematics. One Aboriginal child felt shamed when the teacher singled them out by asking them a question in front of the class. Another, when they had to ask the teacher to explain again after they have not listened. One child believed that it was better to get the mathematics wrong than be shamed in front of friends by not knowing how to do it. There was a current of belief amongst these Aboriginal children about not being seen to not know the mathematics or not being able to answer a question. This always led to shame. One Aboriginal child felt that for some it was better not to try at mathematics in the first place than to face the possibility of failure and, thus, being shamed. The fear of failure, of not being seen to know the mathematics and being scared to ask all appear to be linked to the feeling of shame.

Eight children explained aspects of mathematics that annoyed them. The individual issues included not being able to do the mathematics, other children copying answers, laughing at someone when an incorrect answer is given, talking and the occasions when children come into the mathematics class angry and annoyed about something that happened out of class.
One Aboriginal child felt that some Aboriginal children misbehave so they will not be victimised by the others for being good because some Aboriginal children put smart Aboriginal children down. At times, they misbehave because they do not want to learn. One child believed that it was unfair when the whole mathematics class was punished because of the misbehaviour of a few.

People

From the expressed comments of Aboriginal children the following sub-categories concerning people who helped them with mathematics were identified.

At school
Cassie depended on her class peers to assist her if she missed what the teacher was saying. Other Aboriginal children helped Cassie by telling her what the teacher had said, using different words. When Brian did not understand, his teacher or a friend helped him with the mathematics. He was not worried about asking the teacher for he thought she was good “cause she doesn’t get growly all the time. There are some who do if you be real naughty.” Brett would ask the teacher for help when he did not understand. Other than his teacher, Tom received help from “the Aboriginal Education Assistant and some of his friends.”

*I: How do they help you?
*TOM: They ask me if I want help and if I did I just say yes.
*I: When you say yes, what do they do to help you?
*TOM: They just start helping me...they explain it to me different to the teacher

At home
At home, Cassie identified her brother and father as people who “learns me at home”.

*CASSIE: Well be writes like sums in my old books and I have to do them out and he tells me to work out whatever table he says and he’s got to tick them if I get them right.

Meryl also identified her father as someone who helped her with her mathematics.

*MERYL: Dad helped me with my divided bys last year and I’ve forgot half of them this year. Dad learnt me some divided bys and I forgot them.
*I: And does Dad help you with your homework sometimes?
*MERYL: Yes. If it’s hard I ask him because Mum she doesn’t know much about maths.

Meryl explained a role that her father played in her learning of mathematics.

*MERYL: Well I came home one day and I got this maths sheet. I bring home heaps of maths stuff, and I was trading and I got one wrong and I thought it was right. I asked Dad if he could help me if I did it wrong. I got a couple wrong. I think it was four or five wrong and me and dad had an argument because I thought it was right and he said it was wrong. It was wrong. Dad
The voices of Years 5 and 6 Aboriginal children

gave me some take aways, plus and one divide and I think I got the divided right and five of plusses and take aways wrong cause they were divided. I showed dad and I was wrong. But when I sort of sat down and concentrated I got them right. So I said sorry to dad that I argued with him.

Lucy identified her mother as someone who showed her that she was improving with her mathematics. Charley gave credit to his mother.

*I:  How do you learn mathematics?
*CHARLEY: Just learn it.
*I:  Yes but how do you do it?
*CHARLEY: Mum gives me a couple of sums and I do it. It starts off easy and get a bit hard.
*I:  She helps you a fair bit at home does she?
*CHARLEY: Yes.

Brett’s mother also helped him with his mathematics and he thought that she was good at mathematics.

*BRETT: Yeah sort of she’s doing a program about maths. I think it’s maths and I’m not quite sure of what other thing is. It’s about teaching young people and kids not to swear and things like that. She does this program with these other people and she’s trying to teach people not to swear and that.

Summary

Table 5.2
Aboriginal children commenting on sub-categories of people (n=21)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>At school</td>
<td>7</td>
</tr>
<tr>
<td>At home</td>
<td>9</td>
</tr>
</tbody>
</table>

Sixteen Aboriginal children believed parents [mothers and fathers], Aboriginal educators, teachers, friends and other Aboriginal children can help Aboriginal children in their learning of mathematics. Four of the children believed that teachers can influence Aboriginal children’s views about mathematics and that teachers helped Aboriginal children learn mathematics. When Aboriginal children do not understand the mathematics taught by the teacher other people can explain the mathematics in ways and terms that are different from and perhaps more appropriate than the teacher’s ways.

Language

From the expressed comments of Aboriginal children the following sub-categories concerning language and mathematics were identified.

Mathematical comprehension

For Charley the language used in mathematics lessons was a problem. He found some of the words too long “and I don’t know what they mean and that.” Tina’s reading difficulties posed a problem.
*TINA: The only trouble that I have at school is reading most of the time.
*I: Is that reading the words or understanding what you’ve read?
*TINA: Understanding what I read.
*I: So you can sort the words out?
*TINA: Yeah.

When Natalie did not understand she would ask the teacher or her friends for further clarification of what was said or written on the board.

*I: What makes you get confused?
*NATALIE: Just the words that she used on there that I can’t understand, that I don’t know what they mean or something. There may be a word that I haven’t looked up in the dictionary and don’t know the meaning.
*I: What happens then?
*NATALIE: Um I ask the teacher or my friend and they always help me out.

Brett liked doing sums in mathematics and was asked if he preferred these because there was less to read.

*BRETTE: Yeah I don’t like. I don’t mind reading a little bit, some words and that but that’s just too much and big words.

Dennis would not do things he did not understand and often his misunderstanding was related to the mathematical language.

*I: What do you do when you don’t understand something?
*DENNIS: Don’t do it.
*I: Fair enough. Do you ever ask the teacher or do you just not do it?
*DENNIS: I just go how do you do this and she puts it in all hard English sort of stuff, language. Mathematical language she puts it in that and I don’t understand.
*I: Are there other kids in class who don’t understand the mathematical language?
*DENNIS: Yeah about three or four.
*I: What do you mean by mathematical language?
*DENNIS: Different terms speaking about mathematics if they say five squared why can’t they just say five fives, five time five.

Mathematical comprehension and problem solving
For Cassie, reading was a difficulty when attempting problem solving.

*CASSIE: Sometimes they are real good but when you come up to the big long words you can’t work them out.

When she did not understand what to do she put her hand up to get help and then she knew how to do them. Lucy identified reading as a difficulty for her.

*LUCY: Yes all the time. Sometimes I get sir to read it because I don’t understand it.
"I:
What do you mean you don’t understand it?
LUCY:
When I can’t get the full information how to do it. Some tests, they never have enough information on top to read how to do it. When you’ve got the words it’s a bit harder.

Brett, in saying that problems were hard at times, identified language and the size of the sum as difficulties for him.

"I:
The words make it hard?
BRETTL:
Yeah difficult.
"I:
When they are difficult how do you get help?
BRETTL:
I just put my hand up and ask the teacher and she reads the sentence out to me and I go along and do the sums.

Maggie liked doing problems because she liked “doing division and working them out” but they were hard sometimes because “they use words that I haven’t heard before.” Natalie thought that problem solving was “good when they’re easy and a bit hard, but not when they’re really hard.”

"I:
What are they like when they’re really hard?
NATALIE:
Augh you have to do all times and division but most of the time they’re good because you understand what you’ve got to do like you might have to do multiplication or division something like that.

Identifying the operation in solving problems

Charley thought that most of the problems he did were given to him on sheets and sometimes they became hard. At those times he would “just ask me friends or something.” Darryl thought problems were good but hard.

"DARRYL:
They’re hard. They’re hard. They’re good because you say three times and Matthew comes home from the shop and it’s three dollars and you put times besides it and then put two dollars and then an equals sign and then you add it all up.

"I:
Is it sometimes hard to work out what to do?
DARRYL:
That’s what I don’t like.

Colin thought problems were “kind of good because when you’re doing them sometimes I’m using the paper and sometimes I’m using my head.” He sometimes found it difficult to understand how to solve the problem. Brian liked problems once they were explained to him.

"I:
What do you think of the maths problems in class like Martin scored twenty, four, ten?
BRIAN:
Averages. They’re a bit easy but before when miss never told me how to do them I use to just add them up. But miss told me how to do them and they’re a bit easy now.

"I:
Do you get confused as to what you have to do with some problems?
BRIAN:
Yes sometimes.
Teacher language
Sometimes the teacher talked too fast for Judy to understand whilst Natalie would become confused with some of the words teachers use when doing problem solving. Charley, Brian and Richard agreed that sometimes teachers talked too fast and used words that the children did not understand.

Summary

Table 5.3
Aboriginal children commenting on sub-categories of language (n=21)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematical comprehension</td>
<td>11</td>
</tr>
<tr>
<td>Mathematical comprehension and problem solving</td>
<td>8</td>
</tr>
<tr>
<td>Identifying the operation in solving problems</td>
<td>4</td>
</tr>
<tr>
<td>Teacher language</td>
<td>8</td>
</tr>
</tbody>
</table>

The teacher's use of mathematical language and the difficulty of reading were significant issues related to Aboriginal children's learning of mathematics. For sixteen of these Aboriginal children, the language of mathematics and the language used in the mathematics lessons played critical roles in their understanding of what they were learning. Clearly, some Aboriginal children do not understand the mathematical language of the class and not being able to understand the meanings of mathematical words is a major learning difficulty. The belief was expressed that Aboriginal children should have opportunities to talk about mathematics itself, not just do handouts.

Critical difficulties in problem solving, for twelve of the Aboriginal children, were their ability to read the words, the size of sums and identifying the required operation to solve the problem. They believed that teacher correction through explanation assists Aboriginal children in completing problems. It was believed that most problems are given to Aboriginal children on stencils and that you need the right information to do a problem.

Eight Aboriginal children believe that teachers speak and do the mathematics too fast. Indeed, the teacher's mathematical language can be confusing and a constraint to learning mathematics.

Context

From the expressed comments of Aboriginal children the following sub-categories concerning context were identified.

Attendance
Sam and Tina attended school regularly and they suggested what should be done to improve Aboriginal children's school attendance.

*1: You two come to school a fair bit.

*SAM: Nearly everyday. I love it cause I'm here with my friends and learning about things. Growing up to get an education not just like some people drunk and smoking all the time. I saw one of the kids in my class up drunk.
The voices of Years 5 and 6 Aboriginal children

the other night smoking yammi [marijuana]. She can’t even spell. They should force her to be in this here school.

*I:
How would they do that?
*TINA:
Get the welfare to go down there.
*SAM:
Why shouldn’t the HSIO go down there? That’s the job now, ain’t it? Someone’s got to protect kids and that.
*I:
What if the parents say they don’t care what she does?
*SAM:
I wouldn’t blame her. Her father’s an alcoholic. Her mother’s dead.

Aboriginal parents and education

Sam talked more about her behaviour at school and the influence her father had on her. What he said to her had a bearing on her school work and, thus, directly on her learning of mathematics.

*SAM:
I thought I was my own boss and calling them everything but dad got sick of me and he sat me down and had a good talk to me. He said, "Where are you going to be when you grow up?" I said, "I don’t know" and I was being real smart with him. He said, "Don’t worry, I can’t talk to you." I came to school and I was thinking I thought I might be calm and stop myself from doing what I’m doing all the time. From then on I didn’t hit people or swear. This was a couple of months ago now.

*I:
You’ve changed a lot this year?
*SAM:
Yeah I used to be violent.
*I:
If you can do it why don’t others?
*SAM:
Because they don’t see what they’re doing. They can’t stop themselves and they’re going to keep on doing it.

*I:
Do you think it’s important to be calm in yourself?
*SAM:
Yeah have pride in yourself. I use to have a big mouth and scream at people. Now I’m quiet. I use to be the little girl of the school and when I was bad and slack all the teachers knowed me and like now I think it’s not fair to the other Aboriginal children if I mess up and they’re doing the right thing. I said if they can do it I can.

Summary

Table 5.4

Aboriginal children commenting on sub-categories of context (n=21)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance</td>
<td>2</td>
</tr>
<tr>
<td>Aboriginal parents and education</td>
<td>1</td>
</tr>
</tbody>
</table>

Two Aboriginal children talked about the contextual impact of the teacher, school, family and community issues on Aboriginal children’s learning of mathematics. They knew the roles of the Home School Liaison Officer as well as community welfare personnel. These two Aboriginal children liked coming to school to be with their friends and to learn. In mathematics lessons, they did not like teachers rousing loudly and other Aboriginal children being noisy. At times, they believed that it was not the child’s fault that they are not at school. However, for their educational sakes, Aboriginal children should be made to attend school. One Aboriginal child talked about the direct impact her father had.
making her think about and change her behaviour

Relevance

From the expressed comments of Aboriginal children the following sub-categories concerning relevance and mathematics were identified.

Out-of-school mathematics
Maggie identified two instances of mathematics being used out-of-school, one related to homework and the other to her mother’s use of mathematics when she paid the bills. Cassie perceived that the only mathematics that she did out-of-school was homework. Even though he liked playing football, hide and go seek and cricket Darryl believed the only mathematics that he did at home was his mathematics homework. Vivian said she could not identify any life-related mathematics that she did on the weekends. Crystal said that she just goes to her cousin’s, on the weekends, to ride her bike but she did not do any mathematics. Judy spent most of her time at the pool. Natalie played netball and went shopping.

On the weekends, Lucy went to her friend’s place and played schools. She was the teacher but did not identify any mathematics that she used. When asked why she should learn mathematics now, Sam replied “so you can get it in here [pointing to her head] and learn about it before you grow up.” Charley and Richard were positive that they never used mathematics outside of school. Brett did mathematics at home for the fun of it. As well, his father would sometimes ask him to do some mathematics on the week-end.

*BRETT: Ob yeah sometimes I do. My dad, he has cattle and he wants me to do some take aways for him so I do some of those for him.
*I: Why does he want you to do those?
*BRETT: I don’t have to do it. I just feel like doing it cause there’s nothing to do. We’ve got some cattle and that and we get to take some away. I have to add the rest up and that. I help him with his times tables and that, I mean with his things and that. He does them but sometimes he pays me cause we’ve got a piggery.

Dennis was able to identify mathematics used out-of-school “when I’m trying to work out how much money I get a week...to see how far things is.” Dennis was sure that you had to be reasonable in mathematics for future employment.

*I: Do you think you have to be good at maths?
*DENNIS: Yeah, a bit. You don’t have to be real good you just have to be good. If you want to be a shopkeeper you have to know adding and take away and how much to give to them. To be a bank thing manager you’ve got to know the same thing.

In-school mathematics
Lucy believed that “when you get into high grades you’ve got to be good at maths.” She saw the importance of mathematics related “just mainly to tests.” For Tom, the main reason you had to be good at mathematics was “to get good grades and stuff like that.”
He only did mathematics at school yet used it in the games he played.

*TOM: We got put out in the semis 24 to 16.
*I: Did you score any tries?
*TOM: Scored a couple through the season, half way through cause I only joined up half way through the season.
*I: Do you ever use much maths outside of school like on the weekends?
*TOM: Nope.
*I: So you only really do maths at school here?
*TOM: Yeah.

Importance of mathematics

Lynda thought mathematics was important because “like if you’re in a shop and there’s a blackout and you can’t use the thingo (cash register) you can just pop it out of your head.” She also believed that “when you play games you can use maths and when you play adding up games like Scrabble and card games like twenty one.” Lynda talked about the use of mathematics when shopping.

*I: Do you use much maths after school or on the weekends?
*LYNDA: When we go shopping I make sure they don’t rip us off and when we’re playing games.

Cassie believed mathematics was important “because it shows you how to learn and for when you get older.” Susan considered the importance of mathematics from a mother’s perspective, saying:

*SUSAN: ...you need to learn your sums cause one day if you have kids and if they want you to help them with their homework. And that they’d want to know what the parents know and you’d have to learn them. Anyway if you don’t have kids and that you still have to learn them just to learn about things.

Tina and Sam talked of the importance of learning mathematics as related to shopping and future employment.

*TINA: Cause when you go to the shops you don’t get ripped off.
*SAM: If you want to get a job like in Home and Away that Selina didn’t know how to do maths. She was real happy about this job. Mathematics is just like learning everything, and if I want to be a shopkeeper I should know how to add up and all that.

Brett believed mathematics was important, particularly for one’s future life.

*I: Do you think maths is important?
*BRETT: Yeah with an education I think it is.
*I: Why is it so important?
*BRETT: Just because when you grow up you could be a bean counter. You don’t know what you could be and if you don’t got maths you wouldn’t know what thingo. You’d need a calculator.
Though Diane believed that mathematics was important she was unable to identify any mathematics that she used when she went shopping on the weekend or to the canteen at lunchtime. Richard thought mathematics was important for high school when “it gets harder and harder” though he said he did not use any mathematics outside of school.

Brian did not see the importance of mathematics.

*I: Is it important to be good at maths?
*BRIAN: Not really. I reckon you can get on and get a job without doing that much maths.
*I: How have you reached that decision?
*BRIAN: My brother doesn’t do that much maths and he’s already got a job working at the corner store and he’s only fourteen.

Summary

Table 5.5
Aboriginal children commenting on sub-categories of relevance (n=21)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out-of-school mathematics</td>
<td>11</td>
</tr>
<tr>
<td>In-school mathematics</td>
<td>6</td>
</tr>
<tr>
<td>Importance of mathematics</td>
<td>7</td>
</tr>
</tbody>
</table>

Eleven of the Aboriginal children believed they did not use much mathematics outside of school. However, seven Aboriginal children talked about the importance of mathematics relating it to their future employment and identifying a number of instances where it was important in their daily lives. In school, Aboriginal children believe you have to be good at mathematics to get good grades in tests, it helps children learn but you do not have to be excellent and that in high school, mathematics gets harder and harder. Besides homework, the Aboriginal children identified few occasions when they used mathematics at home.

Homework

From the expressed comments of Aboriginal children the following sub-categories concerning homework were identified.

People who help with homework

Natalie viewed mathematics homework as providing something to do in the afternoons. Her mother helped her when she did not understand. Meryl sometimes had hard homework that she did not understand. Vivian had mathematics homework nearly all the week and her mother would help her. Diane would take her homework home and, as with Vivian, her mother would sometimes help her. Lucy’s mother would set her homework because she found the set homework too easy. Susan would sometimes have trouble with her homework and have her mother do it though there were times when her mother did not know what to do. Sam indicated that her father helped her with her homework while Tina suggested that sometimes it was her aunt.

*I: Do you get much help at home when you do your homework?
The voices of Years 5 and 6 Aboriginal children

*TINA:  
Nope do it on my own. When my aunty’s in a happy mood she might help me. She gives me all the answers when she’s in a happy mood.

Susan explained what happened in her home when her mother did not understand the mathematics homework.

*SUSAN:  
She just helps me or tells me to do it by myself and if I keep asking her she’d go up to the teacher and ask for sheets and she’d do it for herself cause she said it’s more or less for herself than me learning about it. She doesn’t help me much more now because I’m learning more about it and getting more things and getting use to it now.

*I:  
What’s things?

*SUSAN:  
Learning much more about maths.

As Colin had two types of homework that his father helped him with - his mathematics and his class homework. He also talked about his mother’s role with homework.

*I:  
Do you get much maths homework?

*COLIN:  
Yeah but sometimes I forget. I forgot last week on Friday because I was too busy making a plane for my class homework.

*I:  
So you get homework for maths and then your class homework?

*COLIN:  
Yes.

*I:  
Does mum or dad help you with your maths homework?

*COLIN:  
My dad, my mum’s not very smart. Sometimes I ask her but she says go and ask your father I don’t know anything about this.

*I:  
Are there sometimes when he can’t help you either?

*COLIN:  
Yes.

Importance of homework

A number of Aboriginal children thought homework was important yet they identified a number of reasons why they would not do it. They were not worried about detention for not doing their homework because they did not see detention as really being in trouble. Richard said that he did not get mathematics homework and though he thought it important he would not do it anyway. He would rather go on detention for fifteen minutes.

*I:  
Is homework important?

*RICHARD:  
Yes.

*I:  
Well if it is why don’t you do it?

*RICHARD:  
I don’t want to. It’s not real important it’s just the stuff you haven’t finished in class.

Brian would sometimes do his homework and at other times not. If Brian's friends were at his house he would rather play with them. Dennis was not in favour of mathematics homework.

*I:  
What do you think about maths homework?

*DENNIS:  
Stupid, cause it takes all your time. You get homework from your teacher
and homework from your maths teacher. You don’t get to go to golf and find golf balls or play kicks.

*I: So you don’t do your homework much?
*Dennis: I don’t do it at all. I did it once last year and once the year before.
*I: Do you get into trouble?
*Dennis: No, just get on detention.

Summary

Table 5.6
Aboriginal children commenting on sub-categories of homework (n=21)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>People who help with homework</td>
<td>11</td>
</tr>
<tr>
<td>Importance of homework</td>
<td>6</td>
</tr>
</tbody>
</table>

Eleven Aboriginal children identified either fathers and particularly mothers as people who assisted them in completing set mathematics homework. Even though parents help their Aboriginal children with mathematics homework there are sometimes when Aboriginal children and their parents do not understand the mathematics homework. Three Aboriginal children espoused the belief that adults cannot help with mathematics homework when the child knows more mathematics than they do. The importance of homework was recognised. However it was believed by three of the Aboriginal children to be stupid taking up too much time and just being the work unfinished in class. Doing things with your friends was viewed as more important than homework. One Aboriginal child believed that if a child was placed on detention for not completing homework it was not really being in trouble.

Materials

From the expressed comments of Aboriginal children the following sub-categories concerning materials were identified.

Stencils

Vivian did not like stencils much because “you’re always doing the same stuff,” whereas Cassie liked them. She thought they were good because “instead of writing things down from the blackboard like sums you get a sheet.” She sometimes found writing sums down from the board boring. Natalie liked them too, though she did get tired of doing mental. Brett believed that they used a lot of stencils. He thought that they were “all right but a bit too much writing” and a lot of reading. Brian thought they used a lot of stencils and that “they’re better than Miss writing them on the board cause you’re always looking up and reading it instead of just looking on the page and reading it.” Darryl expressed his views.

*I: Do you get many stencils in mathematics?
*Darryl: Sometimes. They’re sort of good like you get a hard one and then it goes easy to halfway and then hard. You do all the easy work and then you put your hand up and the teacher comes around and you ask for help.

Base 10 materials

Cassie and Susan used Base 10 blocks infrequently although Cassie had used centicubes.
Diane used Base 10 blocks and liked them because they helped her better understand numbers. Lucy found them too elementary.

*LUCY: They're probably good for little third graders or Kindergarten to use. Year 5 are too old to use them. We haven't used them this year and now that I know all the times tables and getting use to doing maths I don't need to use them.

Meryl would like to be able to use Base 10 blocks every now and again and she was sometimes annoyed that she could not. She explained how she had used them in the past.

*MERYL: Last year we did. We used these little blocks and we used these hundred blocks and thousand blocks. We used them to help us kind of thing and we used them. Then at the start of fifth grade we used them and when we got use to doing divideds and stuff we put them away because we had to use our head.

Natalie spoke about how Base 10 blocks were used in her class.

*NATALIE: We used them at the start of the year but not since then. We didn't use them till about...March or something.
*I: And what did you use those for? Do you remember?
*NATALIE: Um...we were doing a stencil and you had to use them for, I don't know, something.

Lynda felt that she did not need to use Base 10 blocks.

*LYNDA: Like on our maths test when they have the big blocks I know what they are and they have those little blocks. The thousands, hundreds, tens and units they're good things to use when you can't add up properly you just get them to help you. I haven't used them for ages.
*I: Would you like to use them?
*LYNDA: No because I don't need to.

Charley had used Base 10 blocks occasionally in past years and believed they had helped him but now he saw their use as a form of cheating.

*I: How did they help you?
*CHARLEY: Just get six or something and seven and just add them together and that.
*I: Do you think they're good?
*CHARLEY: Yeah.
*I: Why don't you use them this year do you think?
*CHARLEY: You have to know it without cheating.
*I: So the blocks are a bit like...
*CHARLEY: Cheating. Yeah.

Brett could see that the Base 10 blocks had their use but the class was too busy to use them.
Diane used Base 10 blocks and liked them because they helped her better understand numbers. Lucy found them too elementary.

*LUCY: They're probably good for little third graders or Kindergarten to use. Year 5 are too old to use them. We haven't used them this year and now that I know all the times tables and getting use to doing maths I don't need to use them.

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*NATALIE: Um...we were doing a stencil and you had to use them for, I don't know, something

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*I: Do you think they're good?
*CHARLEY: Yeah.
*I: Why don't you use them this year do you think?
*CHARLEY: You have to know it without cheating.
*I: So the blocks are a bit like...
*CHARLEY: Cheating. Yeah.

Brett could see that the Base 10 blocks had their use but the class was too busy to use them.
The voices of Years 5 and 6 Aboriginal children

*I: Were they good?
*BRETT: Yeah not bad. They were all right. They helped a bit.
*I: Why don’t you use them now?
*BRETT: I don’t get the chance to use them in maths. We’re too busy doing some things and tests and that.

Crystal expressed her views on the use of Base 10 blocks and the extent to which they should be available.

*I: When you trade do you use those base 10 blocks?
*CRYSTAL: Yeah sometimes. We used them once I think. Yeah once we used them this year on the floor.
*I: Do they help?
*CRYSTAL: Yeah.
*I: Would you like to use them more?
*CRYSTAL: Yeah. Last year we used them quite a few times.

As well as talking about Base 10 blocks, Colin retold an experience of using Multilink blocks to build shapes.

*I: Do you like using those base 10 blocks to help you work out sums?
*COLIN: No not really. I’d rather use my bead. When I was in Miss Jones, you know those blocks that you can connect together we had to do this worksheet and we had to build these things to work out how many squares you can’t see. The one we were doing bad two. They asked how many can you see with one missing? There was about eight.

Other mathematics materials
Susan liked using Multilink, Polydrons and Pattern Blocks.

*I: What about building shapes?
*SUSAN: They’re all right. I like them only with these here Multilink things. I like building with them but sometimes you get thingo with them, mad at them because you can’t like put them together much. I like this here square and circle ones that you click together and you can make those triangles.
*I: Are they the Polydrons?
*SUSAN: Yeah and these sponge things that we only got at school two or three years ago. I had them in my class last year and the year before and we use to play with them even when it wasn’t maths. You just make castles and things out of them.

Children’s use of materials
Judy had used Centicubes in Year 5 but not in Year 6. Once, when her teacher was away, some Aboriginal children misused the materials. Judy talked about this and why she thought the Aboriginal children were disruptive.

*JUDY: But those little coloured blocks we don’t use them no more because when the teacher was away the kids kept throwing over the classroom and hitting people.
Even girls were doing it as well.

*I:* Why do they do it in mathematics do you think?

*JUDY:* In mathematics. They only want people's attention.

### Summary

#### Table 5.7

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stencils</td>
<td>6</td>
</tr>
<tr>
<td>Base 10 materials</td>
<td>11</td>
</tr>
<tr>
<td>Other mathematics materials</td>
<td>1</td>
</tr>
<tr>
<td>Children's use of materials</td>
<td>1</td>
</tr>
</tbody>
</table>

Five Aboriginal children liked mathematics stencils because they were something different and they save time writing down sums though sometimes they contained too much of the same thing. One did not because stencils were often a repetition of content previously learnt. Eleven of the Aboriginal children liked using Base 10 materials. Base 10 materials help Aboriginal children learn their mathematics and are good to use when you cannot add up. However, it was also believed that Base 10 materials could be confusing, using them was like cheating and that Aboriginal children have to know how to do the sum without them. It was believed by one Aboriginal child that Base 10 materials were appropriate for Years 3 and 4 but by Year 5 Aboriginal children were too old to use them. One Aboriginal child believed that Aboriginal children misuse materials during mathematics lessons because they want attention.

### Learning

From the expressed comments of Aboriginal children the following sub-categories concerning learning were identified.

#### Personal practices of learning mathematics

Brett depended on listening to learn mathematics. "I just listen and learn them and that and go back to my tables and do them sometimes." Colin believed he learned mathematics mainly by listening but also writing it down.

*I:* But you like learning new things in mathematics?

*COLIN:* Yes. Sometimes old things that I don't know I like to learn.

*I:* Sometimes you've learnt them and forgotten about them?

*COLIN:* Yeah.

*I:* Well how do you think you learn mathematics?

*COLIN:* Some people think I'm dumb and I try to prove that I'm not dumb by listening and listening.

*I:* How do you prove that you're not dumb?

*COLIN:* I listen and try to get the right answer.

*I:* Do you learn mathematics any other way?

*COLIN:* Writing it down and trying to work it out on paper.

Judy believed that she learnt by listening to the teacher and at times reading her Year 8
brother's mathematics textbook. Natalie tried her hardest in mathematics except on those days when she was not in the mood. She expressed her beliefs on how she learnt mathematics.

*NATALIE: Yeah. Well I just mainly listen and keep my ears open so I can learn more than what I've already learnt cause I may think that I haven't learnt enough so I need to learn more so just listening to the teacher and stuff.

When he learnt mathematics, Dennis depended on watching.

*I: How do you learn all this maths?
*DENNIS: Watching and try to do it.
*I: Can you explain what you mean by watching?
*DENNIS: The teacher shows you how to do it and you just watch her the right way to do it.
*I: Some kids say you have to listen a lot?
*DENNIS: Yeah a bit.
*I: But it's more watching?
*DENNIS: Yeah that's what I reckon. You've got to watch.

Richard expressed a definite view of how he learned mathematics.

*RICHARD: Teacher just puts stuff on the board and if we don't do it you get put on detention and get in trouble. Teacher says if we don't do it he'll just make us.
*I: How does it get into your head?
*RICHARD: The teacher learns us.
*I: How do they learn you? You do something, what do you do?
*RICHARD: Write it all down and do it.

Vivian believed that "the teacher teaches us" and that what the Aboriginal children have to do is "listen and learn". Lynda believed that her learning "just popped into her head as the teacher was talking." Tom believed that he learned mathematics through the teacher teaching him.

*I: How did you learn how to do it?
*TOM: Getting taught.
*I: Do you think it's important for teachers to talk a lot or is better for teachers to explain it well or take their time?
*TOM: I just like it when she explains work to us.

Lucy was very good at her times tables and when asked how she had learnt them she responded, "I just practised them. Sir says them with us some times and then I practise." Cassie learned her tables by saying them every week. Even though Susan tried hard in mathematics at school she believed that she needed to "try a bit more." She was sure of how she learned mathematics both at home and at school.

*SUSAN: I learn by just getting my paper and I tell mum to write out about two
pages of sums. I do them and then I give them to her and tell her which ones are right and which ones wrong. The ones that are wrong I tell her and then she tells me to go back and do them again and when they're right that's how I learn. I learn at school from things that mum doesn't show me and that.

*I:* So how do you learn at school then?

*SUSAN:* Learn by the teacher. By the way they explain it and that and the way they talk about it and you got to listen and that.

Meryl believed that she learnt mathematics through listening to the teachers, her dad and to other Aboriginal children. She would get annoyed when other Aboriginal children misbehaved because it affected her learning, “cause when someone’s trying to learn something other kids don’t want to learn and they don’t know that you want to learn and then they muck up anyway.” She revealed her strategy for trying to learn mathematics and participating in the class.

*MERYL:* Oh when the teacher asks questions and whoever puts their hand up I try to listen and then when I get the idea I put my hand up and sort of answer the question.

*I:* Sort of say what they’ve said in your words?

*MERYL:* Yeah.

During her interview, Sam introduced a concept of “dos and don’ts” leading to a discussion involving Tina about learning strategies.

*SAM:* By doing dos and don’ts. Just say you want to go and play with the equipment and you’re not allowed to. That’s what you want to do but they says you don’t. Like if I want to go to the canteen and miss says no sit down. Well that’s a do and a don’t.

*I:* That’s what you want to do but the teacher says don’t?

*SAM:* Yeah.

*I:* What’s a do and a don’t in mathematics?

*SAM:* Let us go and learn by ourselves.

*TINA:* Instead of just sitting there and listening.

*I:* So you might want to do maths on your own but the teacher says don’t?

*SAM:* Yeah.

*I:* I haven’t heard that before. Anything else about maths?

*SAM:* Mathematics is like a learning technique.

*I:* What do you mean that maths is this learning technique thing?

*SAM:* You should know a lot about maths. I’d rather learn maths than other subjects.

*I:* How do you learn your mathematics?

*TINA:* The books. I learnt my maths when teachers used to take me out for extra help. In my old school you get your own maths book.

*SAM:* This is a different way to learning maths here. When mum and dad were fighting mum and I took off and we learned up in Melbourne that you used books and you called teachers by their real name. In maths we had a big thick book and all we had to do was turn the page and do what we wanted
Learning new mathematics

Natalie believed that her teacher taught her something new in mathematics most school days "because she is really understanding and she knows what you’re talking about and she helps you out a lot." Judy liked learning new mathematics though she felt that she knew a lot of what was being taught. Crystal liked to learn new things but the only thing that she could remember that was new was the use of the term trundle wheel. Dennis liked learning new things in mathematics "cause you’ll know more things." Susan also liked learning new mathematics because "you don’t get to learn things every day of the week." She even liked to learn hard things though she did have her limits.

*I: What about hard things?
*SUSAN: Yeah I suppose so, but just a bit, but not that much.

Learning mathematics in high school

Richard thought that Aboriginal children had to be good at “their tables and dividing up things and adding” before they go to high school “cause if the teacher asks you sums or something you’ve got to know it.” Natalie believed that there was more mathematics to learn than any other subject, especially in high school, and that it was going to get quite hard. Lynda talked about mathematics getting harder in high school and what it might be like.

*I: Do you think maths is going to get easier or harder?
*LYNDA: Harder cause when you get older and you get a bit good at maths they put you in a higher maths group and you might not be able to do it. I can do some of the top maths class’ work.

Sam believed that Aboriginal children did not use mathematics materials often in Year 7 believing that “next year we’re not going to get to use a lot of the things we use now. Because they think we’re grown up and they don’t need this.”

Summary

Table 5.8

Aboriginal children commenting on sub-categories of learning (n=21)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal practices of learning mathematics</td>
<td>18</td>
</tr>
<tr>
<td>Learning new mathematics</td>
<td>5</td>
</tr>
<tr>
<td>Learning mathematics in high school</td>
<td>6</td>
</tr>
</tbody>
</table>

Eighteen Aboriginal children expressed their beliefs about how they learned mathematics. Most believed in the importance of listening, others on watching and then others believed in writing down the mathematics and working it out on paper. Five of the Aboriginal
children believed that the more Aboriginal children listen and the harder they try in mathematics the better they learn. The teacher was the main source of Aboriginal children’s learning of mathematics with mathematics being learnt through watching teachers and listening to their explanations. It was also believed that the teacher puts mathematics into the Aboriginal children’s heads through Aboriginal children writing it down. Mathematics could also be learnt through textbooks and by redoing incorrect work. Some Aboriginal children learn mathematics when they are given individual help and others learn to answer questions in mathematics by listening to the answers of other Aboriginal children. Aboriginal children could prove they had learnt the appropriate mathematics by giving correct answers. Two Aboriginal children believed that there were different ways of learning mathematics in different schools. The same two talked about the “dos and don’ts” of doing mathematics.

Three Aboriginal children believed there was more to learn in mathematics than any other subject. They believed that Aboriginal children find learning mathematics hard and some believe they cannot do some parts of mathematics even though they know a lot. Specifically, times tables are learnt through practice and some mathematics can be learnt incidentally at home. Five of the Aboriginal children liked learning new things in mathematics.

Six of the Aboriginal children expressed established beliefs about learning mathematics in high school. Manipulatives available to them in Years 5 and 6 would be unavailable in high school, the mathematics would get harder and high school Aboriginal children will ridicule those who do not know the answers to mathematics questions. Before going to high school, Aboriginal children have to be good at tables, division and addition.

**Teaching**

From the expressed comments of Aboriginal children the following sub-categories concerning teaching were identified.

**Mathematics classrooms**

Natalie believed that everything in her mathematics class was just fine though she would “let everyone sit where they wanted to” if she were the teacher. Cassie was happy with mathematics at school and did not want anything changed. Meryl, too, thought “it was all good except when you have to trade sometimes.” Brian, Colin, Richard and Darryl would change nothing in their mathematics class if they were the teacher. If Tom was the teacher of mathematics he would do “measuring, times tables, add and division” as well as fractions because they get hard while Dennis would like to do more shapes and Brett would concentrate on the times tables, graphs and use mathematics sheets.

*BRETT: I’d get them to say their times tables of a morning. Let them say their times tables and give them a maths sheet with a lot of subtractions, graphs and times tables. Put all different kinds of new things on the sheets and that.*

Susan, too, was happy with most of the teaching in her class saying that “I wouldn’t change that many things, but I wouldn’t have ‘divided by’ in my class. That’d be a bit too
hard though you have to learn it but.” Vivian, on the other hand, thought that she “would change everything, just play games and no homework.” Crystal thought that mathematics should be made easier by just doing addition. Brian spent some of his mathematics time talking as he waited for others to finish. He thought that it was good to have some free time to have a chat. Judy talked about her teacher’s reward system that used chance cards. This was the only direct mention of reward systems in mathematics during any of the Aboriginal children’s interviews.

**Teaching Aboriginal children mathematics**

Natalie’s mathematics learning was aided also by her willingness to ask the teacher questions about mathematics when she did not understand. However, she did have friends who worried about asking the teacher questions when they did not understand. Judy had some strong views about asking questions of her mathematics teacher that raised many issues affecting her class involvement.

*I:*  
*JUDY:* Yeah sometimes because he does it too loud and I get headaches so sometimes I don’t take notice of him because I get too much of a headache.

*I:*  
*JUDY:* So you turn off. Do you ask your friend to help?

*I:*  
*JUDY:* Yeah the person who sits next to me on that side because the person who sits on the other comes to school late and be always asks me what to do. I’m not allowed to take notice of him.

Charley expressed a definite belief about the teacher’s role in helping Aboriginal children having difficulties learning mathematics.

*I:*  
*CHARLEY:* What could we as teachers do to help you get better at mathematics?

*I:*  
*CHARLEY:* Help you like if other kids are working and you’re having a bit of trouble come over and help you for a little while.

*I:*  
*CHARLEY:* Do teachers leave you on your own too much, do you think?

*I:*  
*CHARLEY:* Yeah.

*I:*  
*CHARLEY:* And what happens then?

*CASSIE:* People start fighting and that and they cheat and talk and everything.

Cassie believed that Aboriginal children found it hard to do mathematics but she did not know why. Sam and Tina were positive that some Aboriginal children find mathematics hard and they suggested one way teachers could help.

*SAM:* Get us to all sit around and have a good talk like we’re talking to you now about mathematics. Instead of just giving out sheets all the time. She wouldn’t even know how to work it out. She had to add it up on the calculator.

*I:*  
*SAM:* Is this a student?

*SAM:* No our teacher. She should know. She’s learning us. She just gives us sheets all the time and a bit of work off the board.
Natalie indicated that she learnt her mathematics because she had an understanding teacher.

"NATALIE: Well she sits and listens...she's just different to other teachers from last year because we only started going to different classes last year. My last year's teacher was good as well and he listened but I just think this year's teacher is more understanding. I think she probably has been probably teaching maths longer than the other teachers and she knows more about it. She handles the kids very nicely."

Managing children
Tom commented on the Aboriginal children who misbehaved saying that teachers should "move them away from each other if they're sitting near each other or just put them on detention." Judy spoke of the disruptive Aboriginal children and those who arrived late causing the teacher to review what had occurred. She was not happy about Aboriginal children arriving late. Judy thought it unfair that "when you're in the middle of doing something and they come in and the teacher rouses on them and puts them on detention and then you've got to start all over again."

Summary

Table 5.9
Aboriginal children commenting on sub-categories of teaching (n=21)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
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<tbody>
<tr>
<td>Mathematics classrooms</td>
<td>15</td>
</tr>
<tr>
<td>Teaching Aboriginal children mathematics</td>
<td>9</td>
</tr>
<tr>
<td>Managing children</td>
<td>2</td>
</tr>
</tbody>
</table>

Fifteen of the Aboriginal children generally liked their mathematics classes, enjoyed doing shapes, having some free time and talking to each other. One Aboriginal child thought that there was enough shape work done in mathematics. There was only one mention of the use of rewards in mathematics. Aboriginal children believed that understanding teachers sit and listen to them and the more experienced teachers were the better they were at teaching mathematics. Two of the Aboriginal children believed that it was important for them to be able to ask the teachers questions when they did not understand the mathematics. They believed that teachers should help Aboriginal children individually and spend more time on fractions. One child believed that teachers leave Aboriginal children alone too much and that this could lead to children misbehaving. Two Aboriginal children believed that it was the same Aboriginal children who always misbehave in mathematics and that it was unfair to the class when Aboriginal children arrived late to mathematics classes.

Structures

From the expressed comments of Aboriginal children the following sub-categories concerning structures were identified.

Graded classes
At Ellen Road Public School the Aboriginal children were graded into mathematics classes based on term results. There were five mathematics classes across Years 5 and 6. There
was a top mathematics class comprising Year 5 and 6 children, the second class focussed on Year 6 Aboriginal children, the third on the lower group of Year 6 Aboriginal children, and the fourth class was predominantly the middle ability group from Year 5. The fifth class comprised the lowest ability children from Years 5 and 6.

Colin felt weird when he moved from one class to another class.

*I:
*COLIN: What was weird about it?
*I: You get harder sums and that.
*COLIN: Was it a bit scary for a while?
*COLIN: Yeah. Martin he was in a higher class and he got dropped down because of not learning his sums and I got put up because I was the top of the class.
*I: What else made it weird besides the harder sums?
*COLIN: You leave the classroom and sometimes you forget where you’re going.

Dennis talked about the mathematics classes that he had been in and how he moved from class to class.

*DENNIS: I started in Mrs Cotter but I didn’t work hard so they put me down to Mrs Allan’s.
*I: Why didn’t you want to do the work?
*DENNIS: Cause some of it was too hard. I just sat there and I did a few of them and I got them right but I didn’t want to do the rest.
*I: But you could have done them if you had worked harder?
*DENNIS: If they give me some more time.
*I: Do you get annoyed that you have to do maths in this much time when you might need a bit longer?
*DENNIS: Yep. Mrs Cotter gives us a full page and we might only have five minutes to go. have to do all this writing in five minutes.
*I: But Mrs Allan doesn’t do that?
*DENNIS: No she just gives us a few easy sums like five into five hundred and thirty six.
*I: So why did you quit working hard?
*DENNIS: Just didn’t want to do it.

Working individually

Lynda and Judy preferred working on their own: Lynda because it helped her concentrate and Judy because her friends could confuse her “because they get you mixed up and stuff.” Lucy also liked to work on her own.

*LUCY: Yes. I like it that way because I don’t want people cheating off me cause I might have it wrong and they might get it wrong too.
*I: What if you have it right?
*LUCY: Well they might not too.

Charley liked to work on his own in case other Aboriginal children looked at his work and the teacher became annoyed.
*CHARLEY: *Cause they look at your paper and the teachers get up you.
*I: *Teachers do, do they?
*CHARLEY: *Cause you get in trouble if they copy off you. They get up you instead of the other kid.

Tom liked to work on his own because others “muck up and they don’t want to learn anything.” Brian, too, liked to work on his own because “then you’re able to concentrate a bit harder without your friends talking to you.” Tina definitely liked to work on her own.

*TINA: *My own, cause if the other person copies off me and I’ve got the wrong answer they’ll probably come back and say I’m dumb and why did I give them the wrong answer.

Working with others
Dennis liked to work with other Aboriginal children “cause you get them to help you.” He also liked to chat. Richard liked to work with his friends because “if you get stuck they can help you and you help them sometimes.” Susan worked “mostly with my mates but sometimes I don’t like doing it on my own cause you’d rather share, like answers, with your mates and that.” Cassie much preferred to work with her friends in mathematics because they could help each other. Crystal had a friend with whom she liked to work because she sometimes gave her the answer. It was a case of “I help her and she helps me because we sit together in maths.” Meryl had definite views about working with friends.

*MERYL: *Yes. Cause sometimes like when the teacher tries to explain it to you I can’t really understand them but sometimes I can and sometimes I can understand my friends because I think they can explain it better. I think it helps us both.

Meryl liked working with others, so they could explain mathematics to each other in words that they each understood, though she did not think that this should be done in mathematics tests because Aboriginal children would cheat. Natalie agreed, though she thought it would be good if children could explain the mathematics to each other in tests.

Choosing to work individually or with others
Sam liked working on her own but, at times, appreciated the advantages of working with others. She identified one occasion when it was preferable to work individually.

*I: *Do you like doing maths on your own or with your mates?
*SAM: *On my own mostly cause I feel free if I just want to go ahead and learn it myself. Like I try to do it myself but when I’m in a group with friends they’ve got to discuss this and it takes a lot of time. You know you have to learn about these things but they just say this and that and you haven’t a clue what they’re talking about by the time they’re finished. I like to do it by myself because people criticise you.

*SAM: *It’s better just working by yourself. I mean the sheets that miss gives we
have to do it as a class all the time but you know how to do it. She should let you go ahead and do it.

Maggie preferred to work on her own but sometimes liked to work with other children.

*I:* How do you decide whether you want to do it on your own or with your mates?

*MAGGIE:* Last week we had this game that included mathematics and you could do it by yourself or with your friends. If I bad of done it by myself it would have taken too long.

Natalie liked to do mathematics on her own but there were times when working with a friend helped her understand and she enjoyed socialising with her friends.

*NATALIE:* I like doing it on my own most of the time but if a question gets a bit hard I ask my friend sitting next to me and she just tells me what you're meant to do.

*I:* What, she understands it better than you?

*NATALIE:* Yeah because I mustn't have been listening or something.

Darryl and Colin both liked to work alone and with their friends at times.

*I:* When you do maths do you sometimes do it with your friends or on your own?

*COLIN:* That's a hard question. Sometimes I do because I don't know the answer and they just say write this down and they kind of convince me to write it down.

**Working outside or inside**

Cassie, Judy and Maggie liked doing measurement outside. However, Cassie also liked doing mathematics inside "because it's nice and shady." While Dennis liked learning mathematics outside because "it gets too hot and stuffy in class." Meryl liked working outside in mathematics because when "you're stuck inside all the time it gets really annoying." Brian also liked to work outside and he would like to do so more often.

*I:* Do you like doing maths inside or going outside?

*BRIAN:* Going outside cause it's a lot different than being inside. You get to sit on the ground not seats. You get to do other things than times and stencils.

*I:* Do you go outside much?

*BRIAN:* No, not really only when we do metres.

*I:* Would you like to go outside more?

*BRIAN:* Yes.

Darryl, on the other hand, preferred to do mathematics inside:

*DARRYL:* Just say the teacher wrote something on the board and you have to and you're outside and you have to stay in that one spot. Now how are you going to see what's on the board?
Summary

Table 5.10
Aboriginal children commenting on sub-categories of structures (n=21)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
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<tbody>
<tr>
<td>Graded classes</td>
<td>4</td>
</tr>
<tr>
<td>Working individually</td>
<td>7</td>
</tr>
<tr>
<td>Working with others</td>
<td>6</td>
</tr>
<tr>
<td>Choosing to work individually or with others</td>
<td>5</td>
</tr>
<tr>
<td>Working inside or outside</td>
<td>9</td>
</tr>
</tbody>
</table>

Two of the Aboriginal children felt strange when they moved from one graded class to another believing that it takes a while for Aboriginal children to get used to a new mathematics class. The Aboriginal children believed they should be allowed to pace their learning and decide on how they work, whether individually or with their friends. The type of mathematics that was being done influenced the Aboriginal child’s preference for working individually or in groups.

The Aboriginal children identified the advantages and disadvantages of working individually and with others when they did mathematics. There was a general concern about the effect on learning when others copied or misbehaved. The belief was expressed that when you work individually your friends cannot cheat from you, you do not give your friends wrong answers and you concentrate better. It was thought that working with others can be a barrier to learning although, it was useful working with someone else when mathematics becomes hard because children can help each other, share ideas and explain to each other what the teacher has said. However, working with others in mathematics can also confuse children and slow them down. Indeed, when working together in mathematics children can convince each other of an incorrect answer and teachers could think the children were cheating. Six of the Aboriginal children expressed a liking for doing measurement outside.

Technology

From the expressed comments of Aboriginal children the following sub-categories concerning technology were identified.

Calculators

Darryl liked to use calculators “on those hard sums when you have to work it out.” Richard and Tom thought they were “good for help” though they were not used much in class. Colin did not like using them “because sometimes calculators can break, sometimes your head can break but usually it won’t.” Brian did not have his own calculator though his brother and sister had one each. He used them for checking answers. Crystal was unsure if she had used them and she did not have one at home. Meryl expressed her view on the appropriate student use of calculators.

*I:  Do you ever use your calculator in class?
*MERYL:  No. We’re not really allowed to use them.
*I:  What do you think about using calculators?
*MERYL:  I reckon that we should use our brain but if the question is a bit hard we
should use the blocks or a calculator.

Lynda neither used a calculator nor had one at home though she thought “they’re smarter than me because they give you the right answer.” Natalie did not have one at home and she thought they were a good thing to use because “you could know the answer. What the right answer is and if it isn’t you can find out what it is.” Natalie used a calculator in her mathematics “to mark our mentals or our sheet so the teacher doesn’t have to mark it. We just get a calculator and work out the answer ourself.” Susan definitely liked using calculators.

*SUSAN: Yeah I like them cause they help you more about sums. If you don’t know something you can just get your calculator and do the thing on the calculator, what the sum is. I love calculators cause my pop and my aunty have got heaps of them. I use them more than what I use mine. When we go up home, up nanna’s I use theirs all the time.

In Judy’s mathematics class there was no organised use of calculators though children did use them.

*JUDY: Only when sir’s too busy and he doesn’t want kids to cheat. Usually we haven’t got no calculators and we have to run around the other classes to get them.

Tina and Sam were concerned about how she would learn if she used a calculator.

*TINA: I don’t like them because if you cheat off a calculator, “However are you going to learn?”

*SAM: Calculators, I use to use them a lot but then I figured how am I ever going to learn so I gave mine back to my sister. I just said no way, not anymore.

Cheating

If Tom was the teacher the Aboriginal children would not use them “because they might sneak out and get a calculator and cheat with it under their desks.” Charley thought they were all right. He used one for his homework though he thought it was like cheating.

*I: Why are they good?
*CHARLEY: Cause you can cheat.
*I: Have you got one at home?
*Charley: Yes.
*I: Do you use it to do homework?
*CHARLEY: Yes if it’s a bit too hard. First I go home and if it’s too hard I use my calculator.

Brett was not in favour of them because “I reckon they just help people cheat and that, cause people sneak calculators into tests and that.”
Summary

Table 5.11
Aboriginal children commenting on sub-categories of technology (n=21)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculators</td>
<td>13</td>
</tr>
<tr>
<td>Cheating</td>
<td>3</td>
</tr>
</tbody>
</table>

Thirteen Aboriginal children commented on the use of calculators with the significant issue of learning being raised. They used them because they believed they helped with the hard mathematics, particularly for the harder algorithms. There was the belief that calculators provide the right answer and that they can be smarter than a person because they give right answers. The belief was expressed that Aboriginal children should be able to decide when they use calculators. However, three Aboriginal children believed that using calculators was cheating and their use hindered Aboriginal children's learning of mathematics.

Assessment

From the expressed comments of Aboriginal children the following sub-categories concerning assessment were identified.

Mathematics tests
Judy usually had a mathematics test every Thursday and she thought that they were good because the class was quiet. For Cassie, some parts of mathematics tests were easy and some were hard. The marks she received indicated how well she was doing at mathematics. Lynda liked tests and she liked to finish before the other Aboriginal children so that the teacher thought that she was brainier. It did not worry her that much if she made mistakes.

*LYNDA:  If you get them wrong you get them wrong. I just practise them. I just get stuffed on the shapes and that.*

Darryl liked doing the problems in tests "because some sums you haven't seen before and it's kind of fun trying to work them out." Tom knew he was good at maths because "Miss Martin, Mum, Dad," told him this. He thought mathematics tests were good "cause they help us out in maths. If you don't know what to do just go on with the next question." He thought tests were good because "they'll help you get good grades."

Crystal knew that she was good at saying her nine times tables and doing money but it was the mathematics tests that told her that she was poor at mathematics "cause I get some of the tests wrong and it's too hard for me. Like I get most of them right on my other sheets when we did them." Brett thought he was "not too bad" at mathematics though he would like to be better "at times tables and that." He thought the length of the tests was sometimes too much.

*I:  What do you think about all those tests that you said you did?*

*BRETT:  Yeah I got the highest points a couple of times for scores and that and the sheets are all right but some of them have got too much writing and that*
PLEASE NOTE:

P. 119 is missing from this thesis
Susan described mathematics as her worst subject in which she usually did “no good.” She often felt bad in mathematics because “like you never got a good mark and all the other fellas got a good mark and you’re the only one like who got a bad mark and you feel bad cause they got a good mark.” Maggie knew she was good at maths because she received good marks in her tests “cause last year on this test that we did I got 98%.” Brian felt that he was not that good at mathematics “because most of the time I get the answers wrong” but it did not seem to worry him.

*I: How do you feel when you get them wrong?
*BRIAN: Nothing, just normal. Doesn’t worry me much.

Dennis believed he was good at mathematics tests because he got “good marks.” He said that there was one teacher who “says to me put your head down and you’ll be good.” Colin seemed to enjoy the challenge of tests. He thought he was good at mathematics “because I can work out maths using my head instead of using my fingers.”

*I: You don’t use your fingers much?
*COLIN: I don’t even use a ruler like other people do.
*I: So some kids in your class use fingers and rulers to work it out?
*COLIN: They only use rulers in my maths class but when I was in the other class people were using fingers.
*I: Is that good or bad to use your fingers?
*COLIN: Very bad because you can’t always get the right answer because you might have a question with fourteen and you run out of fingers.

Summary

Table 5.12
Aboriginal children commenting on sub-categories of assessment (n=21)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
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<tr>
<td>Mathematics tests</td>
<td>14</td>
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<tr>
<td>Test scores</td>
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</table>

Fourteen Aboriginal children expressed a number of beliefs about the impact of mathematics tests and the resultant scores on their views about mathematics. The belief was expressed that mathematics tests are good, particularly as they keep the class quiet. In what appeared to be contradictory beliefs the Aboriginal children thought it a good idea that they help each other during mathematics tests but that it should not be allowed to happen. Aboriginal children believe they are good at mathematics when their parents and teachers tell them so, if they gain good marks or if they can work out the answer mentally. Further, it is believed that the quicker Aboriginal children finish a mathematics test the smarter they are. There are some Aboriginal children who are nervous leading up to a test but the tests are important because they help Aboriginal children gain good grades. Many mathematics tests are reviews of the work and teachers go over work that the Aboriginal children know to help them in their tests. However, there is sometimes just too much to do on some mathematics tests and some have content that the Aboriginal children have not seen before. Aboriginal children believed that marks were the indicator of how well you knew your mathematics and that the mark you received would make you feel good or bad.
Content

From the expressed comments of Aboriginal children the following sub-categories concerning content were identified.

Specific mathematics content
Brett said he would like to be better at “graphs and measurement and all that stuff” as well as shapes. Colin thought that temperature was one of the most interesting aspects of mathematics and he also enjoyed problems. Crystal and Cassie particularly enjoyed temperature measurement. Lucy talked about the measurement and spatial activities that were done in her mathematics class.

*I: Do you do much measurement in class?
*LUCY: We finished that last term. We measured the back wall of our classroom, the window, the table, the heater and the blackboard. It was all right but I didn’t like it all that much.

*I: Do you like shapes and building things?
*LUCY: Yes but we don’t do much of that. I’d like to do more because it’s good and you can make things. We get plasticine and we make things.

Vivian disliked what was done in measurement in her mathematics class and there appeared to have been little spatial work introduced.

*I: What happens in your class?
*VIVIAN: We just get the metre rulers those ones that you mark with and we measure things.
*I: Would you like to do it more?
*VIVIAN: No.
*I: What about building shapes and looking at angles? Do you like that?
*VIVIAN: We don’t build shapes. We haven’t done any building yet.
*I: Would you like to use different materials to make all different shapes?
*VIVIAN: Yeah. We only make them out of paper like the cube.

Brian talked specifically about measurement and shapes. He thought measurement was “all right but sometimes it gets complicated cause I don’t know the things like tonnes and kilograms, not that well.”

*I: Should you do more?
*BRIAN: Yeah a bit more so I know it better before I go to high school.
*I: Do you do much building of shapes in class?
*BRIAN: At the start of the year we did. We did shapes and all that.
*I: Did you like doing that?
*BRIAN: Yeah. I know most of them and I like doing them.

Lynda liked mathematics except she thought that she was “shocking at shapes.”

*LYNDA: Shocking! All that I know are octagon with eight sides the quad what you call it
The voices of Years 5 and 6 Aboriginal children

*I:* How many sides has it got?
*Lynnda:* Four. Triangle, circle, square, rectangle. I'm not too bad at my prisms.
*I:* You're not shocking at shapes.
*Lynnda:* Yes I am. When we do our prisms, what do you call those other ones where you have the shape on the bottom and they all go up to the top? Like you have a triangle there what are they called?
*I:* Pyramids.
*Lynnda:* I can draw them and all that but some are hard. Miss says draw such and such and I don't even know what it is.
*I:* Have you ever made those shapes?
*Lynnda:* With paper and we glued them together.
*I:* So you've never used plasticine or clay to make them?
*Lynnda:* Noo.

Repetitive content
Brett believed that in Year 6 you "probably do more of the same" sorts of mathematics as in Year 5. Linda, who was in Year 6, also felt that she was repeating work that she already knew.

*Lynnda:* She gives me all the stuff I've already learnt and I told her that. I don't know my tables very well and I want to learn my shapes and I know how to do my sums. I'm not very good at my times tables and I want to get better. I get confused in my phrases because I'm not used to doing them so much.

Games
Charley, Darryl and Brian all liked mathematics games because they "teach and learn quicker and that." They would like to play more.

*I:* Do you play any games in maths?
*Darryl:* Yeah. They're good fun. We play Hangman in maths and we have to guess what the answer is. That's good fun cause you got to guess and put your hand up and then the teacher asks you.

Susan, too, was definite about playing games in mathematics and at the same time talked about what she would like to do more.

*I:* Is there anything that you don't do in maths that you'd like to do?
*Susan:* All the things there are all right I think. They're pretty good but I wish we could do some more plus things.
*I:* Why them?
*Susan:* I don't know. I just like them.
*I:* Some kids say that we should play more games in maths?
*Susan:* Well you're not going to learn nothing if you play more games in maths.

Crystal enjoyed playing mathematics games when they had finished their tests. Judy liked playing multiplication tables games. She did not like other games "because people muck up in games and can't get games finished before people go because they're not paying attention." Diane liked games and thought there should be more of them in her class.
Summary

Table 5.13
Aboriginal children commenting on sub-categories of content (n=21)

<table>
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<td>Specific mathematics content</td>
<td>17</td>
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<td>Repetitive content</td>
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<td>Games</td>
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Seventeen Aboriginal children commented about specific mathematics content. They liked measurement, particularly temperature, working with shapes and building. They believed that they should do more measuring and spatial mathematics. They believed that there are too many tables to remember in mathematics and that trading and long multiplication can be hard to do. Four Aboriginal children believed that teachers repeated mathematics content that they already knew. Twelve Aboriginal children enjoyed mathematics games though some did not when children misbehave. One Aboriginal child believed they would not learn much if children played games too often in mathematics.

Overview

This chapter has reported on the analysed data related to the research question, What are the beliefs expressed by Years 5 and 6 Aboriginal children, in a rural community, about mathematics and the learning of mathematics? These Aboriginal children were interviewed across a number of weeks after initial relationships had been established through my presence in the school, classrooms and playground for the previous month. The Aboriginal children voiced beliefs across a wide range of issues related to mathematics and the learning of mathematics. Overall, the Aboriginal children liked mathematics and liked their mathematics class. Individual Aboriginal children experienced a variety of feelings whilst learning mathematics including confusion, ridicule, annoyance, embarrassment, shame and anxiety. Feelings of self-confidence in asking teachers questions and belief in one’s self to do mathematics were identified as important in learning mathematics.

These Aboriginal children expressed a variety of feelings that affected them in their learning of mathematics. They expressed beliefs about their likes and dislikes in mathematics. Mathematics could be fun, exciting when you do not know an answer and you work it out, boring if the work is too hard or too easy and challenging at times. When they did not understand the mathematics they could become confused, frustrated and annoyed. There was a strong belief in that it was perhaps better to fail than to be shamed in front of your friends by being put on the spot in front of the class or by giving an incorrect response. For six of the Aboriginal children there were strong connections between being scared, failing and being shamed.

The Aboriginal children stated that measuring and spatial work were mathematics strands that they enjoyed doing. They believed that mathematics can be hard, particularly division and problem solving, and linked many of the difficulties they experienced in learning mathematics to the teacher language and the mathematical language used in the mathematics classroom.
The Aboriginal children believed that it is the teacher who is the key person who teaches Aboriginal children mathematics. The teacher has to explain the mathematics clearly. If the teacher does not explain the mathematics clearly Aboriginal children become confused. The teacher who is caring and understands what Aboriginal children are saying is important when Aboriginal children are learning mathematics. These Aboriginal children expressed the belief that a critical factor in learning mathematics is listening. Aboriginal children believed it was their fault if they did not understand mathematics, believing that you learn mathematics by listening to the teacher and that if you did not understand it was because you had not listened well enough. They identified family members, Aboriginal educators, teachers, friends and other Aboriginal children as people who help Aboriginal children learn mathematics.

The expressed student's beliefs of these Aboriginal children are important in that they clearly show that Aboriginal children do hold opinions about the learning and teaching of mathematics in Years 5 and 6. They have expressed significant comment concerning their feelings towards mathematics, the people who help them, ways in which they believe they learn mathematics and provided teachers with suggestions about teaching mathematics to Aboriginal children. Their expressed beliefs display the complex social and cognitive issues related to their learning of mathematics. An awareness of the range and depth of their beliefs about mathematics and the learning of mathematics is an initial step in teachers implementing appropriate classroom strategies to enhance the mathematical learning potential of Aboriginal children.
Chapter 6

The voices of parents of Aboriginal children

This chapter reports on the interviews with parents of Aboriginal children learning mathematics in Years 5 and 6 at Ellen Road Public School. Six parents agreed to be interviewed: Angie, Sally, Mrs Finane, Dawn, Mr and Mrs James. First name or surname pseudonyms are used for the participants depending on their preference.

 Angie was a grandmother with the role of looking after her three grandchildren who attended the school. Her eldest grandchild Brian was in Year 5. Angie had grown up on the Aboriginal Mission within the town. She was actively involved in the school.

 Sally, whose daughter Diane was in Year 5, was very hesitant to talk about mathematics but agreed to be interviewed with a female Aboriginal educator present.

 Mrs Finane was president of the ASSPA (Aboriginal Student Support Parent Association) committee and worked as the Aboriginal health co-ordinator through the local hospital. Her daughter, Crystal, was the only Aboriginal child in the top mathematics class.

 Dawn worked for a government agency and was enrolled in a university teacher education program. She was actively involved in the school, a member of the ASSPA committee and had a daughter in Year 5.

 Mr and Mrs James had two sons, Bill in Year 5 and Colin in Year 6. Mrs James was Aboriginal and Mr James was non-Aboriginal, both were always willing to assist the school in whichever ways they could.

 Though willing to be interviewed, Sally, Angie and Mrs Finane preferred not to be audiotaped. Notes of their interviews were taken and they were asked to read through them to acknowledge accurate reporting. A female Aboriginal Education Assistant was present during the interview with Mrs Finane, at the participant’s request. Dawn, as well as Mr and Mrs James, gave consent for their interviews to be audiotaped. Final transcripts of the interviews were read by the parents to ensure they were satisfied that they were a true record of the interviews. Transcriptions of these interviews have been used in this analysis. The transcriptions reported beliefs about the learning of mathematics through the voices of parents of Aboriginal children in Years 5 and 6. In reporting the interviews both direct quotes and paraphrasing of the participants’ comments are used. The number of parents of Aboriginal children who commented for each of the sub-categories is reported in a table within each category summary.
Feelings about mathematics

From the expressed comments of parents of Aboriginal children the following sub-categories concerning feelings about mathematics were identified.

Concern for children’s learning of mathematics

Mr James expressed concern about his son’s confidence in doing mathematics, the pressure which comes from going to high school and in his own difficulty in trying to understand the language of mathematics so that he could help his son. Mr James, himself, had not used mathematics very much since he left school.

*MR JAMES: Yes he has a lot of pressure on him. I think it’s only his maths that’s holding him back. If he was better he’d feel a little more confident about going into high school. He’s picked up a hell of lot but he just doesn’t have the confidence there. As I say I can sit there and look at a question and it takes me some time to find out what the teacher is trying to ask. The way they word it, is different to what I was used to. I haven’t used maths much since I left school anyway. It’s all been computers or calculators. I just haven’t bad to work with it. I haven’t bad to read it.

Mr and Mrs James’ noted that their Year 6 son, Colin, was worried about his mathematics ability and did not want to go to high school. Mr James believed that if Colin listened at school he could learn and that his mother could help him at home if he still did not understand. He also believed that Colin’s mother was the one who could help him more with mathematics than himself. He expressed a feeling of hopelessness in not being able to do the mathematics and helplessness in not being able to support his son’s mathematical learning.

*MR JAMES: Colin said to me “I don’t want to go to high school because I’m no good at maths and I won’t be able to do it.” I said you’ve got to learn. You’ve just got to listen to the questions and if you don’t know bring it home to mum and mum will work it out.

Self-confidence

For Mr James, one’s confidence in mathematics was important. He believed that his son “has to get the confidence to put his hand up and say I don’t know what you’re talking about.” The James’ felt that their son’s own feeling of not being good at mathematics was affecting how he felt about going to high school.

*MRS JAMES: He said that he’s no good at maths. He doesn’t want to go up to high school because he’s no good at it.

*I: He’s a bit scared?

*MRS JAMES: Yes because he’s no good.

*MR JAMES: The problem with his maths is he’s too scared. With everything else he’s fine but with maths…

*MRS JAMES: He doesn’t understand it.

*MR JAMES: He doesn’t seem to be able to grasp it. He’s very quiet and withdrawn.
Mr James was a father fully aware of his son’s difficulty in doing mathematics. He was concerned with his son being “no good” at mathematics and being scared of mathematics, particularly, as he believed his son was managing with all the other subjects. The link between ‘confidence in’ and ‘competence at’ doing mathematics emerged during the interview. Mr James believed that because his son was quiet and withdrawn, teachers had to tell him how to do mathematics and had to maintain a strict surveillance over his son in his learning of mathematics.

Pearl and Angie, too, raised the issue of Aboriginal children’s feelings of self-confidence in doing mathematics, linking it to the role of language in the learning of mathematics.

*ANGIE: *A lot of Murri kids find it hard to understand the language of mathematics. They don’t know what the words are. Often in mathematics the Murri children feel a bit put down. They don’t feel good about mathematics. They lack confidence in their own ability to do it.

**Summary**

**Table 6.1**

<table>
<thead>
<tr>
<th>Sub-category</th>
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<tr>
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<tr>
<td>Self confidence</td>
<td>4</td>
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</tbody>
</table>

Two parents believed that Aboriginal children worry about going to high school because they are not good at mathematics. There was a concern expressed by a father in that he felt unable to help his sons with mathematics. He felt unable to help because mathematics was taught and worded quite differently to the ways he was taught. Often Aboriginal children feel ‘put down’ in mathematics and develop a lack of confidence in their own ability to do mathematics. The issue of Aboriginal children’s self-confidence in their ability to do mathematics was seen to be important by four parents, particularly in Aboriginal children asking teachers questions when they were unable to do the mathematics. Links between self-confidence and feelings of competence emerged as an issue that impacted upon Aboriginal children’s learning of mathematics.

**Context**

From the expressed comments of parents of Aboriginal children the following sub-categories concerning context were identified.

**Aboriginal children at school**

One parent, Dawn, spoke directly about many of the issues related to the context in which Aboriginal children learn. Dawn was of the view that many of the schools focussed on literacy but that the same degree of interest and funding did not go towards numeracy. She believed in the importance of parent involvement in their children’s education but identified reasons why it was not happening. She talked about the two
significant issues of discipline and institutional racism and their impact upon the learning of Aboriginal children.

Dawn believed that many teachers were not even aware of the institutional racism that existed. Issues of discipline and detention as they influenced Aboriginal children’s learning were a focus of part of the interview. Dawn believed that, from a school point of view, Aboriginal student behaviour and resultant discipline strategies were of major concern. This was seen to be in conflict with the community’s concerns about cultural awareness and issues of racism.

*I: Now you said from a school point of view.
*Dawn: Not from the parents’ point of view. Their view would be cultural awareness or racism whereas the school would say behavioural problems. They’re picking on our kids.

If teachers concentrated on developing their awareness of the cultural issues faced by Aboriginal children and the institutional racism, overt as it may be, that exists in schools rather than focused attention on Aboriginal children’s behavioural problems the children’s learning may be enhanced.

Dawn believed that the more assimilated Aboriginal people appeared to be, the more non-Aboriginal people accept them.

*Dawn: The more assimilated you are the more accepted you are. So you be a good little Jackie you’re reliable and prompt and all those things which are requirements of the hidden curriculum. I know people have been harassed. They don’t treat us as individuals. Why should you be judged differently because you’re Aboriginal?

Aboriginal children link strongly to their identity of being Aboriginal. This is as evident in the mathematics class as in other contexts. Through appropriate teaching strategies the Aboriginality of the child can be recognised.

Dawn believed that a policy of exemption from class to enforce discipline could not support Aboriginal children’s learning.

*Dawn: A parent from one school pulled her kids out of a school because there was a query about the welfare of the children. She wasn’t going to put up with that interrogation. If a kid does get to school late they’re made to sit outside the classroom for a couple of periods. How is that important to education? Like these detention periods. My child isn’t getting educated they’re getting disciplined. The discipline is becoming more important than the education. We’ll punish this kid because he mucked up. We’ll sit him outside. That’s an old punishment strategy.

Dawn is suggesting that a punishment approach to classroom management will not support Aboriginal children’s learning. A focus on discipline and the use of detention can minimise learning opportunities.
Aboriginal children and non-school contexts

Angie and Dawn talked of non-school contexts in which Aboriginal children experience and learn practical mathematical concepts. Pertinent comments were made about the relevance of the cultural context in which the children lived and mathematics they learned out of school, particularly in the dice schools, and how the children became aware of the relative value of money.

* ANGIE: When kids play in the dice school, even from the age of six, those kids were doing mathematics. They were remembering the odds on the dice and they were playing for money. They could give you change for their bet straight from the top of their head without writing it down. I believe you can’t cheat a Murri kid gambling or at the canteen when it comes to anything with money.

Sally raised the issue of there being no age discrimination in children’s activities in Aboriginal families, while at school, artificial age barriers existed between children as they progressed through the different grades. She believed that, at times, such age barriers could affect children because they highlight a difference about learning between the Aboriginal community structure and that of the schools. Within the community Aboriginal children learn from each other in the things they do. At school they are separated into different classes for their learning based on their age and, in the case of Ellen Road Public School, their mathematics ability.

* SALLY: There’s no age limit in a lot of the things that kids do. They’re not limited by age in joining in community activities. Thus it becomes hard for some of them when kids go on excursions. How come they go away and I don’t go? Aboriginal people have a community life where often everyone goes away together. When they don’t kids can’t understand. There’s often a different structure in the community to that within schools.

Summary

Table 6.2
Parents of Aboriginal children commenting on sub-categories of context (n=6)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aboriginal children at school</td>
<td>1</td>
</tr>
<tr>
<td>Aboriginal children and non-school contexts</td>
<td>3</td>
</tr>
</tbody>
</table>

The context for Aboriginal children learning mathematics was placed within the broader context of Aboriginal children’s learning at school. The belief was expressed that racism still exists in schools but that it is more subtle now than what it used to be. Because many teachers were not aware of institutional racism and the subtlety of that racism within schools, Aboriginal children suffer. Further, one parent believed that Aboriginal children were being victimised in some schools. The belief emerged that Aboriginal people were judged on the basis of their Aboriginality rather than for their own worth. Two parents believed that behavioural problems amongst Aboriginal children were of major concern to teachers. One parent expressed the belief that there were inconsistent school practices in relation to discipline and that discipline was becoming more important in schools than education. For Aboriginal children there was often a different learning structure in the
community to that within schools. Aboriginal children were not limited by age when they join in community activities. However, at school there existed an artificial barrier of age.

**Homework**

From the expressed comments of parents of Aboriginal children the following sub-categories concerning homework were identified.

**Homework and language**
The parents believed that they could not understand many of the mathematical words and symbols used in the children's mathematical homework. This made them feel that they could not help their children as much as they would like. As Mr James commented, "I can add up in my mind, that's no problems, but to try and read what the teacher's after, that's a different story altogether." Mr and Mrs James emphasised their belief that in trying to help their sons with their mathematics homework they struggle in trying to explain the language used. The language of mathematics homework, both the words and the symbols, was identified as a critical barrier to parents helping their children.

*MR JAMES: There've been times when they've had their maths homework. I've had to sit down and instead of just reading it and saying this is what you have to do I've had to try and decipher what they're trying to say myself. It might have taken me two or three minutes and then all of a sudden click and I know where I'm going.*

**Misinforming children**

Of even greater concern to Mr and Mrs James was their belief that they might be misinforming their children in the correct way to do the homework.

*MR JAMES: As I said, it's the way it's worded at times he doesn't understand it even after I've explained it to him. I have to try and write it out myself and try and show him how it's done and sometimes it's hard for me.*

*MRS JAMES: And we might have it wrong too.*

*MR JAMES: We might be pointing him in the wrong direction.*

**Changing times**

Angie talked about the issue of homework and how she felt that times had changed for many children. She compared her childhood homework experiences to those of today's Aboriginal children. Angie talked about the home situation that many Aboriginal children have after school which often does not support their doing homework. She also talked about the degree of frustration that she has seen in her own Aboriginal children when doing mathematics homework.

*ANGIE: When I was young at the Mission school I would come home where mum and dad would make me sit down and do my homework and this was the case for a lot of the Marri kids living on the Mission. Nowadays with my children I make them do their homework but I am aware that there are a lot of kids both Aboriginal and non-Aboriginal that come home to empty to learn my tables off by heart and I believe that's still important. I see my*
own get fromes and often the homework is not that important and is left. The kids go and play. When I was going to school I had frustrated every now and again with some of their homework. I tell them to sit down, take your time, look at it and do it bit by bit. I get upset myself that I can’t help my own as much as I would like. I feel that having left school, when I was fourteen stopped me from learning as much maths as I would like to know.

Angie believed that through her own school experience of having to leave when she was 14 she was now unable to help her own grandchildren as much as she would like. The issue of helplessness in supporting their children’s mathematical learning, expressed earlier by Mr James, echoes in these comments.

Summary

Table 6.3
Parents of Aboriginal children commenting on sub-categories of homework [n=6]

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework and language</td>
<td>4</td>
</tr>
<tr>
<td>Misinforming children</td>
<td>4</td>
</tr>
<tr>
<td>Changing times</td>
<td>1</td>
</tr>
</tbody>
</table>

Helping their children with mathematics homework is hard for a lot of Aboriginal parents. The language of mathematics homework emerged as a significant issue for four Aboriginal parents. Many Aboriginal parents have not seen the mathematical words that are included in some homework and have to decipher the mathematics homework themselves, before they can help their children. They become confused with some of the mathematical homework, upset that they cannot help their children as much as they would like and worried that they might misinform them in how to do the mathematics.

Learning

From the expressed comments of parents of Aboriginal children the following sub-categories concerning learning were identified.

Aboriginal children and learning
Sally did not speak specifically about mathematics but tried to put the learning of mathematics into a holistic framework of community and family. She suggested a way of thinking that was different to the compartmentalisation of school subjects. Sally believed that teachers needed to decide what was important for learning to take place and to consider these issues when they were teaching. Teachers had to talk about learning because if the teachers did not know how learning takes place for Aboriginal children there was no use in their trying to teach the children anything. She believed that Aboriginal children learn when they want to learn - that there was a time for learning. Teachers needed to establish consistent, stable classroom routines for Aboriginal children. Once stable routines were established there would be a better chance for learning to occur.
Aboriginal children learning mathematics

Issues were raised which related to Aboriginal children's difficulties in the learning of mathematics, including placement in a rowdy class and with a group of other children who had difficulty with mathematics. Mr and Mrs James saw this class placement as a problem for their son because "he couldn't ask them how to do it because they didn't know themselves."

Angie believed that there were some children who just could not hear what was being taught because of a disability. Many Aboriginal children suffer from otitis media a middle ear infection that can result in children suffering hearing impairment.

*ANGIE:  *I believe some kids don't learn maths because they just can't hear what's going on. The kids may just not be able to hear that well. There may be the instance of glue ear. Once they can't hear in the early years at school learning just gets worse and worse and the kids get frustrated and angry. Because they can't hear they don't know.

Dawn believed that, for many Aboriginal children, learning mathematics appears to be abstract and unrelated to everyday life. She espoused the belief that if the learning of mathematics was related to everyday life and teachers used appropriate materials, Aboriginal children would find it easier to learn.

*DAWN:  *Mathematics for Aboriginal kids has always been imaginary like you had ten little sheep in your mind and five little sheep. It wasn't related to everyday life which drives mathematics home.

*I:  *Do you think a lot of Murri kids do that imaginary maths?

*DAWN:  *I think that's the way that in the past we were taught. There's a different approach now with the hands on approach. That's where I feel I understand it better by using concrete materials and looking at the different strategies you use going from informal units to formal units and how we measure things.

Summary

Table 6.4

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aboriginal children and learning</td>
<td>1</td>
</tr>
<tr>
<td>Aboriginal children learning mathematics</td>
<td>4</td>
</tr>
</tbody>
</table>

One parent identified the need for teachers to talk about how Aboriginal children learn and the importance of establishing consistent classroom routines to enhance Aboriginal children's learning. The impact upon learning of otitis media, working with other children and the independence that many Aboriginal children experience at an earlier age than most non-Aboriginal children impact were raised by parents. One parent expressed the belief that for Aboriginal children learning school mathematics was, often, imaginary and not related to everyday life.
When learning mathematics Aboriginal children needed to work with others whom they could ask for help and that working with a noisy group of children affected concentration and learning.

**Teaching**

From the expressed comments of parents of Aboriginal children the following sub-categories concerning teaching were identified.

**Teacher-student relationships**

Emphasis was given to the critical nature of positive relationships between the teacher and Aboriginal children for effective teaching and learning to occur.

*ANGIE: There has to be a good relationship with the teacher. If they don't like the teacher they are not going to learn and often the Murri kid picks up whether the teacher likes them. Not by what they say but the way they act and the body language that they give the kids.*

Sally reinforced the belief that learning and effective teaching would be fostered in a teacher-student relationship based on mutual trust and earned respect. She believed that Aboriginal children only learn from someone they trust. Not only do they have to trust them but they have to know that they are important and are considered important by those they know. A person cannot just say that they are important and expect Aboriginal children to accept that statement, trust them straight away and learn from them.

Sally held the view that Aboriginal children know someone is important from how they see or hear adults talking, walking and interacting with them. Aboriginal children listen and watch all the time, observing and taking note of things from people and happenings about them. Their parents’ relationship to other people, comments, feelings and how these are expressed, influence the children. It is what the children see and hear happening around them that makes them realise that the person is important and should be respected.

Mrs Finane talked of the importance of teacher-student relationships. Quite often when children reach Years 5 and 6 they perceive correctly or otherwise that teachers play favourite. Some Aboriginal children start to feel that the teachers do not take much notice of them as individuals and cease to put in much effort.

*MRS FINANE: In Year 5 when the mathematics is starting to get harder there may be the situation where kids start to say the teachers aren’t respecting us or interested in us, the work is becoming harder, mum and dad can’t help us at home, don’t see much future anyway, so why bother. Let’s just put up with what we have to at school and cop out.*

**Mathematics Teaching**

Mrs Finane thought that with the basic skills tests and ‘the higher ups’ telling the community what they have to do in schools, teachers may feel a lot of pressure to cover content. This might result in the teachers focusing on the content rather than putting an
effort into how children feel about different aspects of school.
Dawn talked a little about the use of materials in mathematics classes as a teaching strategy. She believed mathematics materials might be useful for Aboriginal children in their learning. Further, she believed that teachers should know how to use such materials.

*DAWN: Maybe with the teaching strategies for mathematics and the use of concrete materials in mathematics for Aboriginal kids is not so much of a problem.

Dawn presented an overview of what teachers should do when teaching mathematics.

*DAWN: A lot of schools are concentrating on reading. Mathematics is important but not that same emphasis. Maybe people think that if you build up literacy then hopefully that would boost their grasp of mathematics. If they get their language confidence up... If everyone had the benefit of maths courses that emphasises language, enjoyable activities, concrete materials and related to everyday life we would have a lot of good maths teachers about.

Managing children
Mr and Mrs James believed that classroom management difficulties were an issue effecting the quality and effectiveness of teaching Aboriginal children.

*MR JAMES: That’s a sign of the times at the moment. The way I see things with the students today. A lot of teachers, to my way of thinking, they have given up. They can’t do anything with the kids. They just say, “What’s the point?”

*I: They are not my problem.

*MR JAMES: That’s right. I’m talking about discipline. There’s nothing teachers can do these days. They just have to stand back and take whatever the kid gives to them, especially up there at the high school.

Summary

Table 6.5
Parents of Aboriginal children commenting on sub-categories of teaching (n=6)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher-student relationships</td>
<td>4</td>
</tr>
<tr>
<td>Mathematics teaching</td>
<td>2</td>
</tr>
<tr>
<td>Managing children</td>
<td>2</td>
</tr>
</tbody>
</table>

Teachers' knowledge of Aboriginal children's thinking and learning is enhanced through the development of positive relationships with Aboriginal children. Aboriginal parents believed that teacher-student relationships, based on mutual trust and respect, were critical to their children's learning. Aboriginal children can sense whether teachers like them or not and they have to know that the teacher is seen to be important by Aboriginal parents and adults. However, there was the expressed belief that more teacher emphasis is put on content than developing such critical teacher-student relationships. One parent acknowledged that teachers may feel a lot of pressure to cover the mathematics content while two others appreciated the management difficulties experienced by teachers. A
teacher emphasis on language, the use of concrete materials and a variety of teaching strategies were viewed by one parent as enhancing Aboriginal children’s learning.

**Structures**

Two parents of Aboriginal children commented on structures. Teachers make decisions about the placement of students in varying classes often without consideration of the impact of such decisions upon the children and without parental consultation. The means by which the children were placed in their respective mathematics classes was of concern to the James’. The structure of the graded mathematics classes had caused concern in their home. Bill, the younger brother, was put in a higher class than the elder brother and Colin “don’t want to repeat because Bill is behind him and if he repeats they’d be in the same class” [Mr James].

These parents raised the issue of Aboriginal student placement within graded mathematics classes and the unintentional impact it can have on families. Mr and Mrs James believed that the placement of children in graded mathematics may have an emotional impact on children and cause concern within the home.

**Technology**

Mr and Mrs James were the only parents to express beliefs related to the use of technology and mathematics. They talked about their sons’ use of technology.

*I: You use computers and calculators. What about the boys? What do you think about them using them?
*MRS JAMES: They don’t use the calculators. I just use a piece of paper. Bill be don’t do that.
*MR JAMES: He just does it in his head. It’s all in his head. Colin has to write things out.
*MRS JAMES: But he don’t know how to do it sort of thing.
*MR JAMES: He gets lost. He can put a start to it and a f’nish to it but be just can’t put a middle to it to come up with the right answer.

Mr and Mrs James talked about mental, written and calculator-assisted calculations and how their two sons use different strategies to do calculations. They believed that mathematics used to be either in your head or on a piece of paper, now there are calculators. Some children do not use calculators whilst others have to write their mathematics down or do their mathematics in their heads.

**Assessment**

One parent of Aboriginal children commented on assessment. Mrs Finane, whose daughter was the only Aboriginal child in the highest graded mathematics class, discussed the competitive nature of mathematics tests.

*I: What’s that test for the university?
*MRS FINANE: University of NSW that costs two dollars.
• Mrs FINANE: Yeah that’s it. When she did that last year she came in the top 20% of the state and she’s just done it again but I don’t know how she’s gone this time.

*I: Do you think they’re good for her?

• Mrs FINANE: I think they are cause she likes to compete. I’ve noticed with her netball that she gets very aggressive and she doesn’t like being beat at anything.

Mrs Finane expressed the belief that some children like to compete and mathematics tests are one way that they can do this. Mathematics tests were seen as a way in which a child could be seen to perform against others.

Family concerns

From the expressed comments of parents of Aboriginal children the following sub-categories concerning family concerns were identified.

Aboriginal parents and school

Home influences, positive attitudes and the effect of attending prior to school settings were seen as positive factors in supporting Aboriginal children entering school.

*I: When you say she has a good attitude how does she get it?

• Mrs FINANE: I suppose it’s been drummed into her. She’s been told from day one that she wasn’t to play up and do what she was told.

*I: A lot of Murri kids aren’t told that.

• Mrs FINANE: I’ve found that with her she went through a daycare centre and by the time that she got into Kindy she knew most of the work that they were giving her in Kindergarten. I think she had an advantage on some of the kids that didn’t attend the daycare centre.

Mrs Finane believed that what children were told about themselves at home influenced how they thought of themselves in mathematics.

• Mrs FINANE: Yeah well if there’s a kid who’s put down at home by their peers they’re not going to believe in themselves if they’ve bad that put into their head from day one.

Years 4 and 5 are identified as a time when Aboriginal children begin to become aware of their brothers and sisters leaving school and the lack of opportunity for employment.

• Mrs FINANE: They do. Not only that. I think it starts in fourth and fifth grade and they see their older siblings go to high school and drop out and they know that there’s no light at the end of the tunnel in a town like this. There’s no opportunities for employment or whatever.

The issues of self-confidence, belief in one’s self and being told by others that you were good at mathematics were identified previously in the Aboriginal children’s comments.
Aboriginal parents and school mathematics

Mrs Finane stated that she had little idea of what happened in the school in mathematics.

* Mrs FINANE: I wouldn’t have a clue. All I see is the worksheet that comes. I think in some of the schools around here that if they see a black kid doing really well they tend to overlook and look at the white kid.

During her interview Mrs Finane expressed frustrations in helping her daughter do her mathematics. She felt frustrated when she could not help her daughter with mathematics problems, particularly fractions and subtraction, where even though both the child and her mother reach the correct answer they do it in different ways.

* Mrs FINANE: With that maths I find it hard when she’s got a problem and I said I can’t help you because I don’t know how. That’s why I think we need tutors.

* Mrs DRIVER: Do parents need tutoring? We should do a class for parents.

* Mrs FINANE: There are some of the things. With the times tables I’m right but when it gets into the fractions and that, I’m lost. She gets frustrated when I’m doing it wrong and she says give it here I’ll do it myself, you know.

* I: Is there sort of a time when you started to say it’s getting beyond me now?

* Mrs FINANE: Not this year. When they started getting complicated.

* I: What about take away?

* Mrs FINANE: I can take them away but we were taught a different way. What they do now is they put the one up the top there and I just say I’ll do it my way and still come up with the same figures.

Mrs Finane’s daughter was in Year 5 and in the school’s top mathematics class. As a mother, Mrs Finane became frustrated when she was unable to help her daughter with the mathematics. She believed a level of frustration existed amongst many parents within the Aboriginal community because the parents did not have the mathematical skills and knowledge to help their children.

*I: She does it ok?

* Mrs FINANE: Yeah. It’s just that I feel frustrated at times when I can’t help her especially when it gets into things like this.

*I: Is that a big problem amongst the Murris that they really just feel so frustrated that they can’t help their kids sometimes?

* Mrs FINANE: They do. I mean there are a lot of talented kids out there but they’re not given the...I mean they are given the opportunity but they don’t get much help at home because the people haven’t got the skills to do it. Plus they haven’t got the time half the time but that’s another story.

For Mr and Mrs James, mathematics had just become more difficult for parents.

*I: Do you think it’s more complex now?

*MR JAMES: Yeah. Everything is, to me it is. When I was going to school there was no such thing as a calculator, ruler but Colin’s got one. There was nothing
The voices of parents of Aboriginal children

like that when I was going to school. It was either in your head or on the piece of paper. Nowadays they’ve got calculators, they’ve got rulers. They’ve even got it on their wrist watch.

*MRS JAMES: I’d rather them work it out in their heads and then they don’t have to depend on the calculator.

*MR JAMES: Back to the basic three R’s. It always works for me.

Summary

Table 6.6
Parents of Aboriginal children commenting on sub-categories of family concerns (n=6)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aboriginal parents and school</td>
<td>4</td>
</tr>
<tr>
<td>Aboriginal parents and school mathematics</td>
<td>3</td>
</tr>
</tbody>
</table>

Parents and family are a significant influence on the behaviours and attitudes of Aboriginal children. One parent believed that Aboriginal children start to drop out, in Years 4 and 5, when they see no employment opportunities for their elder brothers and sisters. Aboriginal children need someone to encourage them if they are going to succeed at school in general, and mathematics in particular. While at the same time, the belief was expressed that schools may tend to overlook the academically achieving Aboriginal child. There was an expressed belief that talented Aboriginal children do not get the mathematics help they need at home because many parents do not have the required skills and knowledge. This could lead to frustration in the family when it came to mathematics and possible conflicts between parents and their children. Aboriginal parents believe that often they have to tell their children that they cannot help them with their mathematics because they do not know how to do it in the ways the children are taught.

Parent involvement

From the expressed comments of parents of Aboriginal children the following sub-categories concerning parental involvement were identified.

Community involvement in schools
The past negative school experiences of Aboriginal people need to be appreciated when attempts are made for community-school involvement. When asked whether schools invited parents up to talk about children's progress Angie replied:

whenever you get a message from the school to come and talk you always wonder what trouble they’ve been in or what’s the problem. You go up often with a confrontational feeling or a sense of conflict, anxious about the meeting and the issues. Rarely do you get involved in the school from a positive point of view.

Dawn held the view “that there are a lot of Muri parents not aware of a lot in the education system.” She recognised the importance of involving Aboriginal parents in talking about their children's school education and mathematics. Angie and Sally supported the belief that schools need to link more closely with Aboriginal parents.

Dawn felt that a greater degree of communication between schools and the Aboriginal
community, through teachers and parents talking together at community-school workshops, would assist in developing more appropriate contexts for enhancing Aboriginal children's learning.

*DAWN: Schools should have a workshop between teachers and parents and look at the discipline policy. A teacher could suspend a student thinking that they are swearing when they were using an Aboriginal name for them. They need to look at negotiating punishments for types of behaviour and what is acceptable for the parents. A lot don't know this sort of thing is going on. The teachers get all that in theory but role playing it and putting those skills into practice is something else.

For many Aboriginal parents there still existed significant conflict between school and themselves. Relatively few Aboriginal parents were involved in schools. Dawn believed that schools “need to have strategies to actually get more parents involved in making decisions in the school.” She singled out apathy amongst Aboriginal people as one reason why more parents and more of the community were not involved in schools.

*DAWN: I think there's a lot of apathy and a lot of families are caught up with their own problems, like very little commitment. There's awareness of education, their own experiences, their own problems and their lack of wanting to get involved. I think with that apathy, that is one of the things stopping development in Aboriginal communities across Australia I reckon. They expect someone else to do it. They're not willing to volunteer their time to help out.

Dawn, who worked with a government agency, raised the issue of trying to have parents involved in curriculum development. She recognised how difficult it was to get parents involved in schools. Dawn expressed the need for parent involvement in curriculum development and she identified ASSPA committees as one avenue to attempt to try to establish parental and community involvement.

*I: But how do you get it into the schools?
*DAWN: I don't know. Through ASSPA I've been pushing curriculum development. I had a good curriculum conference planned but I only got four or five replies. That is an area. To date ASSPA have bought a lot of resources for schools and not necessarily Aboriginal resources like computers and that but they are not strictly ASSPA responsibilities. We have to look at curriculum development. We are up the creek if we have people in our schools who don't want to develop Aboriginal resources and have that sort of attitude.

Mathematics workshops
Dawn believed that it was important to have some mathematics education workshops involving parents and teachers.

*DAWN: We really need to have maths workshops with teachers. I like doing them with parents but in the past you haven't got the parents there who really need it. Most that you get there are the people who already know about it. I
The voices of parents of Aboriginal children

don't know how you get the parents.
If they don't value it the kids won't?

*DAWN:
How do we motivate parents to get involved in their children's education?
We have the old excuses that the parents had bad experiences themselves.
Well that's old news as far as I'm concerned. We have to get them into
schools.

Dawn's view was exceptional, given that she was completing a teacher education course.
She believed that Aboriginal parents have to become involved in schools and she thought
it important to have mathematics workshops to inform Aboriginal parents of what was
happening in the teaching and learning of mathematics.

Summary
Table 6.7
Parents of Aboriginal children commenting on sub-categories of parent involvement (n=6)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community involvement in schools</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics workshops</td>
<td>1</td>
</tr>
</tbody>
</table>

Three parents believed in the importance of Aboriginal parental involvement in schools to
benefit Aboriginal children's general education and mathematics learning. In the
development of such involvement the past school experiences of Aboriginal people need
to be appreciated. One parent believed in the need for mathematics workshops to assist
parents of Aboriginal children.

Overview

This chapter has reported on the analysed data related to the research question, What are
the beliefs expressed by parents of Years 5 and 6 Aboriginal students, in a rural
community, about mathematics and students' learning of mathematics? Six parents agreed
to be interviewed and of these four consented to the interviews being audiotaped. Three
parents allowed notes to be taken during the interview.

These parents of Aboriginal children willingly expressed their beliefs about a subject area
in which many of them felt uncomfortable. They voiced their comments within the overall
framework of Aboriginal children learning at school, with specific reference, at times, to
the implications for learning mathematics. There was comment on the subtlety of
institutional racism and the need for a greater teacher appreciation of Aboriginal cultural
awareness and how it is linked to Aboriginal children's learning across the school
subjects, including mathematics. There was an expressed belief that schools were
increasingly focused on discipline rather than on the educational issues for Aboriginal
children.

Mathematics was viewed to be abstract and imaginary for Aboriginal children. It was
believed that a good mathematics teacher emphasises language, enjoyable activities,
concrete materials and relates mathematics to everyday life. A recurring belief concerned
the ways in which the current teaching of mathematics differed to the ways in which
many parents taught. These differences often led to conflict between parents and children

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when parents tried to support their children in doing assigned mathematics homework. The level of frustration experienced by parents within the Aboriginal community that often they cannot help their children with school mathematics was a recurrent theme. The language of mathematics, both the terms and the symbols, as well as personal mathematical skill and knowledge levels were believed to be further constraints for parents helping their children learn, understand and complete their mathematics. Beliefs of hopelessness at mathematics and helplessness in supporting their children's mathematical learning emerged from one of the parent comments. Parents raised the importance of Aboriginal children's self-confidence and feelings of competence in doing mathematics. The links between self-confidence, feelings of competence and a willingness to learn mathematics emerged as important factors for the parents. A teacher emphasis on language, the use of concrete materials and a variety of teaching strategies were viewed as enhancing Aboriginal children's learning of mathematics.

By Years 4 and 5 Aboriginal children begin to question the relevance of school as they see their siblings leaving high school and being unemployed. The issue of Aboriginal student placement in graded mathematics classes and the unintentional impact it can have on families was raised. There was the belief in the need for stronger community-school involvement and the development of mathematics education workshops in order to strengthen Aboriginal parents' knowledge of school mathematics. These parents of Aboriginal children have voiced from their perspective difficult issues that they believe impact upon Aboriginal children's learning. Their expressed beliefs provide a further dimension of the people involved in Aboriginal children's learning of mathematics in Years 5 and 6.
Chapter 7

The voices of Aboriginal educators

In New South Wales primary schools there are a number of Aboriginal people employed as Aboriginal teachers, Aboriginal Education Assistants (AEAs) or Home - School Liaison Officers (HSLOs). AEAs are appointed to schools to assist with the teaching of Aboriginal students and the implementation of Aboriginal perspectives across the school curriculum. Each HSLO is responsible for monitoring the attendance patterns of Aboriginal students in government schools within a specified region. They are attached to a District Education Office. Though they are often trained teachers, HSLOs have no specific school teaching responsibilities.

In this study eleven Aboriginal educators in Tremayne were interviewed. All names used are pseudonyms.

Aboriginal Education Assistant 8 Carmel, Pat, Phil, Sandy, Tracey, Carol, Michele, Mary
Aboriginal Teacher 2 Penny, Pearl
Home School Liaison Officer 1 Emma

Mary, Carmel and Tracey were all born and lived in Tremayne. Michele, Pat and Carol had all been born and had lived most of their lives in Tremayne. They were Aboriginal Education Assistants who had developed their knowledge and skills over time through experience and inservice courses arranged by the Department of School Education. Phil, Sandy, Michele, Pat and Carol had all undertaken some teacher education courses and were at varying stages of completing their studies. Phil and Sandy were born in Tremayne and lived about an hour's drive from there.

Penny and Pearl were two Aboriginal teachers who had completed their primary teacher education and returned to Tremayne. Both were employed as teachers who worked across the school from Kindergarten to year 6. They relieved teachers on various classes for up to two hours per week. Neither had been born in Tremayne but both had lived in the town for over 5 years. Emma had lived all her life in Tremayne and just completed a primary teacher education degree.

Mary, Carmel and Pat preferred to be interviewed as a group. Tracey and Carol as well as Phil and Sandy were interviewed in pairs, as they requested. All other interviews were individual. Penny did not approve the audiotaping of her interview but all other participants did. Each of the interviews has been analysed using the previously defined categories. In reporting the interviews both direct quotes and paraphrasing of the participants' comments are used. The number of Aboriginal educators who commented
for each of the sub-categories is reported in a table within each category summary.

**Feelings about mathematics**

From the expressed comments of Aboriginal educators the following sub-categories concerning feelings about mathematics were identified.

**Personal feelings about mathematics at school**

Carmel and Pat thought that mathematics was their worst subject at school while Mary “could handle money and that, cause I’ve always used it.” Carmel really hated mathematics in Years 10, 11 and 12. Carmel believed that it was the lack of an effective teacher-student relationship that made her feel the way she did about mathematics.

*CARMEL: Yeah (Great laughter). I hated my teacher. In Year 10, Years 11 and 12, I hated maths. Before that I enjoyed maths. I guess so many kids being in the one class she didn’t get around to everybody. You’d sit there waiting for her to help you. That probably put me off in Year 10.*

**Aboriginal children and their feelings about mathematics**

Pat, Carmel and Mary suggested that the younger children, Kindergarten to Year 2, liked mathematics, “probably because it’s not sitting down and they have to write sums and everything, it’s more games.” When the Aboriginal educators talked about whether children worried about mathematics, they related it to how the children felt when they arrived at school.

*PHIL: It depends on how they come to school really isn’t it? If they come to school in a good mood I don’t think they’ll worry about it. But if they come in a bad mood they’ll chuck a sicky or go to the toilet. Ask, “Can I go and have a drink during the lesson?” and then they miss out on an important part.*

*SANDY: Yeah it probably depends on their mood. When they are doing it in maths they just do it. I don’t hear them complaining about it or anything.*

**Feelings about the AEA’s role in the mathematics classroom**

The mathematics classes at Ellen Road Public School were graded and Pat was of the view that in the primary grades, “the majority in the lower groups would be the Aboriginal children.” The Aboriginal Education Assistants were often frustrated because they saw the slower Aboriginal children being pushed to one side. They were concerned about the perceptions that other staff had of their roles. Some of these staff saw the Aboriginal educators’ role as being responsible for the slower Aboriginal children, furthering their frustration.

*PAT: Pretty frustrating at times because I mean you’re sort of just seen as helping with the kids who are a bit slow or the ones with some problems. They’ve sort of been pushed aside.*

They felt enormous pressure in the role of an Aboriginal educator.

*I: Do you three feel under pressure trying to cope with everything that you have
The voices of Aboriginal educators

to do?

*PAT: Yes.

*CARMEL: Here's my timetable for today.

*PAT: I don't go into class in the afternoon. Usually I'm on hand for anything that goes wrong with the kids.

*MARY: Whereas for me I'm in the classroom most of the time.

Pat possessed a strong feeling of responsibility yet was daunted by what she had to try to achieve across the primary grades.

*PAT: I do from Year 3 to Year 6 and there's nine or ten classes and to spread yourself around. They have maths straight up for an hour every morning and there's only so much you can do. I do half an hour in one class and then I go to another class each day. It's mainly with the kids who are slow learners.

*I: What about the brighter kids?

*PAT: I don't go to the top classes.

Summary

Table 7.1

Aboriginal educators commenting on sub-categories of feelings about mathematics (n=11)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal feelings about mathematics at school</td>
<td>3</td>
</tr>
<tr>
<td>Aboriginal children and their feelings about mathematics</td>
<td>5</td>
</tr>
<tr>
<td>Feelings about the AEA's role in the mathematics classroom</td>
<td>5</td>
</tr>
</tbody>
</table>

Two of the Aboriginal educators openly expressed that mathematics was their worst subject at high school although three expressed the belief that mathematics was now fun in the first years of school. Two others believed that Aboriginal children's feelings towards mathematics may depend on their overall mood but that most young Aboriginal children liked mathematics.

Throughout the Aboriginal educators' comments a sub-plot of their relationship to school administration emerged. The educators definitely believed that teachers should seek advice from Aboriginal educators about Aboriginal children before the child is put on suspension. The role of Aboriginal Education Assistants was seen to be one of solving behaviour problems rather than one of education. The Aboriginal educators felt under pressure in their role. They were expected to work across a number of classes and be available for any issue related to Aboriginal education that may occur during the day, particularly any management or discipline issues with Aboriginal children. The overwhelming majority of Aboriginal children were in the lower mathematics grades. One Aboriginal Education Assistant saw her role as working primarily with the slower Aboriginal children though the time spent in the classes was considered minimal. Her role in mathematics did not include working with the brighter Aboriginal children.

Language

From the expressed comments of Aboriginal educators the following sub-categories
concerning language were identified.

**Mathematical comprehension**

Aboriginal educators believed that language issues were critical factors in constraining the school learning potential of Aboriginal children. By the time Aboriginal children reached Year 5, language difficulties apparent in worksheets and stencils, such as reading words and comprehension, became apparent.

*I:* Some children in Year 5 have said it's too hard and I've stopped trying to try.

*PAT:* Some can’t read the questions in maths and they just don’t know what to do.

Phil and Sandy believed that Aboriginal children were good at mathematics but that the mathematics vocabulary, terms and written language held them back.

*I:* The long words are a problem?

*SANDY:* Yeah.

*I:* In what ways, do you think?

*SANDY:* Probably because they don’t understand them.

*I:* That’s a big issue. The kids are good at maths?

*SANDY:* Yeah.

*I:* But they find it hard when it’s writing?

*SANDY:* Yeah, you know the words that are used and that’s where they fail because they don’t understand.

**Teacher questioning styles**

Carmel, Pat and Mary talked specifically about the role of mathematical language and appropriate teacher questioning styles in affecting Aboriginal children’s learning.

*CARMEL:* A lot of maths language is just too hard to understand for the kids. Like you’ve got a problem solving question that’s asking you to find this number and how it fits into this procedure and they put it into this question and you read it over and over. The kids lose what they’re looking for after the first line. I think that has a lot to do with it. Simple questions asking directly for what they want instead of going right around I reckon a lot of kids would pick up in maths.

*I:* So again it comes back to the language and the reading.

*PAT:* I mean what’s written down on the stencil. They read it but they don’t understand what they are reading until someone comes along and explains it for them.

*CARMEL:* They ask simple questions. The questions are asking the same thing but it’s going the long way around and the kids are losing.

**Summary**

**Table 7.2**

Aboriginal educators commenting on sub-categories of language (n=11)

<table>
<thead>
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<th>Sub-category</th>
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</tr>
</thead>
<tbody>
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<td>Mathematical comprehension</td>
<td>7</td>
</tr>
<tr>
<td>Teacher questioning styles</td>
<td>3</td>
</tr>
</tbody>
</table>
There were seven Aboriginal educators who believed that verbal and written mathematical language were barriers to Aboriginal children's achievement in mathematics. Much of the mathematical language was just too hard for Aboriginal children to understand and there were times when Aboriginal children’s understanding of a word differed from that of the teacher. An over use of worksheets and stencils can be harmful as some Aboriginal children cannot read or understand the content. The belief was expressed that simple, direct teacher questions would enhance Aboriginal children's learning of mathematics.

**Context**

From the expressed comments of Aboriginal educators the following sub-categories regarding concerns were identified.

**Being Aboriginal children**

Phil and Sandy acknowledged that being Aboriginal affected children's learning and emphasised that Aboriginal children learn through practical, hands-on, experiences.

*PHIL:  Different cultures have different ways of saying that kids have to learn this way and that way and with Aboriginal culture I think the most important thing is hands on stuff. Kids learn better I reckon that way.

*SANDY:  Yeah.

*PHIL:  It just seems clearer to them than all this writing on the board and you know teacher expressions and big long words.

The values that affect Aboriginal behaviour were often reflected in students' attendance at school. Aboriginal people value their right not to listen. Half way through a meeting someone may stand and walk out. They are not being rude, they just do not want to listen anymore. Emma suggested that this is what Aboriginal children may do at school. She believed it was not right, but placed the dilemma in the context of being Aboriginal in white society.

*EMMA:  But it's not all right that they don't come to school.

*I:  In their eyes it may well be.

*EMMA:  Possibly. I think when so much damage has been done to our culture over two hundred years. What people don’t realise is that our culture was so different before anyone else was here. I guess I'm in two cultures. Sometimes I don’t know where I belong. Our kids are disadvantaged because they are not learning and I can see that we're still going to be the workforce. The reality is that everything points towards all Aboriginal classes. We have to do something to get our kids educated. When I came from the Mission I was one of two that went right through to Year 10 because the others couldn’t cope. They got sick of the racism and the teachers and all that stuff.

Many Aboriginal children live in situations where they witness a lot of unemployment. This context can affect how children come to school and they reach a stage of, “What's the point of learning at school?” Emma believed that the employment opportunities
available to Aboriginal people were based on the availability of ‘Aboriginal money’ rather than one’s merit.

*EMMA: I suppose in some circumstances yes. If they’ve never seen their parents in a job...I mean to be real, the jobs that you get are Aboriginal money anyway. You seldom get chosen on your merit. All the jobs I’ve had were Aboriginal money. I suppose they get to the stage of what’s the point. Even with our men if they see educated women they steer away from them.

Emma believed that Aboriginal children, as young as ten and eleven, identified that life was different for them. The Aboriginal parents and children had raised this point when they commented on Aboriginal children in Years 4 and 5 beginning to see their siblings leaving school, the lack of employment opportunities and little light at the end of the tunnel.

*EMMA: I think that they are more aware that they are black and that there are differences cause that’s when I started to realise that I was different and that people treated you differently because you weren’t the same colour and the opportunities just aren’t there. It’s a real issue. That’s what happens.

Aboriginal parents and education

Emma believed that most Aboriginal parents want their children to learn and that “the myth that they don’t, needs to be put away.” However, the Aboriginal educators found it difficult to get Aboriginal parents involved in the school. Many schools have a diverse range of parental socio-economic backgrounds. Emma believed that “Aboriginal people who are in jobs can’t get across to parents how relevant school is.” These are critical issues for Aboriginal children in Years 5 and 6 with regard to how they see the relevance of school and learning.

Emma had begun a university course and reported she was now seen to have changed by other people. She believed that there were significant implications for her in gaining an education. Emma’s perceptions of contextual change in how her own people see her as a result of education provide insights into complex cultural implications of Aboriginal children learning at school.

*EMMA: They [Aboriginal people] see us as different. We’re white because you want to be educated. You leave them because you’re educated and you want to live differently to them. It’s all these things. It all comes into play and it’s all these little things that happen and you can see it. When I first went to uni I hated it because when I came home people treated me differently. My set of friends, now, are not the ones I use to have.

Aboriginal children at school

The role of school and its effect on how Aboriginal children might change was a critical issue for Emma.

*1: Are the schools still trying to make white kids out of black kids?
The voices of Aboriginal educators

*EMMA: Of course they are and you tell anyone that and they’ll say I’m not, I’m not.
*I: To succeed in some schools if you’re Aboriginal you have to be more white than black?
*EMMA: Yes. That means that you have to turn your back on your own people in schools.
*I: Some people would say that you have to do that to succeed. Yet you have to maintain who you are.
*EMMA: Suppose our kids got educated. Who would employ them? I think of the hundred per cent of Aboriginal people in town. You’re lucky if ten per cent work and all the jobs that are funded are Aboriginal money. Aboriginal people have been employed for only thirty years. That’s not a long time.
*EMMA: If our kids go through and want to be educated they have to see at the end that there is a job. We have Aboriginal teachers who have to go into other things to find employment. We’re the minority who aren’t getting educated. We’re the real problem in Australia.

When Aboriginal children were placed on suspension Michele often got upset. “I say I wish you had of come to me first and maybe we could have sorted the problem out before we got to suspension. Something might have happened at home at night and you don’t know anything about it.” There appeared to be an increase in school suspensions with no apparent reasons. She believed that some Aboriginal students preferred detention to being in class.

*MICHELE: When they play up they’re just sent down to the front office and they’re sitting there for a day. They don’t mind sitting there when they’re doing no work watching whose coming and going.

There are Aboriginal children who come to a school as new arrivals and the issues that they bring with them can affect their learning. Sally believed that it was sometimes the little things that put children off. “Do you know my kid was stood up and told that they weren’t in school uniform. Then they expect them to go and learn maths after they’ve just beenibusshed.” Michele agreed.

*MICHELE: Exactly. That’s a big thing here when they come in new. I know that schools want them to be neat and tidy but I say bow’s that going to affect student’s learning. But that’s the policy and I say but they come from a place that’s got no money at the moment.

Emma was annoyed that many of the intervention programs for Aboriginal children were taught by non-Aboriginal teachers. She believed that “some teachers aren’t committed to them and the kids know that.” Moreover, “the present situation is not working for the majority of Aboriginal kids” because “often the teachers don’t have the knowledge or the experience” to work with Aboriginal communities and Aboriginal students.

Carmel believed that Aboriginal children did not achieve to their potential in mathematics because the children saw mathematics as boring. However, Carol and Tracey believed the situation was far more complicated. They saw two systems of learning going on in the school mathematics classroom - the white system, that children have to get used to, and
the Aboriginal system within which they live and learn. Carol believed that, at times, Aboriginal students have to learn to talk differently at school to the way they talk at home. Students have to think in two different systems.

*TRACEY: Because you'll get pulled up all the time. Especially in a white man's system you have to think.

*CAROL: You're aware of it aren't you.

*TRACEY: You're shamed.

Carol suggested that when children want to ask questions they do not think about how to phrase the questions in white terms because they do not know the white language system. Then they are criticised on how they ask the question, and are not told what they want to know. The issues of language and the two worlds that Aboriginal children live in became a theme in Michele's interview.

*MICHELE: I often talk to them about the language with them here. I say we have to change. We're living in two worlds. At home we can speak the way we always speak but the minute you come to school they expect you to change and speak the proper way. Sometimes I forget myself and speak just as I would speak at home. They should be told all this type of stuff.

Teachers' understanding of Aboriginal children

Michele was suggesting that a greater appreciation by teachers of the reality of the home context for many Aboriginal children would assist teachers in understanding some of the learning issues encountered by Aboriginal children. Experiencing the cultural differences evident in the homes of some Aboriginal children may cause a culture shock for the teachers but, at least, they may understand a little more some of the problems that Aboriginal children bring with them to school.

Michele talked of the need for teacher awareness and sensitisation to the issues facing Aboriginal children and parents as well as the development and consistent implementation of school policies on detention, the role of the AEA, teacher induction and teacher development.

*MICHELE: You see in the past...we use to have in-service courses at the start of the year. We'd have different Aboriginal speakers talk about their experiences and what they'd expect from the teachers who are coming in. Lately there's been nothing. It's not only for new teachers. There have been teachers here for years and they've never been in-serviced. They just go on about their work and don't care about nothing. The minute Aboriginal kids play up they're out of the class. They can't handle it. Then they think send them to the AEAs and it's not my problem.

Michele believed that the teachers should come to the AEAs more often because the Aboriginal educators know a lot about the Aboriginal children, the community and strategies to help Aboriginal children learn at school. However, "there's only a couple who'll come to me and it's only when they're in lots of trouble with a kid. I think they should be using us more."
Michele highlighted the need for teachers to visit the homes of the Aboriginal children to appreciate from where the children were coming.

*MICHELE: A lot of the parents when they have to come in just won’t come. Usually I’ll go out and see them and take the stuff to them and talk to them. I’ve been trying to get some teachers to come but I’m not having much luck. Not many will go out. They have to go to the top camp and Mission. They have to realise that’s how the kids live because when I tell them here how the kids are living at home they get shocked. They say that can’t be right. They have to go out and see for themselves. They might get shocked to see some of the houses and whatever but so what. Then they might understand some of the kid’s problems when they come to school.

Educational expectations for Aboriginal children

Emma believed that many teachers hold beliefs comprising of limited expectations of the potential of Aboriginal students.

*EMMA: Nobody expects Aboriginal kids to be anybody. They expect them to be on the dole and stay that way. Kids live up to what’s expected of them.

Emma believed that the parents, children, the school and other parts of the community all had their expectations for Aboriginal children learning at school and that across these groups there were similarities and differences. Parents were concerned for what their children were learning at school. Emma knew that there was:

a difference between what’s real and what the community sees as important. I send my kids to school but are they going to learn what they need to learn? I mean, we have illiterate kids at fifteen who have been through the school system.

Emma raised issues related to the various sets of expectations that exist for Aboriginal children. The reality of Aboriginal children at the age of fifteen being unable to read raises concern within the community of whether or not Aboriginal children are going to learn what they have to at school. Various sets of beliefs and expectations of school and learning existed amongst, the Aboriginal community and Aboriginal students and teachers. Tracey believed many of the teachers “just don’t understand where the kids are coming from.” She also believed that white “education was never part of our life until it was forced upon it.”

*TRACEY: We survived without that [white education] in our own way. I won’t say you. I won’t point at you. I’ll say if they [teachers] lived under bow we was, what we had to come up through you’ll survive anything.
Summary

Table 7.3
Aboriginal educators commenting on sub-categories of context (n=11)

<table>
<thead>
<tr>
<th>Sub-category</th>
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</tr>
</thead>
<tbody>
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<td>Being Aboriginal children</td>
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<tr>
<td>Aboriginal parents and education</td>
<td>1</td>
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<tr>
<td>Aboriginal children at school</td>
<td>6</td>
</tr>
<tr>
<td>Teachers' understanding of Aboriginal children</td>
<td>1</td>
</tr>
<tr>
<td>Educational expectations for Aboriginal children</td>
<td>5</td>
</tr>
</tbody>
</table>

Three of the Aboriginal educators emphasised the school context, societal context and life experiences as factors impacting upon Aboriginal children’s learning of mathematics. Aboriginal people have to keep seeking their personal identity and coming to know who they are. Sometimes they do not know where they belong. It was being Aboriginal, the context in which they live and their life experiences which were often in conflict with school and society contexts that resulted in many Aboriginal children not achieving their learning potential.

Two Aboriginal educators talked about two systems, the white system and the Aboriginal system in which Aboriginal people have to learn. Aboriginal people live in two cultures. They have to learn to talk differently in these two systems. Many Aboriginal children have to think in two different ways to achieve. The same Aboriginal educators believed that Aboriginal children are often corrected for how they ask a question rather than told what they want to know. They are corrected when they do not use the appropriate school language. Aboriginal children need to be told that they have to speak differently at school to how they speak at home, because teachers expect them to speak a different way at school than at home.

The belief was expressed that there are at least four sets of expectations for the learning of Aboriginal children: parental, children’s, school and community. There are few non-Aboriginal people who expect Aboriginal children to amount to anything. Aboriginal children should come to school, though, the majority were not being well served in schools which were still trying to make white people out of them. One Aboriginal educator expressed the belief that Aboriginal people, in Australia, are a minority who are not getting educated. The belief was expressed that, by Years 5 and 6, Aboriginal children are becoming more aware that they are black than when they were younger and they realise that they are different from their non-Aboriginal peers. Aboriginal children in Years 5 and 6 start to realise that they are limited by the fewer opportunities available to them than non-Aboriginal children.

Teachers do try to meet the needs of Aboriginal children but they need continuing sensitisation courses about Aboriginal educational issues. Often teachers do not have the experience or the knowledge to teach Aboriginal children. One Aboriginal educator believed that many teachers were not aware of how Aboriginal families live and would be shocked when they saw the living conditions of some Aboriginal children. If teachers did see where and how some Aboriginal children live they would have a greater appreciation of their problems.
Relevance

Phil and Sandy believed that mathematics was very important for Aboriginal children and that many Aboriginal children and their parents probably did not even realise that they use mathematics in their everyday lives.

*PHIL: Really important. We do maths everyday. We don’t know that we do. When you look around a room. What shape is that there? Window obviously a square. What shape is a car? We say like a box. Things like that. But mate they don’t know that the things they see around is involved with maths.

*SANDY: Just walking to school.
*PHIL: Navigating their way home.
*SANDY: Then at home like cooking, you know.
*PHIL: Putting two eggs into the cake or something like that, you know.
*SANDY: They don’t realise...
*PHIL: ...that’s maths.
*SANDY: Kids probably don’t realise that it’s maths.

These comments have implications for teachers of mathematics in trying to make the implicit use of mathematics explicit and in relating children’s daily use of mathematics to the classroom. The teachers may also need to assist Aboriginal children and their parents in recognising the daily occurrences of the use of mathematics.

Materials

At Ellen Road Public School, in Kindergarten to Year 2, the children did a lot of practical mathematics using materials, particularly in measurement.

*MARY: They just like playing with that. K to 2 they use a lot of materials but they do use stencils. They send homework home that’s not really hard and they give them a week to do it.

*PAT: I suppose we haven’t got enough resources for everybody.
*I: Would you think that there are not as many resources used in Years 5 And 6 as there are in the younger grades?

*PAT: Yes. That’s more or less universal isn’t it because I think that in Years 5 and 6 they should be getting into high school mode where they don’t use concrete materials. They have got some but its spread out. There’s been no application to ASSPA for mathematics materials.

Pearl believed that a lack of storage effects how much mathematics equipment a school might have. She also thought that some teachers might take equipment and keep it in their classrooms, with the result that other teachers would never see it. One Aboriginal educator believed that mathematics in Years 5 and 6 should be a preparation for high school mathematics where they do not use concrete materials. Thus, less practical, hands on mathematics should be evident. There appeared to be a conflict between beliefs about the benefits of using concrete materials to support Aboriginal children’s mathematical learning and the reality that Years 5 and 6 were a preparation for the teaching.
approaches used in high school mathematics. This is in conflict with other comments of Aboriginal educators who believed that Aboriginal children learn mathematics best through practical activities.

**Learning**

From the expressed comments of Aboriginal educators the following sub-categories concerning learning were identified.

**Aboriginal children and mathematics learning**

Michele saw much happening to Aboriginal children that still annoyed and frustrated her. She was proud of her Aboriginality and felt that Aboriginal children should be proud of who they are and from where they and the adults with whom they learn at school have come. Michele has embedded her feelings in her life's history and has expressed her beliefs in a truth that places Aboriginal children's learning in a social, historical and political context which she believes needs to be known and appreciated by school staff.

*MICHELE: I'm very Aboriginal and I don't like to feel that Aboriginal kids are being mistreated. I always speak up and feel guilty. Then I think no you always speak the truth and you're here to do the job. I tell these people, where I come from. I never forget that I come from off a mission and I say we have to look after these kids because we didn't get the education that they're trying to get today.*

Carmel, Pat and Mary had the view that there were two paradigms of mathematics learning - practical and theoretical - and that the practical approach assisted Aboriginal students more than the theoretical.

*CARMEL: They just go. A practical side! There's no problem but if you sit there and do it in theory you'd probably find that they wouldn't do it.*

Carmel and Pat believed Aboriginal children viewed mathematics as being fun, easy, boring and hard. Playing mathematics games was fun. Pat, Carmel and Mary believed that when the Aboriginal children were doing practical work they did not think they were really doing mathematics. Pat believed that, "all they think maths is, is when they're copying things from the board onto their books or doing stencils."

Tracey, Carol and Phil all commented on the importance, for Aboriginal students, of enjoyment in their mathematical learning. Phil expressed his beliefs as to how a mathematics class should be organised for Aboriginal children.

*PHIL: You got to have fun in doing the subjects and that goes right across the curriculum. If all the kids have fun doing their stuff when they come to class, get down, knuckle down and do a bit of work and then have free time as a bit of a reward. If you just go into the classroom and have a dull, old stencil then they'll just sit there and take their time. You've got to reward them in the end.*
Tracey and Carol also believed in the positive influence of humour on Aboriginal children’s learning. Phil went on to say that he did not see much fun going on in mathematics.

*PHIL: Some of the kids, they sort of want to have fun when they are doing their learning activities and if there were a funny part about maths they’d learn good.

*I: Do you see much fun going on in mathematics?

*PHIL: None mate, no. (Laughter)

Aboriginal parents and children’s learning of mathematics

The Aboriginal educators expressed the belief that many Aboriginal parents were unaware that there was a problem with their children’s learning of mathematics because they had not been informed. This was seen to be one reason why there had been no application to the ASSPA committee for any funding for mathematics.

*PAT: There’s been no application to ASSPA for mathematics. It’s all been for literacy. I suppose parents aren’t aware that there is a problem in maths because nothing’s been said to them.

Summary

Table 7.4

<table>
<thead>
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<th>Sub-category</th>
<th>Number</th>
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<tbody>
<tr>
<td>Aboriginal children and mathematics learning</td>
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<tr>
<td>Aboriginal parents and children’s learning of mathematics</td>
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One Aboriginal educator emphasised the importance of an Aboriginal child’s identity and the influence of their Aboriginality on their learning. Three of the Aboriginal educators believe that mathematics has both practical and theoretical aspects and that Aboriginal children prefer to participate in the practical rather than the theoretical. Though most Aboriginal children learn best through active involvement they learn mathematics in many different ways and teachers have to find out which ways they learn best. For many Aboriginal children, mathematics is when they are doing stencils or copying from the board. They do not learn when they are bored. One Aboriginal educator believed that not much fun is evident in mathematics classes, even though Aboriginal children enjoy the fun things in mathematics, particularly games. Three of the Aboriginal educators believed that humour played a role in Aboriginal children’s learning as does play and the use of rewards.

Teaching

From the expressed comments of Aboriginal educators the following sub-categories concerning teaching were identified.

Mathematics teaching

The Aboriginal educators believed that there were major factors related to Aboriginal children failing mathematics. Penny believed that, “kids are just different and they learn
differently. Teachers should be able to cater for the differences." One was genuine concern related to a mismatch between the mathematics lesson where "teachers demonstrate and put it up on the board and then the kids know what to do," and the mathematics tests where the children have to do it themselves. The other was the children's lack of understanding of the mathematical language used in the classroom when trying to grasp new concepts.

*PAT: In some maths classes I've sort of stopped the class and told the teacher that some of these kids don't know what you're talking about. Usually they stop and explain themselves a bit more.

*I: How do you know that the kids don't know what the teacher is talking about?

*PAT: When they have no idea. Like when they're getting new concepts and the teacher's going too fast for some of the kids and they're sort of concentrating on some of the kids and half the class haven't caught onto that concept. They keep going forward without reinforcing or finding out what everybody knows because they're not going around the class as much. Sometimes they're just standing out the front there.

The issue becomes more complicated when one considers that the Aboriginal student may have grasped one meaning but that is not the specific meaning that the teacher has in mind.

*MARY: Then they might listen to what the teacher says and they may be right but it's not the dictionary meaning. To them the meaning might be completely different. They might know the meaning of the word the way we talk it and then they have to learn the other meaning.

*CARMEL: It has a different meaning.

*MARY: Like shook and shake it's different to how other people think it is. Cause when they say 'around' they think that there's someone 'hanging around', and when you say 'around' a shape they get confused.

Penny, also talked about the variety of teaching styles that the Aboriginal children experienced and the focus that some teachers place on classroom discipline issues.

*PENNY: There are so many different teaching styles. They are very different. Even with the same age group teachers don't teach the same way. I don't think the kids think too much because the teachers often do the thinking for the kids by answering their questions. There are also different learning styles but teachers look more at discipline trying to work out the kids who are naughty and trying to control that.

There was only one Aboriginal child in the highest mathematics class. Emma thought that a major reason for this had to do with the "attitudes of the teachers, and I don't care how good a teacher says they are, a kid can pick it up if they're not liked. What usually happens is that if a kid plays up in Kindergarten it goes right through with him into Year 6 and even go over to high school." She said that it comes down to the fact that teachers "don't really think Aboriginal kids can learn. They don't believe that we have the same IQ.
as non-Aboriginal kids do. That's the reality of what it is to be black."

Bringing about major change was going to take time, for a lot had to be overcome. Phil knew that what had taken so long to develop could not be changed quickly.

*PHIL:  You can't change things that have been around for ten, twenty years in one little short term. But it's got to be a bit lenient somewhere along the line to understand that the kids have to understand and that it has to have a bit more time to do. The teachers have to understand that they have to have a bit more time to do it. You know what I mean. I can't go out there and change it all to Aboriginal language all in one day can I?

*I:  No.

*PHIL:  That's what I'm talking about.

Penny believed that mathematics needed to be far more practical. She believed that the children were often given inappropriate mathematical content, particularly on stencils, when "a lot of the fifth and sixth grade kids often don't understand what's on the stencils and when it's explained it's often in the wrong way. You give the kids a stack of stencils not even related to their experiences. Some of them get it. They always will but there are many who don't." Penny believed that a lot of children get into trouble because they have finished their work and have nothing to do. Such children finish their work and it's really "filling the gap" teaching when some children finish before the others.

Sandy and Phil thought it would be good for children to go into the community to identify the mathematics being used. This would be very different from what happened in the teaching of mathematics at school. The focus was mainly mathematics stencils. There needed to be more thought given to the structure of a mathematics lesson with more teacher emphasis on hands on experiences for Aboriginal children.

*PHIL:  I think that's where I was saying before. You need a different view to Aboriginal kids, especially in this school about setting out their lessons. With an example like maths more of a hands on stuff is better than all this stencil stuff. Sure they can have a little stencil there in front of them and they have to do this but it would be better if they could use blocks and money.

*SANDY:  Make it enjoyable.

Teacher-student relationships
The importance of teacher-student relationships for Aboriginal children was raised. Phil considered positive teacher-student relationships as important for effective teaching. He added that positive relationships helped the teacher influence children's thinking.

*PHIL:  I think the relationship is number one. Then you break down the barriers and you slide it into their system that you can't do this at school. You don't go off or nothing like this.

He knew that "a lot of kids don't like the teacher cause of the way they teach it [mathematics], or the way they are or the way they look." Though Phil acknowledged that
it was hard to maintain teacher consistency he believed that if teachers were “consistent with the students they would see down the road that if you play up you're going to get roused on.”

*PHIL:  
It's hard being consistent every time. Sometimes I know that some of the kids want you and they don’t want you to be with other kids. You can pick them and sort of dodge them and say I have to look at these kids first. I'll come over there in a minute.

Managing children

Emma raised the issue of teachers’ classroom management strategies when teaching Aboriginal children.

*EMMA:  
They need to be flexible because some kids just learn in so many different ways and you just have to find out which way it is. I find that a lot of the management skills of teachers aren't good if there are a lot of Aboriginal kids in the class. They draw the Aboriginal kids into a behavioural classes which is stupid because how are they going to learn if they all have similar problems.

Penny believed that teacher expectations had a lot to do with the behaviour of Aboriginal children. She expressed her frustration in knowing that Aboriginal children can perform better at school than they do.

*PENNY:  
Aboriginal kids are expected to muck up so they do. It frustrates me because I know they can do a lot better. I just know they can do better but they don’t.

Sandy and Phil believed that children misuse mathematics equipment when they see other children not doing their work, sometimes as a weapon when they are having an argument amongst themselves or when they carry an argument from out of school into the classroom. They believed that teachers needed to be consistent in their reaction to this type of management issue.

*SANDY:  
Yeah. With a situation like that the teacher has to be consistent. The students have to get on good with the teacher and know that teacher. If the student tells the teacher that I had an argument with this fella on the way to school, then that teacher could say, “I’ll keep an eye on him.” If it erupts in the classroom the teacher can say, “That erupted this morning and they’re just finishing it off,” or something like that. But then explain it to them that they cannot do it in the school. You can’t throw school stuff about in the classroom.

Children bringing arguments into the classroom has implications for teaching mathematics, because “they have maths straight up for an hour every morning” [Pat]. If children misuse mathematics materials, throwing them about the class, teachers are going to be less inclined to use them. The Aboriginal educators profess that the use of hands-on activities in mathematics is beneficial to Aboriginal children’s learning. If their misuse
lessens their availability then the Aboriginal children's learning will be adversely affected. Aboriginal children have "to know" the teacher. They have to know that the teacher is fair, consistent and has established routines in the classroom.

Games
The importance and relevance of mathematics games, across the grades, in Aboriginal children's mathematical learning was a focus.

*CARMEL: If they are playing a game. It makes it fun and they don't think that they have to think very hard about anything.

Pearl talked of how quickly Aboriginal children pick up mathematical concepts, particularly in the younger grades, through games.

*PEARL: We have small groups for maths and we use a lot of games like bingo. It's amazing to watch the Murri kids. I don't know if they play games in the senior part of the school. Once they get there I think the extent of games is the base ten blocks.

Money
Mary and Carmel believed, as did the parents, that dice games and money were two mathematical areas in which Aboriginal children excelled.

*MARY: You notice the difference between a lot of the kids. When it's handling money the kids that live on the Mission they're used to having money. They play amongst themselves cards and dice and stuff like that and they learn from that how to give the change to people, because they bet in money. The kids in the town they don't have that sort of thing. I know that the Mission kids can give you the right amount of change and tell you how much.

*: How old would these kids be?
*CARMEL: Even before they start school. The kids get in and play with all the adults and they learn how to count with money. If the kids go off to the canteen they know they've got the right amount of money. But some of the kids who live around town who don't go down to the Mission and mix with the kids and play cards and dice and bingo they don't even know what change to give you. Those kids on the Mission do. Plus they go around and play two up and they know the right amount of money.

Pearl also commented on how well Aboriginal children knew the value of money, could calculate costs and solve real life verbal problems involving money. She believed that much of what they knew had been learnt out of school.

*PEARL: Money, you can't rip those kids off. They say can you mind my money and they tell you how much they've got and the type of coins. And they don't forget. They know the value of money from the day they start school.
Teaching emphasis in Years 5 and 6 should be placed on Aboriginal children understanding the specific meaning of the mathematical language used in the classroom and the practical nature of mathematics. The Aboriginal educators believed that teachers have to think about the children rather than just the content. They believed that the failure of Aboriginal children at school is related to teacher attitudes. Teacher expectations can influence how Aboriginal children behave. Indeed, the comment was made by one Aboriginal educator that some teachers really think that Aboriginal children cannot learn, while others think that Aboriginal children do not have the same IQ as non-Aboriginal children.

Many Aboriginal children in Years 5 and 6 do not understand what is written on the mathematics stencils that they are given. Often teachers introduce new mathematical ideas too quickly for some Aboriginal children. They keep moving forward in their lessons without knowing what the children understand. The Aboriginal educators suggested that teachers often do the thinking for children by answering their own questions. When teaching mathematics, two Aboriginal educators believed that children should go out into the community to do some of their mathematics.

Six Aboriginal educators raised positive teacher-student relationships as a priority for effective teaching. Five made comments related to the need for teachers to be flexible yet fair and consistent in managing Aboriginal children for the children to know the expected behaviour and routines of the mathematics classroom.

Six Aboriginal educators commented on the value of mathematical games, believing that Aboriginal children like to play them. Games help make mathematics fun and were believed to be an important strategy for learning mathematics even though, Aboriginal children think that they do not have to think hard when they are playing games. There were five Aboriginal educators who believed that some Aboriginal children learn to count and do mental calculations with money before coming to school.

**Assessment**

From the expressed comments of Aboriginal educators the following sub-categories concerning assessment were identified.

**Mathematics tests**

The Aboriginal educators indicated that written mathematics tests were not appropriate
for Aboriginal children. As suggested earlier in the Teaching category, there was an apparent mismatch between proposed hands-on and practical teaching strategies to enhance Aboriginal children’s learning of mathematics and the formal assessment procedures which were often in the form of written tests. Sandy believed that the mathematical language used in tests was a significant factor which led to Aboriginal children failing mathematics.

*SANDY: They probably think that they get it all right or whether they fail but a lot of them find it hard to do especially with the maths cause of the language. You know they fail. A lot of kids are good at maths but when they see it in writing what they got to do, they find it hard.

Also, there seemed to be no practical component in most tests. Many Aboriginal children have difficulty with mathematics tests. Carmel thinks that is where many are failing.

*CARMEL: Yes when it comes to test time you can’t help them. They can’t do anything [not allowed to do] practical.

Penny believed that the mathematics tests were not appropriate and that individual testing would be better.

*PENNY: It’s better to test the kids one to one to find out what they have learnt. Last year’s tests were given on what content was covered over the term. The maths test set by the committee was ‘yuck’. They were set on the content of the curriculum not on what we had done.

Reporting to parents

Linked to assessment was the issue of reporting children’s progress to parents. Michele concluded her interview by talking about teachers’ honesty with parents. She felt that some teachers, particularly with Murri children, circle the truth a little rather than saying that the child is having great difficulty in a particular subject or that the child is misbehaving. Parents really want to know how their children are going and, perhaps too often, teachers are not honest in telling them. She believed that reporting to parents needed to be carefully monitored in both primary and secondary schools. When Aboriginal children move from primary school into high school, with a different reporting system, parents/guardians may not understand that an A in a primary school may not be equivalent to an A in a secondary school.

Summary

Table 7.6
Aboriginal educators commenting on sub-categories of assessment (n=11)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
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<tbody>
<tr>
<td>Mathematics tests</td>
<td>4</td>
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<tr>
<td>Reporting to parents</td>
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The Aboriginal educators raised a number of beliefs related to the validity of formal assessment procedures in identifying the mathematical knowledge of Aboriginal children. There was a mismatch between how teachers teach and the type of written mathematics
tests Aboriginal children have to do. Four Aboriginal educators commented that most mathematics is assessed by written tests and that these tests are used to determine future placement in mathematics classes. These four believed that the format of written tests, the lack of practical components, the language used within the tests and, at times, the content of the tests which is sometimes set on the syllabus content, rather than what has been taught, influenced the performance of Aboriginal children. The influence of such factors is linked to the failure of Aboriginal children. It was believed that individual testing of children’s mathematical knowledge should occur. One Aboriginal educator believed that a more appropriate way of reporting Aboriginal children’s progress to their parents was warranted.

Family concerns

From the expressed comments of Aboriginal educators the following sub-categories concerning family concerns were identified.

Home school links
Pearl explained the difficulties that she experienced between home and school as an Aboriginal educator and expressed a number of beliefs about how children’s learning was affected.

*PEARL: There has to be a link between the teachers and the parents. You have to build up communication so that they are both comfortable with each other and then the parent feels free to come to the school to discuss any problems and to take part in school activities. Going out and getting the parents and bringing them to the school while they still feel uncomfortable isn’t going to solve anything.

Despite being a teacher herself, Pearl reported a sense of hostility towards her as a parent on her child’s first day at school. In discussing the teachers’ hostility that she felt towards her, Pearl raised the issue of body language, saying that Aboriginal people “can read the tension basically. They can pick it up without even seeing anything else.” However, Pearl persevered for the sake of her daughter.

*PEARL: Yeah. That’s right. When my child started school from a mum’s point of view that was a horrible day. It was very hard cause I had not been in a public school. It was foreign to me. Somehow along the line I picked up the feeling that the staff was hostile. I was just another person. I had to be at the school chatting to the staff as much as I could, smiling all the time. Eventually they got used to me and it was easier for staff and me. But I had to work really hard at that.

When asked why Aboriginal children did not achieve to their potential Pearl did not focus solely on the school but discussed the importance of home routines.

*PEARL: A lot of children have no routine at home. The diet is dreadful. They don’t even have to go to bed at a decent hour so they come to school tired. They don’t care. They’re in a bad mood. Often they are staying at someone else’s.
I believe that all contributes to their lack of learning. They have so many other issues to deal with before they get to school. The last thing they want to deal with is learning school stuff. They deal with maybe a mum and dad fighting, drinking, nothing to eat and being shoved from relative to relative. Maybe being abused maybe being bit themselves and then they’re expected to learn.

In Pearl’s view many Aboriginal children are learning to survive, and school learning assumes second place. Just adjusting to school and the differences from home is difficult and it can start from day one for many Aboriginal children.

*PEARL: It was interesting the day Kindergarten started. I was floating around. The kids came in and the kids boohed the parents off and they wanted to look at everything. One went over to the toy fridge and said why isn’t this turned on. “Why isn’t it cold?” Then he opened the bottom part and said, “Why isn’t this working?” He tried to turn the taps on and he said there’s no water coming out of them. He felt the element on the stove. He said, “Where’s the pot? I want to cook something.” They came out at recess and called out to all they knew, “Look at my new shoes, my new shirt” and chatted away. The class next door the kids were all crying and their parents were still there. The little Aboriginal kids for lunch pulled their lunches out and they were that excited. Their older brothers and sisters came over and took on the role of the parents. The non-Aboriginal brothers and sisters came over and cried with the younger ones. It was a real contrast. They climbed and played and were seen as unruly. They were labelled as unruly from that day. It was also suggested to me that Aboriginal children learn to fend for themselves a lot earlier because they are neglected. They are forced to. I laughed. It’s how you choose to bring up your child.

In telling this story Pearl makes the point that from day one at school Aboriginal children have come from families where they are seen to be independent within themselves and in the lives they lead. They are inquisitive, curious and willing to ask questions. Yet, because of their show of independence Pearl believed that some Aboriginal children were labelled as unruly and that tag may stay with them at school.

Aboriginal children at school
Aboriginal children are independent. They look after themselves at home and they expect that they can do the same at school. At school they take on a parental responsibility of looking after their younger brothers and sisters. Many Aboriginal boys and girls take on roles of responsibility at home. Pearl thought that school may have little to offer some Aboriginal children but, nonetheless, some do achieve. Their achievement may be the result of a number of influences.

*PEARL: I guess it depends on their make-up. Some might be so fed up with their life that they decide I’m not going to put up with what mum’s put up with. I want better. I don’t really know. Some might have a more stable background. There might be someone at home or school who really encourages them. They might get on well with the teacher who brings out
Aboriginal children's school attendance was a concern for the Aboriginal educators. Emma held the view that a lot of children stay at home because they do not see the relevance of school, particularly mathematics. "They can't see mathematics in things they do, I think more so with Aboriginal kids just. They're excellent with money in their head but it's the written work." It would appear that there are many Aboriginal children attending school who have a stable family home life and whose parents can see some relevance for school. Then there are those Aboriginal children not attending school because schools have little of relevance to them. Emma believed that there were other reasons for absenteeism.

*EMMA: I think the contributing factors are those kids who haven't got parents that work. If they come from the Mission and are protected, like I used to be, and don't see the outside world as a whole. I think too the extended families. It's a combination of things. If you're dependent on welfare and things are coming to you so easily that the kids can't see that you have to work for life to make ends meet.

Emma believed that those Aboriginal children who are dependent on welfare may, by Years 5 and 6, not see the need to come to school to learn for they do not need a job to survive. They can learn what they need to know at home. The issue of racism also affects children's learning. Emma thought "that the racism is so real in town that people seem to think that it isn't and that we have come such a long way. We haven't really. I don't think so since I was a teenager."

Aboriginal parents and school mathematics
A number of parents were frustrated when trying to help their children do mathematics, "mainly because the way they were taught to do maths and the way the kids are doing maths in schools today, they find it difficult. Not to cope, because they get the right answers but to show the same way as the school is doing" [Pat]. The parents had made similar comments and had expressed the frustration and conflict that can occur between them and their children when they try to help them with their mathematics. Too often, it seems that the current ways in which mathematics is taught are "completely different to what they had done. Once you leave school you don't keep up with what's going on in maths for the rest of your life as if you were a teacher [Pat]."

While this may be one cause why parents did not come into Year 5 and 6 mathematics classes to help, Pat suggested other possible reasons.

*PAT: Well they're not invited but I think they feel intimidated by both the teacher and mathematics. I think they think like all schools it's the teacher's job to teach their children to do maths and reading. They feel intimidated I suppose and not that welcomed.

Michele mentioned that parents may have done well in mathematics at school but as they left and had children they had forgotten the mathematics they learned. She believed that there were a lot of young Aboriginal parents about the place who needed some type of
updating on how to help their children. They wanted to help their children but they feel shamed that they do not know the mathematics. Michele could do certain things with her daughter:

*LIKE* in percentages but then I’m lost after that. She gets wild with me because I’m unable to help her. That’s where I’ve spoken to the teacher. She says they just mark the book but don’t tell how I did it wrong. I tell her that she should pull the teacher up in class and say explain it.

However, Michele’s daughter was “too shy to speak up” even though she was the only Aboriginal student in the highest mathematics class.

*MICHELE: I’ve often told her to ask the teacher to explain it to you. Otherwise they’ll just keep going and it’s just like the Murris - left down the back and forgot all about again.

Michele was concerned about her daughter because she was being taught mathematics by males. She wondered if her daughter was embarrassed, shy or concerned, because of the teacher’s gender, to ask him questions when she did not understand some mathematics.

*MICHELE: I don’t know if she feels really comfortable or not. I say go and ask him and she says no don’t worry about it.

**Summary**

**Table 7.7**

Aboriginal educators commenting on sub-categories of family concerns \(n=11\)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
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Members of this group of Aboriginal educators identified several family concerns that may influence Aboriginal children’s learning at school. Many Aboriginal parents were often frustrated when they tried to assist their children with mathematics homework for it seemed, to many, that mathematics is taught differently at school from when they attended. The Aboriginal children, too, become confused between the way their parents do mathematics and the way they are taught. Often, Aboriginal children in Years 5 and 6 know more mathematics than their parents because they cannot help them with their mathematics.

A number of Aboriginal children lack a stable routine at home that could contribute to Aboriginal children’s poor achievement at school. Aboriginal children have to deal with a lot before they deal with school learning. Many Aboriginal children are quite independent and required to take on roles of responsibility at home. For many Aboriginal children, school was seen as unimportant and did not have much to offer. Often, they were just learning to survive.

One Aboriginal educator believed that Aboriginal parents do not feel welcome or
comfortable at school. They can feel intimidated by teachers, and intimidated by mathematics. They can feel hostility towards them reading the tension and picking up negative body language. Such family-based experiences can have a negative influence on Aboriginal children and how they relate and learn at school.

Year 5 appeared to be a time when much was happening in the lives of Aboriginal children that may impact adversely on their school learning in general and mathematics learning in particular. It was a time when Aboriginal children said that mathematics becomes hard, their parents believed they started to question the relevance of school and Aboriginal educators believed Aboriginal children began to appreciate that they were black and different to non-Aboriginal children.

**Parent involvement**

Phil believed that community involvement in schools is a critical factor in supporting Aboriginal children’s learning.

*PHIL: More community involvement in the school like in the classrooms. Teachers and parents coming and sitting in the class and helping them with their work and saying you did good today with Maths and English. Being positive always.

Yet this is difficult for parents of Aboriginal children who have stated that the language and methods used in mathematics are barriers to them helping their children learn mathematics. Phil and Sandy believed strongly in the school coming together with the community for the benefit of children’s learning.

*PHIL: I think for the parents too when they come up to school they think, “Oh we’re in school now we’ve got to behave like this” (Said in a whisper). If kids go into the community and get the parents involved it’s in a more relaxing atmosphere, isn’t it?

*SANDY: It’d be good if the parents could see them out, you know, like down the street with a teacher doing things whether it be Maths or Science or English. Even just to get a speaker in but that’s hard to get them.

These two Aboriginal educators supported more Aboriginal community involvement in schools although, for many Aboriginal parents, becoming involved in schools was not easy since they do not feel confident to come and work in schools.

**Overview**

This chapter has reported on the analysed data related to the research question, What are the beliefs expressed by Aboriginal educators, in a rural community, about mathematics and students’ learning of mathematics? The interviews with the Aboriginal educators came about as a result of the trust and respect in the personal relationships that developed across the years prior to the study and during the time in the site. During the interviews the Aboriginal educators spoke holistically of issues and influences impacting upon Aboriginal children’s learning at school in general, with specific comments related
The voices of Aboriginal educators

to the children's learning of mathematics. They presented a perspective of issues influencing Aboriginal children's learning of mathematics in the light of their personal school-based experiences as Aboriginal educators as well as those as members of the Aboriginal community.

One Aboriginal educator emphasised the importance of children's Aboriginality on their learning. The Aboriginal educators emphasised that being Aboriginal, the context in which they live, and their life experiences - which were often in conflict with school and society contexts - resulted in many Aboriginal children not achieving their learning potential.

Two Aboriginal educators identified two systems that Aboriginal children have to learn - the white system and the Aboriginal system. In the community and within schools, Aboriginal children live and learn within two systems. Two other Aboriginal educators identified two aspects in learning mathematics, the theoretical and the practical. They believed Aboriginal children preferred the practical. Having to live and learn mathematics within these two systems hold implications for the language used in the mathematics classroom, the practical nature of learning mathematics and the establishment of positive teacher-student relationships. Aboriginal educators believed these to be critical factors in Aboriginal children's learning of mathematics.

There was the desire on the part of most parents of Aboriginal children to send their children to school and for the children to learn and achieve. However, four of the Aboriginal educators believed that many Aboriginal parents felt intimidated by school, by teachers and by mathematics. Often, by Years 5 and 6, Aboriginal children knew more mathematics than their parents. The parents became shamed and frustrated when they tried to help their children and the children became angry and confused.
Chapter 8
The voices of teachers of Aboriginal children

Overall, the Aboriginal educators believed that the use of concrete materials in the teaching and learning of mathematics was beneficial for Aboriginal children, even though, there was often a lack of mathematical resources in schools. There was the belief that Aboriginal children liked using concrete materials and their use made learning clearer than when the teacher just talked or demonstrated. However, one Aboriginal educator believed that there should be less use of concrete materials in Years 5 and 6 as Aboriginal children were preparing to enter high school.

There were seven Aboriginal educators who believed that the verbal and written mathematical languages are significant barriers to Aboriginal children’s achievement in mathematics. Four of the Aboriginal educators believed the format of written tests, the lack of practical components, the language used within the tests and, at times, the content of the tests which was sometimes set on the syllabus content, rather than what had been taught, influenced the performance of Aboriginal children. The implication is that there has to be greater congruence between teaching mathematics and assessment.

Across the Aboriginal educators’ interviews, there was apparent conflict between the Aboriginal educators and the educational system as to their educative role. The role of Aboriginal Education Assistants was seen to be one of solving behaviour problems rather than one of education. They were expected to work across a number of classes and be available for any issue related to Aboriginal education that may occur during the day, particularly any management or discipline issues with Aboriginal children. When it was educative one Aboriginal education Assistant saw her role as working primarily with the slower Aboriginal children. Her role did not include working with the brighter Aboriginal children.

These Aboriginal educators have voiced from their perspective difficult issues that they believe impact upon Aboriginal children’s learning. Through their expressed beliefs the Aboriginal educators have provided valuable insights into the community, school and classroom contexts in which Aboriginal children in Years 5 and 6 live and learn mathematics.

There were five mathematics classes across Years 5 and 6. The top thirty students from Years 5 and 6 were in Mrs Cotter’s class. The next thirty students were in Mrs Allan’s class and the other three classes had twenty-five students in each. All five teachers [Mrs Cotter, Mrs Allan, Ms Martin, Mr Kennedy and Ms Jones] of the Year 5 and 6 mathematics classes at Ellen Road Public School agreed to be interviewed for this study. None of the teachers was Aboriginal. In reporting the interviews both direct quotes and paraphrasing of the
participants' comments are used.

Mrs Cotter had been teaching at Ellen Road for the previous six years. For the last three years she had taught the top Year 5/6 mathematics group. There was only one Aboriginal child in the class, a girl. Mrs Cotter was born in Tremayne and, after completing her teacher education, had returned to teach in Tremayne.

Mrs Allan was the Assistant Principal. She, too, had been born in Tremayne and left to do her teacher education before returning. She had been teaching at Ellen Road Public School for twenty-two years, teaching Year 6 for the previous three years. Mrs Allan taught the second streamed mathematics class comprising Year 5 and 6 students. There were seven Aboriginal children in the class - five girls and two boys.

Ms Martin had been at Ellen Road Public School for seven years. She had grown up in a large country town in the Western Region of New South Wales and had been appointed to Ellen Road Public School on completing her teacher education. Ms Martin taught the Year 6 mathematics comprising those students deemed to be in the middle ability range. Of these, eight were Aboriginal – four girls and four boys.

Mr Kennedy had been appointed to Ellen Road Public School the previous year as a new graduate. He had grown up in Sydney and Tremayne was his first experience of living in a rural community. Mr Kennedy taught the Year 5 mathematics comprising those students deemed to be in the middle ability range, ten of whom were Aboriginal - six girls and four boys.

Ms Jones was a fulltime casual teacher employed to replace a teacher who was on maternity leave. This was the first casual teaching block that she had undertaken in a primary school. Her previous experience had been in one of the local secondary schools and on the IM class [students classified as having a moderate level of intellectual disability] at the other government primary school in town. This was her second year of teaching. Ms Jones had grown up in a small town near Tremayne and had attended one of the local high schools before leaving to complete her teacher education. On the completion of her course she chose to return to Tremayne seeking casual teaching work. She taught the mathematics class comprising the lower ability Year 5 and 6 children of whom twelve out of twenty-five were Aboriginal - five girls and seven boys. The number of teachers who commented for each of the sub-categories is reported in a table within each category summary.

Feelings about mathematics

Three teachers talked about their own feelings towards mathematics. Mr Kennedy liked mathematics at university and teaching mathematics the previous year. Mrs Jones had always loved mathematics. Mrs Cotter liked mathematics though she did say it was often harder to understand than to teach.

*Mrs COTTER: I was one of those people who had a positive image towards maths. A lot of people who failed the course at college immediately thought that they wouldn't be able to teach it. It's nowhere near as hard to teach I think as
to understand the concepts yourself...at our level anyway.

Mrs Cotter taught the top mathematics class and certainly felt lucky to have them.

*Mrs COTTER: I think I’m lucky to have that group cause everyone of them is enthusiastic. They even like doing algorithms. They think that they’re good. Division was the only one. They didn’t like it. I think they rather thought they’d like to do it on a calculator.

She believed that the children thought she was some type of ‘horror’ with some not wanting to move to her class. During the interview Mrs Cotter talked about her own challenges in appreciating children’s difficulties. This was summarised in “I sometimes don’t understand that kids don’t understand in maths.”

Three teachers commented that they liked teaching mathematics. One expressed the belief that it was easier to teach mathematics than to understand the mathematical concepts. Mrs Cotter believed that she was lucky to teach the best mathematics class because the children liked mathematics and did quite well. She liked teaching children who understood mathematics but found it difficult at times to understand why the children did not understand the mathematics.

Language

From the expressed comments of the teachers the following sub-categories concerning language were identified.

Mathematical comprehension
Ms Jones highlighted the importance of reading and the difficulties that children encounter in mathematics if they are not good readers. She was sure that the children in her class had difficulties with the mathematical language, particularly in word problems.

*Ms JONES: They can’t with word problems. Is this a plus or a divided by? They just don’t know. I just assumed what went on was what we did at uni that’s why I can’t understand why they don’t understand. These kids would have been there right at the start of the K to 6 and that’s what I really can’t understand.

*I: So these kids have come through not being able to work effectively in groups, finding it difficult to use concrete materials, don’t have a grasp of the basics and find it difficult to interpret problems?

*Ms JONES: They did well yesterday. They like doing it. I think it’s the sentence problems. They get caught up in all the words because they can’t really read and they miss the meaning. Yesterday with the good kids in the class they could read the question and they understood it. I was surprised at the kids who were having a go. So the reading is a problem and I haven’t thought of that before.

Ms Jones had not previously considered that reading was a problem in mathematics for
the Aboriginal children. The Aboriginal children and the Aboriginal educators in their interviews raised issues linked to learning and mathematical language. Mrs Cotter was uncertain about the children's command of mathematical language in her class.

*I: A lot of children have talked about language and mathematics. They find it hard at times.
*Mrs Cotter: I don't think those children in my room find that very much. I mean the language that we use is fairly high level. I think that they cope with it OK.

Mathematical language

Ms Martin believed that "a lot of the mathematics today is reading, so our children have to be able to read and understand everything to their age level and their ability level." Mrs Allan added that mathematical language was like learning another language.

*Mrs Allan: For some kids it's like learning another language and sometimes we might change things. We might call it add ups and the next teacher says we'll do these addition sums and the next says addition algorithms. It's like we say that's a moo cow and then they have to reteach them and call it a cow. I mean I can't see the point of teaching them one thing and then having to reteach. It's too confusing.

*I: We could be setting kids up by being inconsistent in the language.
*Mrs Allan: I know the syllabus has the language there which is good. I'll say something and they'll say what do you mean. I think that they should have known this but there is a lot of language in maths. It just goes on and on. I tried to build up a word bank once and I thought it would fit on a few pieces of paper. You could make up your dictionary of maths terms. Sometimes I even have to go and check things out. It's only the language that they're going to hear here in a lot of cases.

Mrs Allan believed that mathematics language was not reinforced at home. In fact, she believed that it was only at school that mathematics language was used, "it's only in this room that we use this language."

Summary

Table 8.1

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
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</thead>
<tbody>
<tr>
<td>Mathematical comprehension</td>
<td>3</td>
</tr>
<tr>
<td>Mathematical language</td>
<td>3</td>
</tr>
</tbody>
</table>

One teacher believed that much of the mathematical language was only heard and used at school. Indeed, one believed that learning the language of mathematics was similar to learning a new language. Three teachers believed that there was a lot of language in mathematics and a lot of mathematics involved reading. They believed the ability to read and understand mathematical language affected children's performances in mathematics and that some Aboriginal children had difficulty with the language of word problems. The children in the top mathematics class have little difficulty with language in
mathematics, whilst the children in the bottom mathematics classes had obvious language difficulties. It was during her interview that the teacher of the lowest mathematics class had considered the issue of reading as a difficulty for children in doing their mathematics.

**Context**

From the expressed comments of the teachers the following sub-categories concerning context were identified.

**Aboriginal children at school**

Mr Kennedy believed that the achievement levels of the Murri children “began from the very start of school. From what they know then and what the teacher has to build on.” He viewed the school as being a place where children’s knowledge was built. He used the metaphor of a brick wall being laid to describe how Aboriginal children learned mathematics.

*Mr KENNEDY: By the time they get to Year 5 if you’re making a wall you really need a lot of bricks on the bottom. At least there’s a footing to keep it up. In Kinder, first and second you have to concentrate on building that first row of bricks so by the time they get to Year 3 the wall should be half built and they try to give them those bricks but they don’t have anything to rest on. It’s just a vicious circle and it gets more vicious the older the kids get. What they need is to go back to second class and learn some of the stuff down there and slowly work up that way. So by the time they’re in Year 6 they’re at Year 4 level rather than being at a Year 2 level because they haven’t understood anything for the last year or two because it’s just been above them.*

Referring to Natalie, an Aboriginal student in her mathematics class, the second stream, Mrs Allan explained why there was only one Murri student in the top mathematics class.

*Mrs ALLAN: I don’t know. That’s one of the reasons I don’t like streamed classes. I’ve been here twenty years and it was streamed and I had enough trouble with the B class. I thought it was terribly unfair. You don’t get many Aboriginal kids in the top class. Natalie is a great steady worker. I give her a test she doesn’t fail but she doesn’t shine out. I’d expect her to do better because she always appears confident with her work. She participates well. There’s a lot of that self-fulfilling prophecy where people expect people to perform certain ways. Perhaps you frame things so it works out how you expect it to work out. It could be so subtle that you don’t even know it’s happening. You can’t come to school assuming things are going to happen and it does. Then you start picking. A lot of kids should be doing better and I don’t know if it’s an attitude or they’re not getting support from home. I don’t know much about their history.*

Mrs Allan did not know much about the backgrounds of the Aboriginal children in her class. Mrs Allan was sure that the home life of some of the Aboriginal children would be beyond the endurance of many teachers.
Mrs ALLAN: I’m sure if we knew how some of these kids lived I don’t know if I could take it. You want to make them feel safe and happy here ’cause I think that’s the most important thing with kids in your class. You have to be happy, number one. If they’re happy they’ll work to the best of their ability if they’re not you’re not going to get much out of them. They have to be happy and have an approachable teacher who will listen to them.

Aboriginal parents and education
Mrs Martin believed that mathematics was not what a lot of parents thought. It was believed that parents thought it was more about writing sums down “and working it out as a lot of parents who went through school years ago did.” Mathematics has changed from that. Mrs Martin spoke of the Aboriginal children and their homes.

Mrs MARTIN: Their home life is not directed to learning. There’s no expectation of doing well at school, you just go to school. That’s always a hard one. I ask the children in my maths class and my home class who had bath scales at home and a lot of the Murri kids said no. They had no idea of their mass or their height because it’s not valued at home. Yet I always knew how high I was because it was written on your clothing. The big thing was that you’d grown another three inches this year.

Mrs Martin espoused beliefs that the homes of Aboriginal children are not directed at learning and there is no expectation, in the home, of Aboriginal children doing well at school. Her beliefs appeared to be influenced by stereotypical views of Aboriginal children’s home situations saying that they did not have bath scales at home and had no idea of their height and mass.

Mrs Allan talked about the influence of the home environment on motivation and learning. She believed that many Aboriginal children were not supported in the home and that their parents say they cannot help because mathematics has changed so much. There was the belief that it was the parents’ fault for not wanting to become informed because they did not come to mathematics workshops organised by the school to assist parents of Aboriginal children. There is the overtone of attribution of blame on the parents of Aboriginal children for their level of disinterest in supporting their children’s learning of mathematics. Some of the issues affecting parental involvement such as accessing baby sitters and the general pressure of life were identified.

*I:
*Mrs ALLAN: Yet there are kids who are very motivated?

There are. We always seem to worry about those who aren’t or the ones who misbehave. Quite a few don’t get much support from home and a lot of parents say they can’t help with their maths because they do it differently and they get concerned about that. Then, if you have a session for them, they don’t come. I know life’s very stressful. They’re busy working and they need baby sitters. I think that there is also a lot of peer pressure in Years 5 and 6 so that if your mate is next to you and they want to muck up you’re influenced.

Attendance
Ms Martin and Mrs Allan believed that absenteeism influenced children’s learning. Frank
had been away from school, whilst Kim, a new arrival at the school, had a history of absenteeism that Ms Martin believed had affected her learning.

*Ms MARTIN: Frank found it hard today because he’s been away for two days and he doesn’t retain it unless it’s drum, drum. Kim’s only been here for four weeks but her work has gone from very messy, huge baby like writing to actually getting her writing small, set out like the other children, and completing her work. Obviously somewhere along the line she’s missed a lot of the learning of the basics.

Summary

Table 8.2

Teachers commenting on sub-categories of context (n=5)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aboriginal children at school</td>
<td>2</td>
</tr>
<tr>
<td>Aboriginal parents and education</td>
<td>2</td>
</tr>
<tr>
<td>Attendance</td>
<td>2</td>
</tr>
</tbody>
</table>

One teacher acknowledged that many Aboriginal children should be achieving at a higher level than they were showing at school. Some teachers did not know why Aboriginal children who know their work do not perform to their ability in tests. However, the belief was expressed that many Aboriginal children cannot achieve to their potential. One teacher suggested that much of the work that Aboriginal children did from the early years of school was beyond them because they commenced school with an underdeveloped set of skills and knowledge. Two teachers believed that Aboriginal children’s school attendance rates influenced their learning of mathematics and that for Aboriginal children to succeed they have to have a teacher who will listen to them, a view shared by Aboriginal children themselves.

Some teacher comments suggested that there was a link between the expectations from the home to do well at school and the attainment levels of the students. For some teachers, it seemed that aspects of what was valued at school were not valued in some Aboriginal homes. The belief was expressed that for some Aboriginal children there was no home expectation of doing well at school and that learning was not valued. One teacher believed that many Aboriginal children saw school life as separate from home life. Indeed, one teacher believed that there were many teachers who would not be able to cope with knowing the circumstances in which some Aboriginal children lived. This belief was linked to the fact that teachers may not know much about the history of the Aboriginal children they were teaching. These issues raise significant issues in linking school and home in supporting Aboriginal children’s learning of mathematics.

Relevance

Mr Kennedy and Mrs Allan acknowledged that one retains learning and information if it is seen to be relevant. However, Mr Kennedy believed children did mathematics for the mark or because the teacher is ‘growly’ or out of fear of detention. He linked his own mathematics experiences at school to those of his students.
*Mr KENNEDY: It's not easy to see how you will need mathematics in life itself. I remember in high school just about everything I did. From Year 9 up I thought, "Why am I doing this in maths?" I could do it and it came fairly easy to me but I didn't understand it much and why I was doing it. I was only really doing it for the mark at the end. I think a lot of my class do maths because I grumble. Only because they don't listen to me or I'm listening so that you won't put me on detention rather than I'm hoping to learn something. It's a fairly abstract thought that I'm learning something now that I might be able to use later. Just to have them in learning for the purpose of learning and making them a more rounded person. Not many of them would have that as a key idea.

Mrs Allan spoke about the lack of relevance of the mathematics many students learn at school.

*Mrs Allan: A lot are unmotivated. Perhaps they don't see it's relevant. For a lot of children many of the things they do won't be relevant. One girl has to say a thousand grams in a kilogram. Now that's never going to be relevant for her because she'll go to the butcher's and get enough food to feed her family. She'll get so many sausages. She'll know something's heavy because she won't be able to carry it and she'll survive. They see a lot of those things. It's in front of them at the table. There's the kilo of butter and the litre of milk. They see it but it doesn't register. When they go to the shop they'll get a carton of milk not a litre of milk.

Two teachers raised the important issue of the daily relevance of mathematics to the lives of Aboriginal children in what they do. Many Aboriginal children are not familiar with their daily use of mathematics. It is likely that many Aboriginal children do not see school mathematics as relevant to their lives. The two teachers believed that the children only do mathematics for the test mark and, even then, the Aboriginal children may be able to do the mathematics but they may not understand it.

Homework

From the expressed comments of the teachers the following sub-categories concerning homework were identified.

Importance of homework

Teachers did not appear to see the need for homework and there seemed to be so much energy wasted in trying to make children complete it. Most teachers had decided not to give it or to give it to the children to be done during one of the mathematics lessons during the week. It often seemed to be the case that homework was more trouble than it was worth. Some children did the homework, others did not. There was a conflict between school policy and the reality of the homework situation.

*Mrs COTTER: I don't give that anymore because I decided that the children who were doing it probably didn't need the practice and the kids that weren't they just go on detention or come in and finish it at lunchtime. I don't really
see it as my problem. I just switched off to that. I mean that, what maths they have will get them through so if they don't do their homework, you know. I stopped giving it much to the horror of some of their parents but much to the delight of the kids. Their homework only involved finishing the schoolwork that they didn’t get done. I don’t like giving just a homework sheet or revision of maths that has been covered. If I’m going to give it I want to give it on what I’m doing at the time so I stopped.

Mr Kennedy talked about his annoyance at having to give homework when only a third of the students completed it. Ms Martin talked about homework and the Murri students. She no longer gave homework, for only a few children were completing it. What used to be the weekly homework sheet was used on Fridays as a revision of the weekly mathematics work.

*Ms MARTIN: I don’t do it now cause I was only getting it back from five children. I give it to them on Friday to keep them quiet and they do it on their own time and I go around and look at the kid's work and help those who aren’t as quite as advanced. That sheet they had yesterday was actually a homework sheet. It was good to see the kids do that cause I can see where they’ve improved in their mental mathematics. At the beginning of the year it would have taken them all the lesson to have done it.

Homework causing conflicts

Mrs Cotter expressed the view that parents become stressed when their children do not understand the work and that was another reason why she stopped giving homework.

The parents put the children under pressure “because they don’t really understand it and some of the processes have changed.” She believed many “parents just get berserk about the way we do subtraction now and want to know why, as if we changed the constitution.”

Mrs Allan was continually asking her students to ask her questions. Mrs Allan linked homework to communications with parents and felt upset if the children could not do the homework, especially, since they had covered it in class. She believed that children who could not complete the homework had not listened, had not understood and had not questioned her on how to do the work.

*Mrs ALLAN: I stress with my class if you don’t understand please ask. That is why I’m here. If you haven’t been listening you must ask me.

*1: Perhaps the school could identify some strategies and say to the children...

*Mrs ALLAN: We say ask your friend when they edit their work. If you can’t find a resource ask someone. It’s the same with maths. When I get a letter from a parent saying they had this for homework and they had no idea how to do it I get upset because they haven’t asked me.
Summary

Table 8.3

Teachers commenting on sub-categories of homework (n=5)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Importance of homework</td>
<td>4</td>
</tr>
<tr>
<td>Homework causing conflicts</td>
<td>2</td>
</tr>
</tbody>
</table>

The teachers believed that homework should be based on what was being taught at the time not just used for revision. Overall, four teachers believed homework was more trouble than it was worth, and was almost useless because very few children did it. The children who did their homework often did not need the practice. One teacher believed that parents become stressed and put their children under pressure when their children do not understand the mathematics homework they are doing. For one teacher there is conflict sometimes between the parent, child and teacher when the child cannot complete their homework. She believed that it was usually a result of the child not asking the teacher in class how to do the work.

Materials

From the expressed comments of the teachers the following sub-categories concerning materials were identified.

Textbooks

The teachers talked about print materials. There was an advantage in using textbooks because the work was ready for photocopying and this saved the teacher preparation time. Sometimes the textbook page contained too much content. One textbook was used by many of the teachers. Ms Martin talked about how she used it and the need, for her, to do more mentals in class.

*Ms MARTIN: The book can only show you so much. I know a lot of teachers use “Independent Maths” and I quite like it too. I don’t have to use my brain and the pictures are already drawn. It’s good to photocopy a few off. I don’t use a whole page because I find it doesn’t all suit what I’m doing. It covers too much too quick. I try to space out the page so the kids can go, “Oh yes I can do that.” Some try to save paper because you know you can’t waste paper. It costs the school. Tomorrow the kids are going to do a page of mentals and they’ll be timed. I find that I don’t do enough mentals and they should know them and start doing them in their head.

Ms Martin believed that children needed to be able to do mental calculations. However, the material used to generate the mentals was a textbook which emphasised children’s understanding of written mathematical language to complete a set of tasks. In using a mathematics textbook, Ms Martin did not “have to use my brain and the pictures are already drawn.” She was able to pick and choose activities from a set page of the textbook, appropriate to the classroom mathematics tasks, to focus on the topic at hand.
Children's use of concrete materials

Ms Jones raised the issue of children, including Aboriginal children, misbehaving in rather sneaky ways whilst using materials. She said that it had negatively influenced her in using materials in her mathematics class. Ms Martin raised matters of material organisation, availability, theft, deterioration and issues related to play and learning. She believed children had to play with the material but as they were playing they were learning. However, her belief about the importance of playing with materials was related more to classroom management issues than formal learning. It was a case of once allowing the children to play with the material they were more ready to listen to the teacher as they did the mathematics.

*Ms MARTIN: Our school’s lucky we have a lot. I suppose we have more things than a lot of schools and that’s lucky but just finding the gear. No one’s at fault. We all borrow gear but we don’t all get it back. Slowly it deteriorates then you have the kids who play with the gear and wear it out. Then you have the kids who acquire it because it looks so good and they don’t have it at home. They haven’t had the box of blocks. Sometimes you just have to let the children play with the gear and then use it as a learning experience. They’re still learning while they play with it but as soon as they’ve played with it they are more ready to listen to you.

Mrs Cotter talked about the emerging role of mathematics materials in her teaching.

*I:

I don’t see much concrete material in Years 5 and 6. Why is that do you think?

*Mrs COTTER: No, I think a few years ago we didn’t have the stuff and we’ve got it now. I think of the classroom limitations. You have to be so much more organised and have gone down and borrowed everything the morning before. I think sometimes in fifth and sixth class they’ve reached the level where they don’t always need to see it straight up. I think in the number strand they’ve gotten through needing the concrete.

Summary

Table 8.4

Teachers commenting on sub-categories of materials (n=5)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbooks</td>
<td>3</td>
</tr>
<tr>
<td>Children’s use of material</td>
<td>4</td>
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</tbody>
</table>

The use of mathematics textbooks was helpful because the work was already prepared for the teacher and the pictures drawn. However, sometimes a page in a mathematics textbook can contain too much information for the children. Teachers use of mathematics material depends on its availability. The belief was espoused that the use and availability of materials should enable children to develop greater mathematical understanding and knowledge. At times, mathematics materials can be more of a distraction than assistance to learning. One teacher believed that by Years 5 and 6, particularly in the number strand, children have gone past needing to use materials. Another believed that the children are
learning while they play with the materials and if they are allowed to play with the materials, in the first place, they are more ready to listen to the teacher.

Learning

From the expressed comments of the teachers the following sub-categories concerning learning were identified.

Children’s role in mathematics learning

Teachers raised factors such as motivation and the apparent unwillingness on the part of some of the students to learn.

*Mrs ALLAN: I don’t know why but a lot of these children are unmotivated, both Aboriginal and non-Aboriginal. They don’t want to think either. They like to do the easy things but they don’t want to do anything that requires thinking and working things out. They like doing stencils because it’s all there for them but they don’t like writing things down.

Mrs Allan raised the concern that both Aboriginal and non-Aboriginal children did not want to think or work out mathematics problems. They preferred doing stencils where it was all written for them.

Issues of attentiveness, motivation and teacher frustration when the children did not respond to a prepared lesson were issues identified by Mrs Allan.

*Mrs ALLAN: I have a few in my group who might not be attentive. There are some kids who tune out, don’t listen, and then don’t know how to do something. I’d get cross because they hadn’t been listening. You try to make things motivating but some kids get excited about mundane and boring things. You think of something you think is exciting and they look at you and say, “Do we have to do that?”

Mrs Cotter talked about the timing of learning and how she thought that it might be related to maturity and learning readiness.

*Mrs COTTER: You can see that they’re really different in their eyes. It’s just not evident. I think it’s a maturity thing with a lot of kids, maths. I think it’s like reading that you can introduce things at certain times and it’s the wrong time and if you just leave it and don’t worry about it six months down the track it might just fit in and they just weren’t ready for it.

Thinking Mathematically

Ms Martin’s beliefs towards children’s thinking suggested a further aspect of teacher frustration. In referring to the children’s thinking, Ms Martin, initially, doubted if all children were capable of thinking mathematically. However, she espoused the belief that they all have the ability to some degree. She acknowledged that the Aboriginal children try hard in their mathematics and they try hard to please the teacher.
Ms MARTIN: Some have a lot and some have none. No they all have some. Some kids are too keen to please you rather than do their work. Some kids apologise when they get things wrong. They say they’re sorry because they are trying so hard to please. It’s the processes. There’s no good a child giving you an answer unless they can tell you how they got there.

*I:* Often in them telling you how they got there you find out that they don’t understand anyway.

Ms MARTIN: I’ll often ask if I feel a child is guessing. I’ll say, “How did you get there?” I find that with this class when they estimate something they don’t think it through.

Mrs Cotter was disappointed with some of her children’s Basic Skills Tests results. She knew that they could have performed better but blamed herself for not having emphasised mathematical thinking more in her teaching. She expressed her frustration and personal annoyance at having to cover the basics, do some extension work, and cover the curriculum before she had time to focus on the children’s mathematical thinking.

Mrs Cotter: I just thought they had more thinking ability than what came across. I know they had the basics. They have all the skills but I obviously haven’t extended them enough into the thinking. That’s why we have to finish the curriculum earlier so that we can go into that. By the time you deal with the basics and do some extension you don’t always have a lot of time to get into that thinking.

Mrs Allan suggested that the use of stencils might discourage the children from thinking mathematically. Mrs Cotter believed that a number of children were unwilling to tackle problems that they deemed difficult to do.

*I:* What do you mean by the thinking bit?

*Mrs Cotter:* The problem solving and seeing the different ways that they can do it. They don’t often...what’s the word, tunnel vision. I think society, I blame them, doesn’t teach them perseverance. I don’t think that’s something that they can get from school. A lot of children say I can’t do it and straight away don’t want to do it. I think that’s the old style way of society.

Mrs Cotter believed that many children were unwilling to attempt mathematical problems and said that they could not do them. Society was seen as not teaching perseverance to children.

Teacher’s role in mathematics learning

Ms Jones felt that she had been given little information on what the children had learnt in mathematics over the previous years. She was new to the school and had been provided with no background information on the mathematical learning activities experienced by the children. She was not aware of the mathematics teaching and learning that occurred in the infant grades (Kindergarten to Year 2). Ms Jones did not know if the children had been allowed to use materials in their learning of mathematics, did not know the past
mathematical school experiences of the children and thought that teachers in mathematics lessons may have been quite strict on the children in past years. Not knowing the learning backgrounds and experiences encountered by the students has implications for both the children’s learning and the teacher’s teaching.

*Ms JONES: That’s with all the things I think I try to do this with them and I don’t know if they’ve ever been allowed to use materials. They must have been like that all the way through so the teachers have kept them under the thumb. I don’t really know what goes on in the infants. This is my first year here.

Learning styles
Mrs Allan talked about issues of cross-cultural learning.

*Mrs ALLAN: They talk about different learning styles for Aboriginal children. I don’t know sometimes if I’m catering for them because a lot of Aboriginal children don’t appear to go well with maths. Sometimes you wonder why? Then you get a good kid and you think this person is special and you shouldn’t have to think of that. Then you have other kids who perform well in class and you put a test in front of them and they just do poorly. I don’t know why. If I sat down with them they would be able to do it. I don’t know if it’s the concentration, they have to sit still or what it is. It doesn’t matter what you use - test, quiz, review - I’ve used all those terms. Confidence too, they might think I’m not going to do too well so I don’t try.

Summary
Table 8.5
Teachers commenting on sub-categories of learning (n=5)

<table>
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<th>Sub-category</th>
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</tbody>
</table>

The influence of Aboriginal children’s levels of attention, motivation and willingness to learn were identified as important factors in the learning of mathematics. Another believed in the timing of learning mathematics and how she thought that it might be related to maturity and learning readiness. She believed that there may be times when Aboriginal children are just not ready to learn the mathematics that the teacher is presenting while at another time the children would learn it quickly. Only one teacher talked about varying learning styles and wondered if she was catering for the Aboriginal children because many just did not appear to do well in mathematics. The Aboriginal children always performed better at mathematics when working individually with the teacher than in a test. She did not know if it was concentration or confidence or whether the Aboriginal children just did not think they would perform well so did not try.

There was little information passed from teacher to teacher about what children had attempted or learned in mathematics. One teacher felt pressure, frustration and personal
annoyance that she had to cover the curriculum content and this reduced the amount of
time that she had to concentrate on helping the children develop their mathematical
thinking. It was thought that, perhaps, children would think more mathematically if
teachers made their lessons more interesting and tangible rather than depend on the use
of stencils.

While this category reported the espoused beliefs of these teachers about learning, there
was not a general focus on Aboriginal children's mathematics learning. This seems
paradoxical given that the teachers had Aboriginal children in the class and had
acknowledged that they were not learning to their potential.

Teaching

From the expressed comments of the teachers the following sub-categories concerning
teaching were identified.

Mathematics teaching

Mrs Cotter thought that at the school there had been a push to improve student
achievement in mathematics over the last few years. Mrs Allan presented an overview of
what had happened across the school in mathematics teaching over the previous few years.

*Mrs ALLAN: We had a push on numeracy a few years ago. We developed a school
overview and we thought that we were going too slowly and not giving
them the basic skills. That was when the tests were introduced in Year
3, a lot of the things the children hadn't dealt with. The consensus was
that we needed to fast track a little more so that at least they had done
some of the things in the test

Mr Kennedy reported that the teachers taught in topics that were planned collaboratively
by the teachers. Consequently, the week's delivery of mathematics did not vary
significantly from teacher to teacher – “Monday, Tuesday and Wednesday is on the topic
area. We have a short test on Thursday and then Friday we look at the test, mark
homework and revise any test problems or do a general revision.”

*Mr KENNEDY: That's why we do it week by week. Between the three of us over a
three-week period we all do the same thing. Let's say I do area this
week I write up a unit of work on area as well for the week cause after
that week I give it to the others.

*I: So the three of you have a corporate program?

*Mr KENNEDY: Yeah. That time frame of a week fits in. I give them the test that we did
and the homework sheet so that over three weeks you plan by yourself
one thing in maths.

Mrs Cotter liked teaching mathematics but she expressed her personal difficulty in not
understanding why children did not understand.

*Mrs COTTER: I like teaching maths. I like it because it's logical. I like the English side
too but I find maths really logical. Probably where I have the most
The voices of teachers of Aboriginal children

*Mr Kennedy employed a variety of teaching strategies in his mathematics lessons.

And if they're not concentrating on that there's no point in them being there for the rest of the lesson either. I generally growl a fair bit in that time. I probably would because sometimes they can't think clearly enough or quickly enough or in the right method. The kids who raise their hands can because they've thought about it. If I pick kids who raise their hand all the time then those kids who don't raise their hand don't learn anything and aren't forced to learn anything and aren't forced to think for themselves a lot of the time.

Mr Kennedy was concerned for what his students would have learnt by the end of the week. He was also concerned about his teaching performance as measured by what the children in his class learnt each week.

*Mr Kennedy: It's a major concern of mine that at the end of this week, are the kids going to know the things that I've been telling them? Have I been successful? I think they'll have an idea but I don't think they'll be able to do it.

*I: Perhaps you're being hard on yourself and what you have to say is, "What do they know?"

*Mr Kennedy: If I've been trying to teach kids for a week and they have no idea, after a week, I've failed to some degree. I haven't done my job and, as a beginning teacher, I think to myself that I bet someone else could have taught them. It could have been done. How could I have done it?

Mr Kennedy saw his main task as getting the children to listen during mathematics lesson.

*Mr Kennedy: I liked mathematics at university and teaching last year made me enjoy it cause I could go off on tangents and do extension work. We could do real life situations and it sunk in really quick. They were all bright eyed and they understood and that made me enjoy teaching maths as well. This year I came in with a fairly positive attitude towards it [teaching] and so that's helped me survive a bit. Ten minutes of each lesson would be on this is how you do it or listen to this person and let them tell you how to do it, on just listening and being shown what to do. The biggest thing for me is to just get people to listen.

At times, Mr Kennedy considered himself a failure as a teacher.

*Mr Kennedy: I'm not always a failure. But there is a point. There are good and bad teachers and the kids in the class learn things and if some of the kids in my class don't learn anything then I have to question myself.

Mr Kennedy believed mathematics was more about thinking and reaching the right answer than having neatly completed work.
*Mr Kennedy: Because most maths is more thinking about it. Forget how neat it is as long as you have the right answer or as long as you're thinking in the right way. For me a big push in mathematics is not to have it neat, whereas in writing you have to be able to read it so it has to be good.

Ms Martin discussed how much the children had written in mathematics this year.

*Ms Martin: I haven't had kids write things down in maths this year though we discussed what we've done to see what they've retained. I tried it one year and I found that the kids who could write and being grouped that year in ability levels the bottom group couldn't do it. The other thing is that you don't always have the time to do it.

For Mr Kennedy time was a constraint on the variety of teaching strategies that he incorporated into his mathematics classroom. He would try group work and he knew the value of the children using materials in their mathematics learning but did not use them because of time pressures to cover the mathematics content. Mr Kennedy gave an overview of the way that he approached his teaching across one week when the topic of 'area' was the focus.

*Mr Kennedy: Sometimes I do it as a group session and then they're listening and showing and improving their knowledge or proving what they thought. It's maybe more enjoyable and more interesting for them. That's why I do it that way but I don't know. It seems to me from university too much of it was just give it all to the kids and let them decide what to do with it and if they come across it well they would. There was never a question that they would not. They will eventually get to where you want them to get by giving them materials and that. But I don't have any time for that at all I'm afraid.

*I: Why don't you have anytime for that?

*Mr Kennedy: Because of time constraints it's a big part of it. I let them discover on Monday. That's as close as I'll let them get. I gave them the ways and told them what to notice and things and asked them to find a relationship between 1 [length] and B [breadth]. But having just said find the area of this all of them would have just drawn the squares and that's not what the object of the lesson or the week was. I think if you're left to your own devices you will do it the way you know. Now you won't actually learn a great deal extra and so if I show them what they know or they show me at the very start and then I get them to know something else. They work on that alone for the rest of the week then they've acquired another skill that hopefully by the end of the week will be entrenched somewhat.

The negative attitude that some girls have towards learning mathematics was of concern to Mrs Allan. She liked teaching mathematics but did not know why the girls found learning mathematics difficult. However, it was not only this difficulty that concerned her. She was also concerned to find appropriate teaching strategies for the boys. Classroom management issues and the learning needs of the boys were becoming a focus.
Mrs Allan reflected on her school days and the place of tables drill stating that “I think that if it worked for me it will work for other people. I mean we probably had the threat of death over us.” Mrs Allan presented a perspective of ‘generational change’ to the discussion. Mrs Allan had been teaching for 24 years and talked about the changes in teaching across that time. She believed that children had lost their innocence through the impact of technology, particularly television and video. These changes had implications for teaching mathematics. She believed that, though she liked teaching, she would not recommend it to anyone as a career because teaching was much harder now than when she first started.

Mrs Allan: *It might be more fun now but we’re catering for all the different personalities. When I first started you just taught the class and everyone did the same sort of thing. We have all different levels of ability in our classrooms and we’ve taught kids to be outspoken and stand up for their rights and they’re more aware of everything that goes on. There’s hardly any naive kids anymore. They have to be streetwise to be aware of stranger danger. You’d like them to be innocent and be children but then you have to prepare them for all the things that happen now. And they see everything on TV and video.*

Mrs Allan: *It’s not entertaining. They really have to be entertained. I used to think showing them a video was great. It’s now old hat.*

Mrs Allan: *That relates to stencil maths and blackboard maths. It’s not the whirl bang.*

Mrs Allan: *They like the calculators and computers but something else will come round. I wouldn’t recommend any young person to go teaching yet I love it. No way would I like to be starting off. Things are pretty tough for kids now.*

Teaching the range of abilities

Mr Kennedy had some misgivings about what he had experienced in mathematics education at university. It had not prepared him for the range of ability that he experienced in his mathematics class. In the previous year he had taught a higher mathematics class but the range of ability levels in this lower mathematics class had presented new problems for this teaching.

Mr Kennedy: *That’s the difficult part isn’t it, covering the range? Yeah I must say that’s my biggest shock this year. Last year having the top class where everyone wanted to learn and everybody tries their hardest and didn’t take that much to pick up on things. Anyway to this year where you’ve got the whole range from the bottom up to a bit over half and those top
kids who finish faster and pick things up quicker than others, to those who
don't listen and are behaviour problems.

Ms Jones, too, had difficulty programming for the range of children's mathematical ability levels in her class.

*Ms JONES: I get a bit stuck with the ones that finish quickly and get it straight
away. I had to move one kid out. What I normally do is put them to use
like I want you to sit next to... or I send them around marking. It is
hard. I tried it once to split them up into ability groups but it was
really hard to keep getting round to them all. The types of mathematical
problems and activities that could be found in teacher resource books
influenced Ms Jones' mathematics teaching. She taught the lowest Year
5/6 mathematics' class and had difficulty finding mathematics
problems appropriate to the children's ability level.

*I: Why did things go so well yesterday?

*Ms JONES: Because I had points on the board. I asked them what they thought of
the problems and they really enjoyed doing them but it's hard to find
the problems. I think every lesson I could give them this problem for
the fast finishers. That's what I did at high school when I taught maths
up there. Cause there's lots of problems for high school but there's
nothing I can find for these kids.

The wide range of the Year 5 children's mathematical ability influenced Mr Kennedy's
teaching.

*Mr KENNEDY: I like to think that I can explain it as simply as I can so that some
amount of it will sink in. I spend extra time with those who are having
trouble during the course of the lesson. There are kids where I could
say, "This is how you do it go and do it," and leave them for a week
doing worksheets and have them know exactly what I want them to
know without even coming to see how they went. Then there are those
who don't have a clue unless I'm one on one and they're forced to
think because they're thinking of what they're going to do when they
get home. Then when I'm talking to them from the front of the class I
have to go from in front of the class down next to them and this is how
you do it again and tell them again. I guess that's one way I try to put
it in simple terms and things like that.

During her interview Mrs Cotter also identified the lack of time in mathematics as a
teaching pressure.

*Mrs COTTER: I think time is a pressure. I enjoy the fact that we have that hour of
maths. Though some with the lower stream do not enjoy it as much
and they often do half an hour of maths and then games and other
activities.

Ms Martin thought that her mathematics lessons should include extension work, some fun
and review of work covered. These were issues related to meeting the individual mathematics learning needs of the children as a result of the wide range of ability levels within her class. She identified some of the pressures that she felt as a teacher of mathematics, particularly the belief that there was now more content to teach than before.

*Ms MARTIN: There's so much to cover. The wide range of kids and I suppose the parent expectations of where they think the children should be at. The only thing that I see is that the children in Year Two this year when they get to Year Six hopefully the range won't be that wide. They would have used a lot more materials because they've only arrived in the last few years. We seem to have more of it and more children can get to it and hopefully you'll be able to get through more.

The reality of teaching mathematics and adequately addressing the individual needs across the range of children's mathematical abilities was something that Mr Kennedy believed he was not doing well. He had had to adopt and invent teaching strategies to cope with the reality of everyday teaching when he did not believe he had the time available to do everything that he was required to complete.

*Mr KENNEDY: ...it just seems to me that having to fit in all the other things as well that I haven't got the time that they are saying that you need for mathematics. I just don't have it so I had to adopt other ways to teach it. I haven't invented them all myself by any means.

*I: We were saying that it could be a case of just trying to survive and manage mathematics?

*Mr KENNEDY: That comes into the physical materials and things like that. I find them more a distraction for half the class. Half the class will use them the way they're supposed to be used and why they were introduced. The other half will make rockets and have learnt no mathematical concepts by the end of the day. All that manages to do is give me a bigger range than I had before. I probably don't teach very well at the moment to the different ranges of kids because I've got top kids and the bottom ones. I teach the same lesson to both those kids.

Mr Kennedy was unsure if he was supporting the 'bottom kids' in his mathematics class. He did not think that giving children materials, asking them to discover and then to write down what they had found out helped the 'bottom kids'.

*Mr KENNEDY: I like to think I give the bottom kids more help or explain it to them at the start so they understand it but I don't know if I always succeed in that. I don't think giving them all the materials and saying what do you notice and leave them to it for forty-five minutes and then getting them to write down what they noticed is going to help the bottom kids a great deal.

Teaching Aboriginal children mathematics
Mr Kennedy did not believe that Aboriginal children should be taught any differently to other children. All children, no matter their colour, should be taught the same.
**Mr KENNEDY**: I don't have any problems with that. I just teach kids and if they pick it up they pick it up no matter what colour they are. But there are issues that are hanging around that we teach Morris differently. I'm not a great believer in that.

**Teacher-student relationships**

Ms Martin speculated on the links between Aboriginal children's learning and their relationships with teachers.

**Ms MARTIN**: Bill is in my class because he just doesn't click with Mrs Allan so we've kept him there.

**I**: You're the first to mention that relationship difficulty with learning maths. Does that happen with other kids in the class?

**Ms MARTIN**: It would have to, especially the children from average down whom are negative in themselves in a lot of ways. They are negative to learning. I think you have to have problems. Those above should have the initiative and outlook to learn. I'm sure there are kids that go into a teacher’s class and don’t ever improve and next year they can get a different teacher and just go zoom.

**Summary**

**Table 8.6**

Teachers commenting on sub-categories of teaching (n=5)

<table>
<thead>
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<th>Sub-category</th>
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<tr>
<td>Mathematics teaching</td>
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</tr>
<tr>
<td>Teaching the range of abilities</td>
<td>4</td>
</tr>
<tr>
<td>Teaching Aboriginal children mathematics</td>
<td>1</td>
</tr>
<tr>
<td>Teacher-student relationships</td>
<td>2</td>
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Teaching was believed to be harder now because of the wide range of children’s ability levels, children were more outspoken and more aware of everything going on about them, the amount of mathematics content to be covered and the lack of teaching time. The two teachers of the bottom mathematics classes found it difficult to invent teaching strategies that catered for the range of abilities for there was not enough print materials available appropriate for the children’s ability range. One beginning teacher believed there was a lack of appreciation of these factors in teacher education courses.

The teachers taught collaboratively planned topics across the graded mathematics classrooms. Though all tried a variety of teaching strategies, the children’s behaviour was a determining factor in what teachers did in their mathematics lessons. One teacher believed that children had to be forced to learn and to think for themselves and considered it important that children listened during mathematics lessons. There was a belief that children should reach a common standard at the end of a teaching week and that the level of personal teacher efficacy was reflected in what the children learnt. Even though, the teachers knew that some children would learn the work and that others would not. There was speculation of the level of importance of teacher-student relationships in Aboriginal children’s learning of mathematics. Though one teacher expressed the belief that Aboriginal children should not be taught any differently to non-Aboriginal children.
The voices of teachers of Aboriginal children

Structures

From the expressed comments of the teachers the following sub-categories concerning structures were identified.

Graded classes

Most of the teachers liked streamed classes for mathematics. Over time the school had tried a variety of structuring formats to accommodate the children’s wide range of learning abilities. At the beginning of the year, some classes were reorganised because there were too many ‘trouble makers’ in particular classes. Mrs Allan, who had taught at the school for twenty years, talked about all the differing structures that have been used at the school to help the students.

*Mrs ALLAN: We're all crowded in here with little space to get up and move around and into groups. I mean we've tried different things. At the moment we've got ungrading. I've worked with my class and I've had mixed ability groups and I've had graded groups.

*I: So in your time here there have been different class structures to try to address the issue of kids' learning?

*Mrs ALLAN: Yes, I think that's the issue of why we have the ungrading. I don't know why they call it ungrading. It's streaming. We're trying that to see if we can extend our top kids.

*I: What's your feeling about it?

*Mrs ALLAN: I don't like streamed classes but I quite like that we stream for maths. My group are very good and easy. Last year we streamed over five and six and we took the top ten fourths up but the lower group were just horrendous. There was trouble every maths lesson. I think it had a lot to do with the teacher and what she was getting them to do. The teaching style and content for the classes have to be different.

Though teaching the lowest mathematics class, Ms Jones also liked the streamed structure because the children were all on the same level. She also noted that absenteeism was an issue.

*Ms JONES: I like it. I find it easy because they're all on the same level. I don't have any real problems because the good kids are gone.

*I: How many top kids have you got?

*Ms JONES: About half of them are in the top groups. I have twenty-five kids but I've lost a few so about twenty. I haven't really lost them they just haven't been coming.

Ms Martin liked the graded mathematics classes because the children are “all on one level and you can keep going back when you have worries.” Both Ms Jones and Mrs Martin believed the streamed classes were advantageous because the children were all at the same level. The class could be taught as a whole. Ms Jones continued the idea of the ‘sameness’ of the mathematics level of the children being an advantage to teachers because teachers could plan units of work and then share them across the classes.
*Ms JONES:  I like it this way because the three of us share and all our kids are about the same level and we just plan the units. We all have the same problems. I'd find it hard because I have two of the brightest in my class and they're in the top maths class. I wouldn't feel that I was pushing them enough because so many of the others have pretty poor basic skills. You know you do some things so many times you should just know it but some of them still have to count it. They use their fingers and rulers.

Mrs Cotter believed the fact that there was only one Aboriginal student in the top class was a major concern for the Principal.

*Mrs COTTER:  That's a concern of the Principal with the streaming. It's a major concern of his because the ratio goes right down. Theoretically we're suppose to have the ratio of kids in the class four to one of non-Aboriginal to Aboriginal. We should have that number in our groupings but we don't. We just don't by any sort of means that you use whether you do it on working class or a standardised test it doesn't happen.

*I:  Any ideas why?

*Mrs COTTER:  I think they come to school a lot of times already having missed the input that the non-Aboriginal kids have had.

Ms Martin agreed with Mrs Allan in her belief of different teaching styles for different classes.

*I:  What happens next year to the top Year 5 children in that maths class this year?

*Ms MARTIN:  Where do you go? Good question. I've often looked at that. I also know that the top class in fourth grade are pushing to the end of fifth grade work now. Where do they go next year? They could end up bored and that's why you have to have a very good teacher on the top class.

Ms Martin believed that the structure of streamed mathematics classes had implications for children, Aboriginal and non-Aboriginal, who come from other schools. Children may be graded in a top mathematics class in one school and be placed in a lower mathematics class at another. There was no given standard across schools as to how children were placed in particular streamed mathematics classes. There were times when parents and children could not understand why children were placed in different levels when they moved from one school to another. The standards across two schools could be so different that they affected the child's placement. Explanations had to be made to parents that one school had different standards to another.

*Ms MARTIN:  How do we accommodate those kids who arrive at school? I see a big difference between new kids and kids who have gone through our system. There was one arrival who said he was in the top maths class at his old school. Either he wasn't or their level was not to the level here. He was put in the top maths class but then dropped. Mum asked why and we had to explain why. He's good in my group but he's not the best.
Mr Kennedy talked about how different he found the graded classroom context, in which he was teaching a lower mathematics class, to teaching the top mathematics class the previous year.

*Mr KENNEDY: A lot of the kids see school life as a separate entity to home life. At three o'clock they forget school until they have to come back tomorrow morning. But there are some who don't. Last year when I had the top maths group in 3/4, I used to give them little projects to do like find the area of their backyard or find the area of the whole block and take away the area of their house. If I did it with these I'd get five who'd do it.

Working with others
Ms Jones tried to use group work in her mathematics teaching.

*Ms JONES: I try to do different things every time. I try groups but it doesn't work. The kids I've got don't get along. They like to work on their own. I try to team them up but they won't ask their friends, they'll ask me. I keep on doing groups to try and get the benefit but they don't work in groups very well.

*I: Why do they keep on asking you?
*Ms JONES: They say you're the teacher and you're supposed to help us. I say I am but I can't get around so why bother when someone next to you might know the answer.

Ms Martin incorporated group work into her mathematics class though, at first, the students did not seem to be able to share and work together.

*Ms MARTIN: And they share better. There was no sharing. Did they not have it last year or was it the seven week holiday? We all talk about doing group work.

Mrs Cotter talked about the constraints on teaching using group work when the classrooms were not large enough for the number of children.

*Mrs COTTER: You don't have the same discipline problems but you'd have a class of thirty five particularly in these classrooms which I think are not big enough to handle that number. To separate out and do that work you get all this noise and bother. Whereas when you can separate out and you've got tables to spare and you can go here and there. Kids like to get away from what they consider to be the standard desk. They like to get into the corners. I don't know if they think that you can't see what they're doing or they've got privacy or they just don't see it so much as work if they're not at their desks.
Summary

Table 8.7

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</tr>
<tr>
<td>Working with others</td>
<td>3</td>
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The five teachers believed streamed classes were better than unstreamed classes because all the children were on the same level. The teachers believed that streamed classes cater for children's learning, although, they also believed that both the content and teaching styles for streamed mathematics classes have to be different to those for unstreamed classes. One teacher believed that the top mathematics group needed a very good teacher so the children do not become bored. Indeed, some teachers find it easier to teach the better mathematics classes and some the lower mathematics classes. It was apparent to two of the teachers that different ways of identifying levels of mathematical ability exist in different schools and this could lead to confusion amongst newly arrived parents and children. Three of the teachers' comments supported group work for mathematics. However one believed, that by Years 5 and 6, there was little space in the mathematics classroom for the children to move about and form groups.

Technology

Ms Jones was not in favour of the use of calculators because classroom management problems occurred as a result of the children's inappropriate use.

*1: Does the school have any policy on calculators for the kids?

*Ms Jones: I don't know. I haven't used them yet. I know there is a set but they get too distracted and start playing around with them. I'd like to use it for checking and stuff but I just don't like it cause it's too much trouble. It's the same with concrete materials in my class. I've tried it but they chuck them. They just don't know how to be mature and use them. They're just too busy fooling around with them.

*1: Any ideas why?

*Ms Jones: Most of them have never been allowed to use them.

Ms Martin talked about difficulties related to children using calculators. The children in her class had calculators available and could use them under certain conditions. She thought it was a worry that children in Year 6 did not know how to use a calculator. Ms Martin allowed the children to use them to check completed work.

*Ms Martin: Calculator activity like making words up. The children were very poor on using a calculator and they were in Year 6. It was a worry.

*1: What are we going to do to build kids' competence and confidence with the calculator?

*Ms Martin: The other thing is you can't trust them. You can't let them have a calculator at their desk because they'll probably use it before they use their own brain. I allow the children to use the calculators at anytime.
Not to do their work but if they finish you see them either read a book or get their calculator out. I think it’s good because they don’t go off the air they know they’re there and they can use them.

Though the school had a number of computers, none of the teachers commented about the use of computers in the teaching and learning of mathematics. Individual teachers were concerned that students would use calculators before they used their own brain and that many of the children would misbehave when using the calculators. There were children in Year 6 who were unable to use calculators. They did not know how to use calculators properly because they had not been allowed to use them. One teacher did not use calculators because they caused classroom management problems and teachers could not trust children to use them properly. One advantage of the availability of calculators was in having the children check their answers.

Assessment

From the expressed comments of the teachers the following sub-categories concerning assessment were identified.

Mathematics tests
Testing was the prime strategy being used to assess children’s mathematical performance. Issues of concern were that testing did not tell the teacher the true extent of a child’s mathematical knowledge and that some children experienced test anxiety, which affected their performance. Ms Jones relied on tests to assess children’s mathematical knowledge. Mrs Cotter believed that tests did not always tell the teacher what the children knew. She believed that the teacher needed to move about the class to see what the children were doing.

*Mrs Cotter: You can use the written work they’ve done on stencils but quite often they’re worked in culverts with other people and the work that you might get at the end of a lesson mightn’t necessarily be theirs. I mean it’s so difficult to tell unless you’re doing a lot of circulation. You don’t have time to do that every lesson to tell if they are actually helping each other or when they have other mates do the work.

Alternative assessment strategies
Although Mrs Jones relied on tests she did use alternative forms of assessment to tests with the children, particularly one to one discussions. Using this assessment strategy the children seemed to know how to do more of the work than tests results indicated. If she had the time, Ms Jones believed that this form of assessment was one way in which she could help the children more.

*Ms Jones: Most of it’s test. We spend a week on a particular subject and I just go on the answers they give me, cause in the tests they don’t do the answer but I know they know how to do it. That’s what I can’t understand. If I was sitting there with them and we talked it through they’d tell me and they know how to do it. I’d like to have the time to help them.
Ms Martin discussed many issues related to assessing an individual child’s mathematical knowledge including the use of checklists and tests.

*Ms MARTIN: With the new maths policy after each year or stage there is what we feel the children should do in that year. Then there’s a checklist as to what understanding they have. Then the next teacher can say these children have got up to this and they don’t know this. It tells you what they’ve been exposed to with some things being quite well understood and other things needing to be reinforced. We say tests but should we have individual assessment? Cause as soon as you say test, you do get children who stop and freeze. I found my class don’t worry about them. When they know the work they are really good.

*I: A lot of kids that I’ve interviewed like tests.

*Ms MARTIN: Yes because it shows them how they went against their friends and they have a motivation to succeed.

Mrs Cotter explained how she assessed children and the pressure of maintaining her assessment records.

*Mrs COTTER: When it comes to physically doing it by themselves they feel insecure and so other than looking at the worksheets and the stuff that they’ve handed in I give them an end of unit review. That way my bookwork … and that’s another pressure on us … that my bookwork is up to date. I find that really hard. Even though I observe and I try and look at what they’re doing I find it hard to tick off my checklist without sometimes having something physical in front of me to see. That’s not exactly true.

I usually start a topic with that class with a review. I give them a section of work and see the level they’re at before I even start so I don’t waste my time.

Mrs Allan held firm views about marking children’s work and allowing students to talk to one another about their work in mathematics. She raised issues related to the teacher’s trust of the students in allowing them to mark their own work and that of children cheating as a means of telling the teacher that they could not do the work.

*Mrs ALLAN: If someone’s helping someone else that’s OK. In a test that would worry me. Some are thinking out aloud and they don’t realise that they are doing it. I have to write when I’m working something out.

*I: Do you think it is one way children learn?

*Mrs ALLAN: Yes.

*I: So if teachers say you’re not allowed to talk.

*Mrs ALLAN: I tried that. It doesn’t work in my class. I don’t like to see kids obviously cheating … but talk doesn’t worry me.

*I: Those who cheat are just telling you I don’t know it.

*Mrs ALLAN: Yes. I like to let kids know that I trust them and when they mark their work they are generally pretty good and I just go around and put a stamp or sticker on. If we knew all the answers we’d be fine.
Mrs Cotter reported how one child had completely slipped through her assessment. The child was unaware of how to do division and she had not picked up the fact.

*Mrs COTTER: I had one student whom I didn’t realise couldn’t divide until a couple of weeks ago. In class we do demonstrations like who wants to show us today and you go through the strategies. You do your stencils and your games and then he couldn’t divide. He slipped right through me and I didn’t even know he couldn’t divide.

Summary

Table 8.8

Teachers commenting on sub-categories of assessment (n=5)

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics tests</td>
<td>2</td>
</tr>
<tr>
<td>Alternative assessment strategies</td>
<td>5</td>
</tr>
</tbody>
</table>

Two teachers expressed their belief that mathematics tests do not always tell the teacher what the children know. Children can complete work satisfactorily in a one on one situation that they seem unable to do in a test situation. Some children ‘freeze’ when they know they have to do a mathematics test. For some children the test results allow them to compare themselves against their friends. All the teachers believed in moving about the classroom discussing with and observing children to assess what the students have retained. However, they believed they did not have the time in each lesson to find out what work each child had done.

Content

The teachers agreed that because there was a lot of compulsory mathematics syllabus content to be taught in Years 5 and 6, they felt under great time pressure to cover it all. Mrs Allan believed that no matter how hard a teacher works, there were some children who were never going to achieve the required mathematics outcomes by the end of Year 6.

*Mrs ALLAN: There are so many areas within the three strands that the kids have to know.

*I: More than any other subject?

*Mrs ALLAN: It appears that. Before the kids go into high school they’re expected to know all these things and it seems to me that there is just so much to get through. I think, too, now with the Basic Skills Tests you have that pressure too.

*I: How much pressure does it put on you to cover all this maths?

*Mrs ALLAN: All the kids are supposed to be progressing at their own rate and there are some children really who are never going to get to what’s expected at the end of sixth grade. I know that.

Ms Jones agreed with Mrs Allan about the amount of content that needed to be covered in mathematics. She expressed how the children did not view three-dimensional building and drawing as mathematics and how she was concerned about finding more time to concentrate on the basics of mathematics.
Ms JONES: We have to get through it all. A week on this, a week on that. Area, temperature, mass, subtraction and they can’t do that. I’d like to combine. You can do temperature and addition. I don’t really know what they got out of the 3D unit. Just building blocks and drawing. That was the best thing that they liked was drawing on the dot paper.

*I:* The isometric dot paper?

*Ms JONES:* Yeah. They thought it was art rather than mathematics.

*I:* You didn’t design that unit?

*Ms JONES:* No. We just got it out of the syllabus.

*I:* Is there anything else about maths? What would you change about it?

*Ms JONES:* Maybe just combining a few things so you can concentrate a bit more on the basics.

Ms Jones believed that ‘the basics’ were most important for the children she taught.

*Ms JONES:* I think just the basics. You can’t do any working out for anything, even area. How do you do that if you don’t know your times tables? Everything goes back to that.

Mrs Cotter believed that some children could be extended beyond the content stated in the K-6 Mathematics Syllabus (NSW Department of Education, 1989). She expressed similar beliefs to Ms Jones, concerning the impact of the Basic Skills Tests and children’s beliefs about work with three-dimensional (3D) shapes. Mrs Cotter concluded this section of the interview with a question about how important it is for children to see that 3D work is mathematics.

*I:* Is that because the emphasis has been more on the basics of the four operations and tables?

*Mrs COTTER:* It does scare you into doing those things but when you actually look at the Basic Skills Tests there’s not as much numeration as you initially think.

*I:* There is more spatial work coming in.

*Mrs COTTER:* And I think, too, that the kids think that they’re not doing very much as what they perceive as maths. The number strand is still the major but they have been doing a fairly good mix across the school in the last few years I believe. They don’t see what we’ve been doing in the last two weeks as maths. They really don’t. They didn’t see the number games we made as maths. They didn’t see making a lot of the shapes as maths when we were doing volume and capacity. They thought we were doing art when we were doing symmetry and that sort of strand, your rotations and your tessellations. They had a wonderful time but they thought they were doing art. I don’t know if it really matters what they think they are doing as long as they come up with the goods. Do you think it’s important that they see it as maths?

Ms Martin believed that teachers were being asked to do more and more each year “and there’s only so many hours in a day. It’s going to keep getting more and sooner or later we’re going to have to say, ‘No, we can’t do anymore’.” She supported Mrs Cotter in her
belief that there was too much content to cover in mathematics.

*Mrs MARTIN: The other thing that I find with mathematics is that we have such a wide area to get across. We’ve got three subject areas and in that, like in space. How in your forty weeks of school do you cover it all and know that the kids have learnt it? Like if you did graphs at the beginning of the year and you never did graphs again because it just didn’t fit into your timetable through the interruptions and as you’ve seen the interruptions are pretty high.

The reality of never having the syllabus right was an issue raised by Mrs Allan.

*Mrs ALLAN: There’s always going to be new things put into it. Isn’t there a new strand? It’s forever going to get broader. Here I am worrying about not getting it all done now. I mean I can teach it but will the kids learn it? Will they remember it? I could go through the syllabus very quickly but are they going to retain it? That’s the worry. When I feel that they have that then I can go the next step.

The teachers felt under pressure to ensure that the children knew and understood the work, particularly, those students who they knew would not achieve the mathematical outcomes required by the end of Year 6. They believed that there was not enough time in the year to cover all of the mathematics syllabus content that the children had to know. These teachers believed they needed to concentrate more time on the basics, while, at the same time, knowing that there will always be new things put into the mathematics syllabus. The Basic Skills Tests impacted upon the mathematics content being taught. They directed teachers into focusing their teaching on tables and the operations, even though the tests seemed not to have as much numeration as some teachers expected.

**Overview**

This chapter has reported on the analysed data related to the research question, What are the beliefs expressed by non-Aboriginal teachers, in a rural community, about mathematics and students’ learning of mathematics? These five teachers taught mathematics in Years 5 and 6. They gave insights into their espoused beliefs towards the teaching and learning of mathematics. The teachers personalised their beliefs with examples given from their teaching experiences at the school. Their beliefs ranged across the spectrum of issues affecting the teaching and learning of mathematics. Although there was a significant population of Aboriginal children at the school, the issue of teaching mathematics to Aboriginal children was not a focus in these teachers’ comments. The teachers focussed on their organisational approaches to the teaching of mathematics. Their beliefs were directed towards the teaching of mathematics as it applied to all children: Aboriginal and non-Aboriginal.

However, individual teacher comments focused on the cross-cultural context of learning mathematics and the complexity of life for many Aboriginal children. The differences between school and home life, the life style of Aboriginal children and the degree of
teacher awareness of Aboriginal history were raised. There was genuine concern in trying
to identify why many Aboriginal children were not meeting their learning potential in
mathematics and why they did not perform to teacher expectations when they undertook
mathematics tests. Two of the teachers believed that Aboriginal children could do better
than their mathematics test results indicated. Absenteeism, lack of motivation and
unwillingness to learn were believed to be factors in Aboriginal children not attaining
their learning potential in mathematics. The belief was espoused that by Year 5 and 6
some Aboriginal children had missed learning a lot of the basics. One teacher believed
that many Aboriginal children commenced school with an underdeveloped set of skills
and knowledge. The same teacher commented that “I just teach kids and if they pick it
up they pick it up no matter what colour they are. But there are issues that are hanging
around that we teach Murris differently. I'm not a great believer in that.”

The teachers believed that there was a lot of language in mathematics and the level of
ability to read and mathematical comprehension affected children's performances in
mathematics. This was a particular issue for some Aboriginal children. They also believed
that children had to have confidence in doing mathematics and that confidence often
followed success.

School mathematics was believed to have little daily relevance to the lives of Aboriginal
children. All the teachers considered mathematics homework to be more trouble than it
was worth because few children completed it. At times, homework caused conflict
between the school and the home, and between children and parents. The belief was
espoused that many parents of Aboriginal children say they cannot help their children
with their mathematics because they learnt to do it differently.

The teachers believed the use of mathematical materials supported children’s learning and
acknowledged an increase in their availability. However, the preparation and organisation
of the materials linked to the age of the children and their misuse of the materials
resulted in many teachers not using them. A key concern for all the teachers was catering
for the diverse ability range of the children in the mathematics class. They supported the
graded mathematics classes because the children were grouped more at the same level.
All five teachers believed that they worked under an increasing pressure of time to
complete the required mathematics content.

These teachers have voiced from their perspective difficult issues that they believe impact
upon the learning and teaching of mathematics. The reporting of their beliefs across
many aspects of their teaching of mathematics provides valuable insights into the
community, school and classroom contexts in which Aboriginal children in Years 5 and 6
live and learn mathematics. These beliefs together with the Aboriginal children, parents of
Aboriginal children and Aboriginal educators help provide a more complete picture of the
varying perspectives and the complexity involved in Aboriginal children's learning of
mathematics.
Beliefs are based on personal knowledge and are defined in this study as “any simple proposition, conscious or unconscious, inferred from what a person says or does, capable of being preceded by the phrase, ‘I believe that...’” (Pajares, 1992, pp. 313-314). A belief is “an individual’s representation of reality that has enough validity, truth, or credibility to guide thought and behaviour” (Harvey, 1986). Different cultures have different beliefs about mathematics leading to different teaching and learning consequences (Stigler & Baranes, 1990). Mathematics education research conducted in cross-cultural settings has emphasised the influence of the broader social context, including the significant role of the family, on children’s beliefs about mathematics (Parsons, Adler & Kaczala, 1982; Stevenson, 1987; Stevenson, Lee, & Stigler, 1986; Stigler & Yao, 1985; Stigler & Perry, 1988). This is of particular importance for Australian Aboriginal children and their learning of mathematics because, currently, they are not achieving to their learning potential and this is of concern to both the Aboriginal and general Australian community (Frigo & Simpson, 2000; Kemp, 2001). This chapter is organised around the categories of belief which have resulted from the analysis of data in Chapters 5-8 and addresses the research questions, How do these sets of beliefs compare and contrast? and What are the pedagogical consequences for the learning and teaching of mathematics based on these expressed beliefs?

Feelings about mathematics

Children need to express their mathematical feelings and to work through them (Southwell & Khamis, 1992). Mathematics arouses a number of feelings within the Aboriginal children in this study. They are able to identify their likes and dislikes and identify instances of annoyance, confusion, embarrassment, shame, boredom and ridicule. That Aboriginal children could talk so openly of their feelings about mathematics indicates that mathematics certainly has an affective impact on them and their learning. This has implications for teachers in that they need to consider the emotional response of Aboriginal children in the ways in which they relate to mathematics.

For these Aboriginal children, learning mathematics seems to get harder from Year 4. This is a time when mathematics tends to become more abstract and the syllabus content becomes more complex. It is a time when there is greater teaching emphasis on trading, division, long multiplication, problem solving, some multiplication tables, money and reading large numbers. The Aboriginal children describe these mathematical concepts as hard for them. Mathematics is boring for them when they do not understand the work, the mathematics is ‘real hard’ or too easy, they have to listen to others and repeat work. The appropriate level of mathematics work has to be monitored by the teacher for if
mathematics becomes boring, it can lead to frustration, anxiety and an unwillingness to be involved (Carroll, 1994; Hunt, 1985).

Shame is a feeling that has specific meaning and impact for Aboriginal children (Groome, 1995). The Aboriginal children are able to identify various instances of being singled out that lead to a feeling of shame. The fear of failure, of not being seen to know the mathematics and being scared to ask all appear to be linked to shame. Shame does occur in the learning of mathematics and needs to be acknowledged. Often Aboriginal children feel ‘put down’, or shamed, in mathematics and develop a lack of confidence in their own ability to do mathematics. Parents are concerned that they feel unable to help their children with mathematics because it seems to them that it is taught and worded quite differently now to when they were at school. It is a recurring theme amongst parents across the Homework, Language and Family concerns categories. This concern is closely linked to shame through a feeling of helplessness in supporting their children’s mathematical learning.

Aboriginal children and their parents link feelings of self-confidence and personal competence as factors that impact upon Aboriginal children’s learning of mathematics. This is important, particularly in the later years of primary school when children’s interest in mathematics may begin to wane (Eccles et al., 1993). It gains further import because one’s view of mathematical achievement is linked to one’s level of self-confidence as a mathematics learner (Forgasz, 1994). Aboriginal children need to be given opportunities in mathematics to develop their self-confidence as learners of mathematics.

Throughout the Aboriginal educators’ comments a sub-plot of their feelings about their role and its relationship to school administration emerges. The Aboriginal educators feel they are expected to take on the role of solving behaviour problems, particularly any management or discipline issues with Aboriginal children, rather than issues of the children’s education. They were expected to work primarily with the slower Aboriginal children rather than the brighter Aboriginal children. If their role is one of management and discipline rather than education they are not involved in assisting teachers in providing appropriate educational and learning opportunities for Aboriginal children.

Mathematics learning is enhanced in a classroom environment which acknowledges and accepts Aboriginal children’s expressed feelings about mathematics (McCarty et al., 1991). The learning opportunities for Aboriginal children may well be further supported with Aboriginal educators having a greater educational involvement in Aboriginal children’s learning of mathematics.

The findings of this study indicate that Aboriginal educators, Aboriginal children, parents of Aboriginal children and teachers should collaborate to:

- appreciate that Aboriginal children will experience a number of feelings in learning mathematics including confusion, anxiety, failure, happiness, success, ‘shame’ and embarrassment;
- provide opportunities for Aboriginal children to express their feelings about mathematics;
- ensure that Aboriginal children, through their success, come to feel self-
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confident in learning mathematics;
• articulate the educational role of Aboriginal educators in supporting Aboriginal children's mathematics learning.

People

Only the Aboriginal children comment about people who help with mathematics. They believe that their mothers and sometimes fathers, Aboriginal educators, teachers, friends and other Aboriginal children can help them in their learning of mathematics. Schools need to foster and support the role of mothers in Aboriginal children's learning of mathematics, particularly at home. The role of mothers in assisting Aboriginal children with their learning of mathematics in the primary years and the supportive actions of parents in developing Aboriginal children's self-confidence in doing mathematics are further areas for investigation.

The key role that teachers can play in influencing Aboriginal children's views, both positively and negatively, about mathematics is identified. This key teacher role and the impact of teacher actions upon Aboriginal children in mathematics classrooms is a critical influence on Aboriginal children's school-based learning (Guider, 1991; Malin, 1990; Maxwell, 1989). In this study, the Aboriginal children's beliefs highlight the importance of a positive personal relationship with the teacher in the learning of mathematics. As discussed further in the Learning and Teaching categories, factors in this relationship that are seen to be important by Aboriginal children include teachers who are caring and those who explain mathematics clearly. It is important for teachers of Aboriginal children to analyse their inter-personal relationships with a focus on the caring nature they show for Aboriginal children within the mathematics classroom. Further, teachers have to examine the quality of their mathematical explanations when interacting with Aboriginal children.

The findings of this study indicate that Aboriginal educators, Aboriginal children, parents of Aboriginal children and teachers should collaborate to:

• identify the people and the roles these people play in supporting Aboriginal children's learning of mathematics;
• provide school–community support, particularly for mothers of Aboriginal children, to encourage the use of the same mathematical language and teaching methodologies between school and home;
• provide teachers with professional development opportunities which would result in their becoming caring and understanding teachers of mathematics to Aboriginal children.

Language

Mathematics language and terminology have long been identified as significant barriers to Aboriginal children's learning (French et al, 1994; Graham, 1988a; Harris, 1991; Malcolm, 1982; Watson, 1987). Misunderstanding the meanings of mathematical words as well as verbal and written mathematical language can be major learning barriers for Aboriginal children. The teacher's mathematical language and the pace of its delivery can cause
confusion and be a constraint to learning mathematics.

Learning the language of mathematics is similar to learning a new language. Many Aboriginal children have to speak a different language at school from that at home and the difficulties this brings are exacerbated by the abstractness of the mathematical language used only at school (Eades, 1988; Gray, 1990). The issue of the varying language registers that may be evident between school and home is seen as a possible constraint to mathematics learning (Dawe, 1991; 1995). Changing or modifying the language of Aboriginal children in order to introduce a new, abstract mathematical language can affect the Aboriginal children's identities. For, the language that Aboriginal children use is inextricably linked to their identity (Eades, 1988). The significance of this aspect of language development has to be appreciated within the mathematics classroom.

Often, Aboriginal children are criticised by teachers for the way they speak rather than for what they have to say. They are corrected for their use of English rather than for the content of what they are saying. The language that Aboriginal children bring with them to school needs to be valued and respected, the learning of the school-based language needs to be appreciated and evident in the learning and teaching of mathematics. For many Aboriginal children, this dual language learning must be taken into account in the development of literacy and numeracy programs and in teachers' mathematical interactions with the children.

A mathematics classroom environment has to be developed that encourages Aboriginal children's self-confidence in asking teachers questions about mathematics. Aboriginal children need to be encouraged to be involved in mathematics discourse with teachers providing opportunities for Aboriginal children to talk about mathematics. It has been suggested that the specific teaching of English language focussed on the learning of mathematics would enhance Indigenous children's learning (Davison & Schindler, 1988). A concerted effort by educational systems and schools to link literacy and language development has potential for improving Aboriginal children's achievement in mathematics learning. The language barriers that occur in mathematics classes are significant impediments in the struggle for educational equity (Bishop, 1994).

The findings of this study indicate that Aboriginal educators, Aboriginal children, parents of Aboriginal children and teachers should collaborate to:

- acknowledge the literacy and language demands encountered by Aboriginal children in learning mathematics;
- foster congruence, between the school and home, in the mathematics language and methodologies used to foster Aboriginal children's learning of mathematics;
- ensure that teachers evaluate their use of language in the mathematics classroom.

**Context**

Beliefs about the context in which Aboriginal children learn mathematics are placed often within the broader context of Aboriginal children's life experiences and overall learning at
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school. Aboriginal children live, work and learn within two cultures (Watson, 1987). Aboriginal educators believe that Aboriginal children have to learn about two systems, the white system and the Aboriginal system in which they have to live and learn. Many Aboriginal children have to think and talk in two different ways to achieve. This biculturalism has profound significance on mathematics teaching, learning and curriculum (Watson, 1987). As Zevenbergen (1995) cited in Zevenbergen et al., (1996, p. 21), found:

*The unspoken rules for participation in classroom interaction were learnt implicitly so that students who were familiar with such patterns of interaction had an advantage over those for whom such patterns were unfamiliar or incongruent with their out-of-school experiences.*

Many of the Aboriginal educators feel that Aboriginal people are judged on the basis of their Aboriginality rather than for their own worth. No matter where Aboriginal children live it is likely they will identify with aspects of Aboriginal culture (Gibson, 1993; Groome, 1995; Guider 1991). Aboriginal children have to seek their identity in the mathematics classroom as in other learning contexts (Burney, 1994; Hudspith & Williams, 1994). A continuing problem for Aboriginal education has been the failure of schools to recognise the Aboriginal identity of children – their Aboriginality. Cultural identity is the most significant issue for Aboriginal people. The issues of being Aboriginal and belonging have been identified as an important contextual factor related to relationships and learning for Aboriginal children (French et al., 1994; Mesa, 1999; NSW Department of School Education, 1996).

By Years 5 and 6, Aboriginal children are becoming more aware that they are black than when they are younger and they realise that they are different from their non-Aboriginal peers and begin to realise that they are limited by the opportunities available to them. This is the same time [Years 4 - 5] that Aboriginal children identify as a critical learning period during which mathematics starts to become more difficult. It is also a time when parents are concerned that there are inconsistent school practices in relation to discipline and that discipline was becoming more important than education.

In Australia the mathematics curriculum has emphasised the concerns of the middle class and drawn on the experiences of children from Anglo-Celtic backgrounds rather than those of Aboriginal descent (AEC, 1991). Yet, all participants in this study are aware of contextual issues influencing Aboriginal children's learning. There should be recognition in mathematics curriculum of these contextual issues.

Many mathematics classrooms comprise children and teachers from varying cultural backgrounds where there are a number of social issues which influence learning including culture, racism, bias, and prejudice (Partington, 1998). The Aboriginal educators believe that subtle racism and discrimination continues to exist in schools and that teachers need to be aware of the stereotypic views, student labelling and institutional racism that occurs. Due to teachers' lack of awareness of these issues Aboriginal children suffer.

The subtlety with which issues of racism, bias and prejudice can occur in the mathematics classroom should be addressed more purposefully. “A whole new set of behaviours so
that everyone sees the achievement of educational quality for Indigenous Australians as manageable and achievable" (Kemp, 2001, p. 12) has to be established. Institutional and cultural prejudices exist in ways that have often been either unchallenged or unexamined (Beswick, 1990). Mathematics classrooms can provide instructional and supportive scaffolding to assist children move from what they know to what they need to learn (Malin, 1998). It is through teaching, and this includes teaching and learning within the mathematics classroom, that children can come to recognise racism, bias and prejudice present in society and be provided with the skills and knowledge to combat it (Brenner, 1996). If change is to occur in the learning and teaching of mathematics to Aboriginal children then their voices have to be engaged (Sarason, 1994) and attitudes and practices about racism and inter-relations between schools and families have to address institutional and individual inequalities (Ahlquist, 1998).

The teachers in this study believe that Aboriginal children's school attendance rates have an influence on their mathematics learning. Individual Aboriginal children like coming to school to be with their friends and to learn. However, within the community context there is often a different learning structure for Aboriginal children to that in schools. Aboriginal children are not limited by age when they join in community activities while at school an artificial age barrier exists. The Aboriginal children believe that for their educational sakes, Aboriginal children should be made to attend school. However, according to one Aboriginal educator, the majority of Aboriginal children were not being well served in schools that are still trying to make white people out of them.

Teachers try to meet the needs of Aboriginal children but they need continuing sensitisation courses about Aboriginal educational issues. For many teachers do not know much of either the history of the Aboriginal children they are teaching nor the cultural contexts in which they live and learn. If teachers are more aware of how some Aboriginal children live they would have a greater appreciation of their problems. Teachers acknowledge that many Aboriginal children should be achieving at a higher level than they were showing at school. This view is reinforced in the literature (Christie & Harris, 1985; Guider 1991; Kemp, 2001; McInerney, 1992b). Some teachers in this study express a deficit view of Aboriginal children's ability to achieve to their potential believing that the children commenced school with an underdeveloped set of skills and knowledge. However, such a view of underachievement in children has been described as "inaccurate and invidious" (Plaia & Walsh, 1996, p. 42) and has been refuted (Allexsaht-Snider, 1992).

There are at least four sets of expectations for the learning of Aboriginal children: parental, children's, school and community. A further set, though not specifically identified, is those expectations set by the mathematics curriculum. Some teacher comments establish a link between the home expectations of doing well at school and children's achievement levels. This raises a significant learning issue about establishing complementary expectations between school and home that support Aboriginal children's learning of mathematics. The influence of low expectations impacts significantly on Aboriginal children, for, as the Aboriginal educators express it, Aboriginal children live up to what is expected of them. Indeed, children from minority groups and those of a lower socio-economic status may be more affected in their learning by the expectations placed upon them than other groups (Hart & Allexsaht-Snider, 1994).
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Teachers will need to make the implied processes and actions of the language of the mathematics classroom far more explicit for Aboriginal children (Frigg & Simpson, 2000). If Aboriginal children are to see the relevance of mathematics “teachers must provide ‘hands-on’ experiences which convey the social meanings of mathematical ideas. The connections between symbols on paper and their representation of real-life situations must be explicitly made” (Dawe, 1995, p. 243). Aboriginal children need “to know about the ‘how to’ or the processes for negotiating successfully” (Smolkin & Suina, 1999, p. 583) within the world of the mathematics classroom. Aboriginal children need to understand the cultural values and activities involved in mathematics education. They “need to know why and where, as well as how, if they are to share cultural goals in mathematics activity” (Crawford, 1989, p. 24).

The findings of this study indicate that Aboriginal educators, Aboriginal children, parents of Aboriginal children and teachers should collaborate to:

- provide appropriate culturally based induction, orientation and ongoing professional development programs for teachers working with Aboriginal children, to sensitize teachers about the contextual issues impacting upon Aboriginal educational issues;
- consider the contextual issues influencing Aboriginal children and their learning of mathematics;
- investigate the mathematical expectations of parents, children, the school and the community for Aboriginal children and how such expectations are expressed and explained.

Relevance

Eleven Aboriginal children believe they did not use much mathematics outside of school. Besides homework, the Aboriginal children identify few occasions when they use mathematics at home. However, Aboriginal educators, the children and teachers raise the important issue of the relevance of mathematics to the daily lives of Aboriginal children, and for the children’s future employment. These comments have implications for teachers of mathematics in trying to make the implicit use of mathematics explicit and in relating children’s daily use of mathematics to the mathematics classroom. All Aboriginal children use mathematics outside of school in their games, at home and in their activities and if they see little relevance for mathematics in their lives they may see little value in learning mathematics. Many children do not see the relevance of school mathematics to their daily lives (Perlmutter et al., 1997). As many Aboriginal children are unfamiliar with their daily use of mathematics it is likely that many Aboriginal children do not see school mathematics as relevant to their lives.

It needs to be emphasized that the mathematics syllabus content (NSW Department of School Education, 1989), for these Year 5 and 6 Aboriginal children, contains no activities related to their cultural background. Teachers have to make connections between school mathematics and the Aboriginal children’s world, making mathematics meaningful and relevant. Issues of connectedness, relevance and purpose influence how children involve themselves in mathematics classes (Koehler & Prior, 1993). Teachers can use the mathematical experiences and funds of knowledge that children bring to school to
identify connections between these and school mathematics (Bishop, 1988a; Masingila, 1995; Masingila & de Silva, 2001), thus making school mathematics more meaningful and relevant for Aboriginal students. If mathematics is to empower Aboriginal children then they must experience mathematics which is relevant to them and which is seen by them to be relevant.

The findings of this study indicate that Aboriginal educators, Aboriginal children, parents of Aboriginal children and teachers should collaborate to:

- investigate and identify the out-of-school mathematics used by Aboriginal children;
- incorporate relevant out-of-school mathematics activities into the learning and teaching strategies of the in-school mathematics syllabus;
- enable teachers to make the Aboriginal children's implicit use of out-of-school mathematics explicit.

**Homework**

This study finds that mathematics homework can cause confusion, frustration and conflict between Aboriginal children and their parents. As with the parents of other minority groups (Allexsaht-Snider, 1992), mathematics homework is difficult for a lot of Aboriginal parents. Even when parents help Aboriginal children with mathematics homework there are times when Aboriginal children and their parents do not understand the mathematics homework. Many Aboriginal parents are confused by the mathematical language included in some homework, upset that they cannot help their children and worried that they might misinform them in how to do the mathematics. Indeed, there are times when some Aboriginal children know more mathematics than their parents. As suggested in the Feelings category, this could easily lead to feelings of shame within some parents of Aboriginal children as they cannot help their children with their mathematics.

The teachers did not comment on mathematics homework from such perspectives. They believed that mathematics homework was more trouble than it was worth because very few children did it. Those who did often did not need the practice. It was recognised that parents become stressed and put their children under pressure and there was conflict sometimes between the parent, child and teacher when the child could not complete the mathematics homework. The comments from teachers, Aboriginal children and their parents focussed on the negatives of mathematics homework and the emotions that it can cause. The participants’ beliefs raised issues concerning the value of mathematics homework. This suggests the need for further investigation of mathematics homework to inform schools and Aboriginal communities of its purpose, benefit and relevance. Parents of Aboriginal children need to be supported in their knowledge of the appropriate mathematics language and methodology in order to assist their children in their homework and establish congruence between school and home in the ways in which mathematics is taught.

The findings of this study indicate that Aboriginal educators, Aboriginal children, parents of Aboriginal children and teachers should collaborate to:
Discussion and Recommendations

- investigate the impact, purpose, format and appropriateness of mathematics homework on Aboriginal children's learning and their families;
- consider the mathematical language knowledge that Aboriginal children require to complete set mathematics homework;
- assist parents of Aboriginal children in understanding the mathematics homework that their children are asked to complete.

Materials

The use of concrete materials in the teaching and learning of mathematics is believed to be beneficial (NCTM, 2000; NSW Department of Education, 1989). Parents, Aboriginal educators and teachers believe that Aboriginal children understand mathematics better through using concrete materials and that their use makes mathematics more real. They believe that Aboriginal children like using concrete materials and their use makes learning mathematics clearer than when the teacher just talks or demonstrates. It is believed that the increased availability and Aboriginal children's use of materials should enhance mathematical understanding and knowing.

The Aboriginal children believe there are benefits and constraints in using base 10 materials. On the one hand, they like using and having them available because they help them learn mathematics and are useful to do addition. However, they also believe that base 10 materials can be confusing, using them is like cheating and they have to know how to do the operations without using them.

There is a conflict in espoused beliefs between the benefits of using concrete materials to support Aboriginal children's mathematical learning and Years 5 and 6 being seen as a preparation for the teaching approaches used in high school mathematics. The conflict is evident further in the comments of Aboriginal educators and teachers who believe that the use and availability of materials and practical mathematics activities should enable children to develop greater mathematical understanding and knowledge. This 'universal' belief - that the older children are the less concrete materials should be available in mathematics - may well be a factor in hindering the mathematics learning potential of Aboriginal children.

Some children seek attention by misusing the materials and this could lead to classroom management difficulties. Indeed, Aboriginal educators believe that there are times that concrete materials could be more of a classroom distraction than assistance for some Aboriginal children in their learning of mathematics. They also believe that Aboriginal children learn while they play with the materials and if they are allowed to play with the materials, in the first place, they would more readily listen to the teacher.

Mathematics stencils and textbooks are used frequently by teachers. Aboriginal children view mathematics stencils as something different which saves time in writing down sums though sometimes the content is too repetitive. As the other prime print material used, teachers believe mathematics textbooks were useful because the work is already prepared. However, sometimes a page in a mathematics textbook contains too much information for the children. The quantity of information and mathematical language contained in mathematical print materials has implications for pedagogy and their
appropriateness for Aboriginal children, particularly when mathematical language has been identified by the Aboriginal children and Aboriginal educators as a significant influence on their learning.

The findings of this study indicate that Aboriginal educators, Aboriginal children, parents of Aboriginal children and teachers should collaborate to:

- ensure that schools provide adequate availability of mathematics materials in Years 5 and 6 for Aboriginal children;
- discuss the most appropriate means of using manipulatives in Aboriginal children’s learning of mathematics;
- investigate the literacy and language issues encountered by Aboriginal children in reading, comprehending and interpreting mathematical print materials.

Learning

Since the late 1970s there has been a growing awareness amongst mathematics educators of the societal and cultural aspects of mathematics learning (Gerdos, 1996). As Aboriginal children, parents, Aboriginal educators and teachers become more aware of the effect on mathematics learning of cultural diversity appropriate mathematics curriculum (Nickson, 1989) and teaching practices (Stigler & Barneres, 1990) for all can be developed. Teachers have to become aware of and appreciate the cultural diversity and hence the cultural conflict that can occur between the teacher, children and the curriculum content (Bishop, 1994; Moore, 1994). Such cultural conflicts are critical elements in the reasons why Aboriginal children are not achieving to their potential in learning mathematics (D’Amato, 1993; Kemp, 1999). If there is a mismatch in the set of beliefs amongst parents, children and teachers towards the learning of mathematics and the interactions within the mathematics classroom, mathematics anxiety for all parties will occur.

When learning mathematics, most Aboriginal children believe in the importance of listening, others of watching while some believe in working mathematics out on paper. Mathematics could also be learnt through textbooks, by redoing incorrect work, through individual help and listening to the answers of others. The Aboriginal educators believe most Aboriginal children learn best through active involvement and this is supported by Aboriginal children’s comments that they like measurement, spatial activities and working outside. Yet there appears to be a conflict in beliefs with Aboriginal children responding that the main way in which they learn mathematics is by listening. One teacher believes that a primary teaching task is to have children listen during mathematics lessons. If a teacher believes in the importance of listening to learn mathematics and emphasises this in the classroom, perhaps this is why Aboriginal children believe so strongly in listening to the teacher in order to learn mathematics.

Learning is fundamentally a social process and this is important in Aboriginal children’s learning and teaching (Gray, 1990). The Aboriginal educators believe learning mathematics has both practical and theoretical aspects with Aboriginal children preferring the practical. The parents talk of mathematics as being imaginary and not related to everyday life. Within the mathematics classroom the metaphors and the imagery of the children have to be used to convey ideas and concepts (Woodrow, 1989). Parents believe
in the importance of Aboriginal children talking about mathematics and the importance of establishing consistent classroom routines to enhance Aboriginal children’s learning are raised. The effects of otitis media (Sherwood & McConville, 1994), working with others and their degree of independence are factors that influence Aboriginal children’s learning. Teachers talk of the influences of children’s levels of attention, motivation, willingness and ability to learn. For the Aboriginal educators, play, games and humour play a role in Aboriginal children’s learning though there is not much fun evident in mathematics classes.

Overall, the teacher comments did not focus on Aboriginal children’s mathematics learning. This seems paradoxical given that the teachers have Aboriginal children in the class and acknowledge that they are not learning to their potential. One teacher espoused beliefs about the timing of learning mathematics and how it might be related to maturity and learning readiness. At times, children are just not ready to learn the planned mathematics while at another time the children would learn it quickly. One teacher believes in a greater emphasis on mathematical thinking. However, there were feelings of teacher pressure, frustration and personal annoyance in having to cover the curriculum content before emphasising children’s mathematical thinking. At the same time as teachers feel under pressure because of the amount of mathematics content to teach, Aboriginal children believe there is more to learn in mathematics than any other subject.

Teachers raise the importance of and yet apparent lack of children’s perseverance in thinking mathematically, particularly in problem solving. With the extended use of mathematics textbooks and stencils in Years 5 and 6, if lessons are more interesting and tangible, perhaps, children may well be encouraged in their mathematical thinking. Teachers who view mathematics as rule-learning do not need to know much about how children learn mathematics (Battista, 1994). As teachers move towards enhancing children’s mathematical learning rather than simply having children recall content and perform skills (AEC, 1991; NCTM, 2000) teachers will focus more on how Aboriginal children learn mathematics.

Only one teacher talks about varying learning styles and the performance of Aboriginal children in mathematics. In co-operation with Aboriginal people, teachers need to become more aware of Aboriginal learning styles to foster appropriate learning environments in mathematics classrooms (Harris, 1984; Sherwood & McConville, 1994). Such co-operation between the community, children and educators can help bridge the difficult social and learning experiences that many Aboriginal children face in the mathematics classroom. Rather than making “the learner (Aboriginal student) fit the system, a preferred focus is on how the system can better meet the learner’s needs” (Frigo & Simpson, 2000, p. 6). Children’s beliefs about mathematics and themselves as mathematicians do affect their learning of mathematics (Garofalo, 1989b). If some Aboriginal children have negative beliefs about mathematics and themselves as learners of mathematics, then appropriate mathematics programs and teaching strategies need to be designed to help overcome such views.

The lack of a mathematics curriculum that emphasises children’s experiences, culture and traditions is viewed as a barrier to achieving mathematics equity amongst varying cultural groups (Tate, 1995). An inclusive mathematics curriculum is needed that supports and empowers teachers to consider how they value the experiences, cultural background and
language that Aboriginal students bring into the mathematics classroom (Frigo & Simpson, 2000). The development of appropriate learning programs for Aboriginal students has to be done in consultation with Aboriginal adults. Teachers cannot do it on their own, it has to be done with adults who share the culture (Delpit, 1988).

The Aboriginal children in Years 5 and 6 have already thought about learning mathematics in high school. Manipulatives available in the primary years would be unavailable, the mathematics would be harder and in high school Aboriginal children would be ridiculed for not knowing the answers to mathematics questions. These expressed beliefs suggest that the development of transition programs between primary and high school should occur and that Aboriginal children’s perceptions of learning mathematics be discussed.

The findings of this study indicate that Aboriginal educators, Aboriginal children, parents of Aboriginal children and teachers should collaborate to:

- talk about, reflect upon and make decisions about appropriate actions that need to take place within schools and homes to enhance Aboriginal children’s mathematics learning;
- assist teachers in discussing and identifying ways in which Aboriginal children learn mathematics.

**Teaching**

Aboriginal children are not achieving their potential mathematics learning standards (Kemp, 2001). It is time to investigate cultural dissonance in mathematics education for Aboriginal children and the associated teaching and curriculum implications (Bishop, 1994). Generally, the Aboriginal children like their mathematics classes, enjoy doing shapes, having some free time and talking to each other. Aboriginal children believe that understanding teachers sit and listen to them individually and more experienced teachers are better at teaching mathematics. A teacher emphasis on language, the use of concrete materials and a variety of teaching strategies are viewed by parents as enhancing Aboriginal children’s learning. For the Aboriginal educators, teaching emphasis in Years 5 and 6 should be placed on Aboriginal children’s understanding the specific meaning of the mathematical language used in the classroom and the practical nature of mathematics.

Aboriginal educators and parents believe that teacher-student relationships, based on mutual trust and respect, are critical to their children’s learning. Aboriginal children respond best when there are positive personal relationships with teachers (Collins, 1999). With the pressure on teachers to cover mathematics content and the management difficulties experienced by some, Aboriginal parents believe teachers may not emphasise the development of such critical teacher-student relationships. Aboriginal children need to see teachers being respected by Aboriginal adults. The Aboriginal educators believe if teachers are flexible, fair and consistent in their expectations and mathematics classroom routines the Aboriginal children will know how they are to behave.

The Aboriginal parents and educators believe body language plays an important role in how Aboriginal children relate to teachers. Aboriginal children can feel hostility towards
them, they can pick up the body language and read the tension. The teachers made no
comment about the importance of body language in teaching Aboriginal children.

Teachers believe teaching to be harder now than previously because of the differing
levels of children's ability. Teaching is significantly affected by trying to program and
cater for the wide range of abilities, the amount of mathematics content to be covered
and the lack of teaching time. There is concern expressed that teachers are struggling
with how to cater for the wide range of children's mathematical abilities. Teachers report
a lack of teacher education preparation for teaching mathematics across ability groups
and the difficulty of inventing appropriate teaching strategies for Aboriginal children.

Aboriginal children's beliefs about the repetitive nature of some mathematics work have
been discussed previously. Yet teachers believe review and consolidation of mathematics
is important because children forget what they learn. This is an example of a mismatch of
teaching purposes between the Aboriginal children and the teachers.

Teacher expectations, beliefs and attitudes influence how Aboriginal children behave. The
belief is espoused by one Aboriginal educator that some teachers really think that
Aboriginal children cannot learn, while others think that Aboriginal children do not have
the same IQ as non-Aboriginal children. Such teacher beliefs have to create a divide
between teachers, Aboriginal educators and Aboriginal children. A clearer appreciation of
each other's role in teaching and more inter-personal discussion about the diversity in
views and the cultural conflicts between all involved in the teaching process would
support Aboriginal children's learning.

For the Aboriginal educators, Aboriginal children's mathematics learning would be
enhanced if teachers checked children's understanding of printed materials, slowed down
the introduction of new mathematical ideas, assessed children's understanding of new
ideas before moving on to more new mathematics and went out into the community to
do some mathematics.

This study supports the view that teachers hold a variety of beliefs across a number of
factors that influence the teaching of mathematics (Tracey et al., 1998) and that teacher
beliefs play a critical role in what and how teachers teach (Battista, 1994). However,
"teaching reforms cannot take place unless changes to teachers' deeply held beliefs about
mathematics and its teaching and learning take place" (Ernest, 1989, p. 99). The teaching
of mathematics in Australia rarely accounts for the diverse social and cultural needs of
children (Rice & Mouseley, 1994). Teachers of mathematics will have to assess their
teaching practices and schools develop mathematics programs to accommodate a diversity
of cultural backgrounds amongst children, particularly for Aboriginal children (Aboriginal
and Torres Strait Islander Commission, 1995). The teaching of mathematics is not value-
free or cultural-free, nor is the development of a mathematics curriculum. Reforms in
mathematics teaching need reconsideration because there are children who continue to
have low achievement in mathematics, disengage from the subject and drop out of school
(Secada, 1992a).

Mathematics lessons where talk is shared, children's ideas valued, relevant mathematics
activities are used and where children are encouraged to use their cultural and language
resources to solve problems provide purposeful mathematics teaching strategies for Indigenous students (McCarty, Wallace & Benally, 1991). Teaching methodologies which include strong teacher-pupil relationships, reducing competition, emphasis on the explicit rather than the implicit, limiting direct questioning, emphasising practical experiences and group co-operation will benefit Aboriginal children's learning of mathematics.

The complex nature of the cross-cultural social interactions of the mathematics classroom impacts upon the teaching of mathematics. Thus, mathematics educators need to appreciate the cultural and social backgrounds of Aboriginal children in their mathematics classrooms. Teachers require continual support in developing their awareness of and implementation of appropriate interpersonal protocols with Aboriginal people and in providing appropriate teaching strategies to enhance Aboriginal children's mathematical learning outcomes. These proposed actions are predicated on the basis that negotiation, consultation and collaboration have to occur.

Issues of connectedness, relevance and purpose influence how children choose to be involved in mathematics classes (Koehler & Prior, 1993). Aboriginal children should not be labelled as disadvantaged. The reality is that Aboriginal children are often poor and from families where the economic support for children's learning of mathematics may not be available and where mismatches between school and home expectations may exist.

*What should be puzzling is not the low achievement, but the social forces that coerced other students ... to learn in spite of such a sorry state of affairs. If reform is to matter, it must begin with the populations for whom we have drawn these special categories. Curriculum and instruction should first be effective with these students and then applied to other populations. Finally, the notions of disadvantage and compensatory education that are linked to these populations should be replaced with notions that acknowledge their competence.* (Secada, 1992a, p. 654)

Teachers cannot devise appropriate educational programs for marginalised children on their own. They have to be "devised in consultation with adults who share their culture" (Delpit, 1988, p. 296). There is national agreement that teachers and systems must listen to and take direction from Aboriginal people, that community partnerships must be reflected in teaching practice and that change has to be a whole school and community effort (Boston, 2001). When it comes to the development of mathematics curriculum, systems need to enact this agreement in developing documents through community partnership and shared ownership. If collaboration and change are to occur then the voices of parents, teachers and children have to be engaged (Sarason, 1994). Such curriculum have to be developed "if for no other reason than we need to break the cycle of school being a place of failure for young Indigenous people" (Buckskin, 2001, p. 10).

The findings of this study indicate that Aboriginal educators, Aboriginal children, parents of Aboriginal children and teachers should collaborate to:

- appreciate the teaching priority that should be placed upon positive Aboriginal student-teacher relationships in Aboriginal children's learning of mathematics;
- ensure that Aboriginal children are taught mathematics in a relationship of mutual trust and respect;
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- discuss the important role of body language in how Aboriginal children relate to teachers;
- provide professional development programs to assist teachers in catering for the range of abilities of Aboriginal children in mathematics classes;
- share beliefs about Aboriginal children's learning of mathematics to further identify appropriate teaching strategies to enhance their mathematics learning.

Structures

Current mathematics curricula (AEC, 1991; NSW DET, 1989) recommend the use of cooperative groups in the learning of mathematics. Teachers support group work for mathematics, though, by Years 5 and 6 there is little space in the mathematics classroom for the children to move about and form groups. The Aboriginal children identify the advantages and disadvantages of working individually and with others when they do mathematics. When you are working individually other children cannot copy your answers, cheat from you, give you wrong answers or break your concentration. Working with others can be useful because children can help each other with harder mathematics, share ideas and explain to each other what the teacher says. However, working with others in mathematics can cause confusion and slow children down, becoming a barrier to learning. The Aboriginal children say that they would prefer to have the choice of when they work individually, when they work in groups and with whom they work based on the type of mathematics being completed.

Parents comment on graded mathematics classrooms and how teacher decisions impact upon Aboriginal children and their families. Such decisions are made often without consideration of the impact upon the children and without parental consultation. Consideration and consultation could avoid the unintentional emotional impact that placement in graded mathematics can have on children and families.

The teachers support graded mathematics classes because of a belief that all children in such classes are on the same level. A consistent concern of the teachers is their difficulty in catering for the wide range of ability levels within their mathematics classes. Aboriginal educators believe that the majority of Aboriginal children are placed in the lower mathematics grades. The teacher concerns support this belief as there was only one Aboriginal child in the highest mathematics class. This suggests that teachers have to consider more carefully the purpose and structure of graded mathematics classes involving Aboriginal children and the processes involved in their class placement. It is apparent to teachers that different ways of identifying levels of mathematical ability exist in different schools and when children move from one school to another this can lead to confusion between parents and schools.

The findings of this study indicate that Aboriginal educators, Aboriginal children, parents of Aboriginal children and teachers should collaborate to:

- consider the appropriateness and function of graded classes for Aboriginal children learning mathematics;
- establish teaching strategies in learning mathematics which enable Aboriginal children to choose when they work individually, when they work in groups
and with whom they work;
- establish school-based transition programs which assist Aboriginal children and families when they move from one school to another.

**Technology**

Aboriginal children believe calculators help with the harder algorithms and are useful in providing the right answer. The teachers believe they help children check their answers. As well, teachers and the children believe their use could hinder Aboriginal children’s learning of mathematics. Some Aboriginal children think using calculators is cheating. Teachers do not use them because their use leads to student misbehaviour and classroom management issues. Other teachers do not trust the children to do the mental calculation before using a calculator and worry that Aboriginal children could become overly dependent on their use. Parents believe that calculations used to be either mental or written, now there are calculators. Though they do not specify them, the parents consider that there are different ways in which children complete mental, written and calculator-assisted calculations. Beliefs about the advantages and disadvantages of calculator use in primary school mathematics have long been identified (McIntosh, 1990; Shult, 1981; Yvon, 1987). That they continue to be evident in this study suggests that teachers, parents and children remain uncertain and unconvincing of their role in Aboriginal children’s learning of mathematics.

The findings of this study indicate that Aboriginal educators, Aboriginal children, parents of Aboriginal children and teachers should collaborate to:

- investigate the beliefs of Aboriginal children, Aboriginal educators, parents and teachers towards the classroom use of technology, particularly calculators, to enhance mathematical learning;
- provide professional development workshops on the effective use of calculators for teachers, parents and Aboriginal educators in Aboriginal children’s learning of mathematics.

**Assessment**

Critically, the Aboriginal educators raise a number of beliefs related to the validity of formal assessment procedures in identifying the mathematical knowledge of Aboriginal children. Teachers believe formal mathematics tests do not inform them of the mathematics knowledge that Aboriginal children have because Aboriginal children perform better at mathematics when dealing one-to-one with a teacher than in tests. The format of written tests, the lack of practical components and the language used within the tests influence the performance of Aboriginal children. At times, the content of a mathematics test is set on the syllabus content, rather than what has been taught. Often, there is a mismatch between how teachers teach and the type of written mathematics tests Aboriginal children have to do. The impact of such factors is linked to the failure of Aboriginal children in learning school mathematics.

The Aboriginal children believe that mathematics tests are good as they keep the class quiet and important because they help Aboriginal children gain good grades. They
believe that test scores are important indicators of their proficiency in mathematics and make them feel good or bad about themselves. Though many tests are reviews of the work some have too much to do and some contain unseen and, thus unknown mathematics content.

Mathematics tests are a phenomenon of a differing cultural view to learning than was traditionally the view of Aboriginal people. Aboriginal children will not perform well in tests “until they start to perceive the connection between tests and achieving their ultimate goals in the Western domain” (Harris & Harris, 1988, p. 76). Little acknowledgement is given to the cultural and social issues and resultant implications on the structure and implementation of formal mathematics tests involving Aboriginal children. The teachers believe in alternative assessment strategies emphasising the importance of classroom discussion and observing. They believe that individual assessment of children’s mathematical knowledge should occur to provide teachers with a better understanding of the mathematics that Aboriginal children know. However, they believe they do not have the time in each lesson to assess each child.

Though mentioned briefly, it is important to raise the issue that developing more appropriate reporting of Aboriginal children’s progress to parents is warranted to enable them to know more about their children’s mathematics learning.

The findings of this study indicate that Aboriginal educators, Aboriginal children, parents of Aboriginal children and teachers should collaborate to:

- identify mathematics assessment strategies which are appropriate and beneficial in assessing Aboriginal children’s mathematical learning;
- use a variety of classroom strategies, including discussion and observation, in assessing Aboriginal children’s learning of mathematics.

**Family concerns**

The beliefs expressed in this category provide an insight into the family issues affecting Aboriginal children and their learning of mathematics. The family concerns of each Aboriginal child will have similarities and differences to those of other children. Each Aboriginal child has to be viewed as an individual and the opportunity given for them to recount the experiences, beliefs, and values embedded in their stories (Secada, 1995).

Parents and family are significant influences on the behaviours and attitudes of Aboriginal children (Parsons et al, 1982; Stevenson, 1987; Stevenson et al., 1986; Stigler & Mao, 1985; Stigler & Perry, 1988). It is recognised by Aboriginal educators that many Aboriginal parents do not feel welcome or comfortable at school and feel intimidated by teachers and the subjects being taught. They can feel hostility towards them, reading the tension and picking up negative body language. Such family based experiences can have a negative influence on Aboriginal children and how they relate and learn at school. Parents become anxious when called to school and use confrontation to deal with the anxiety involved in school meetings. The Aboriginal educators believe there have to be positive interactions between Aboriginal parents and teachers. Aboriginal parents have to feel welcome and comfortable in schools.
Aboriginal children need people to encourage them at home and at school if they are going to succeed in mathematics. Aboriginal educators believe that a number of Aboriginal children lack a stable routine at home and this can contribute to Aboriginal children's poor achievement at school. Many Aboriginal children are learning to survive and to deal with family and community issues. They are quite independent and are required to take on roles of responsibility at home before they deal with school learning. Thus, for many Aboriginal children, school is seen as less important or irrelevant, as they learn to survive. It is apparent to parents that Aboriginal children start to drop out of school, in Years 4 and 5, when they see limited employment opportunities for their elder brothers and sisters.

Aboriginal educators believe many Aboriginal parents are often frustrated when they try to assist their children with mathematics homework for it seems, to many, that mathematics is taught differently at school from when they attended. There is an expressed belief that academically gifted Aboriginal children do not get the mathematics help they need at home because many parents do not have the required mathematics skills and knowledge. Within Aboriginal families, children in Years 5 and 6 can become confused and annoyed, and their parents frustrated and shamed because they cannot do the mathematics or they do it in different ways to each other. It is important for the children's learning that parents come to understand what happens in mathematics lessons (Dawe, 1991). For, when parents understand the school mathematics curriculum, children's learning progress is enhanced (AEC, 1991).

The findings of this study indicate that Aboriginal educators, Aboriginal children, parents of Aboriginal children and teachers should collaborate to:

- appreciate the roles and responsibilities that many Year 5 and 6 Aboriginal children have within their families that may affect their perceptions of the importance of school;
- provide opportunities for the parents of Aboriginal children to understand what happens in mathematics lessons in order to reduce Aboriginal children's confusion between the way their parents do mathematics and the way they are taught;
- reduce the levels of anxiety and intimidation that many parents of Aboriginal children experience about school and mathematics;
- develop school-based strategies that make parents of Aboriginal children welcome and comfortable in schools;
- target academically gifted Aboriginal children to provide them with support and assistance in their learning of mathematics.

**Parent involvement**

A challenge for socially responsible mathematics educators:

*is to forge alliances with parents and the community to make schools more democratic, inclusive, and equitable in terms of race, class and gender, including major curriculum reform, in the interests of a society which is culturally and linguistically inclusive, race and gender equal, and socially just.* (Ahlquist, 1998, p. 18)
Parents and Aboriginal educators believe that their involvement in schools is a critical factor in supporting Aboriginal children's general education and mathematics learning. However, many Aboriginal parents do not have the classroom management techniques nor the required literacy and numeracy skills to assist teachers in the classroom. Parents of Aboriginal children believe the language and methods used in mathematics are barriers to them helping their children learn mathematics and many feel intimidated by both school and mathematics. These factors can hinder parental involvement (Liontis, 1992). Such feelings and influences need to be appreciated in the development and delivery of proposed mathematics workshops. The development of such workshops needs to be based on careful planning, co-operation and collaboration between teachers, parents and the community.

Aboriginal parents support the inclusion of local Aboriginal perspectives in school curricula. Such inclusion could involve mathematics related to the local area, especially involving position and measurement. One way to involve the parents and community in mathematics is proposed by Aboriginal educators. They suggested that teachers could take the Aboriginal children into the community to do some mathematics. The notion of community-school mathematics teaching strategies for Aboriginal children centred about mathematics syllabus outcomes "connecting in-school and out-of-school- mathematics practices" (Masingila & de Silva, 2001, p. 333) should be explored. These strategies would involve the Aboriginal children, community members, parents and teachers in providing a context in which mathematics could be made more meaningful for all involved.

For the mathematics potential of Aboriginal children to be achieved "then early childhood and junior primary programs must incorporate services to parents." (Schools Council, 1992, p. 34). This echoes the comments of the Aboriginal educators and parents that they need support in being able to understand the mathematics and the ways that it is taught in schools to be able to assist Aboriginal children in learning mathematics.

The findings of this study indicate that Aboriginal educators, Aboriginal children, parents of Aboriginal children and teachers should collaborate to:

- investigate ways in which Aboriginal perspectives can be included in community-school mathematics curriculum;
- provide parents of Aboriginal children with mathematics workshops to develop their numeracy knowledge and skills to enable them to support their children's mathematics learning at school and in the home.

**Content**

There is quite a contrast in participant comments related to content. The Aboriginal children and educators identified mathematics that the children like whilst the teachers talk about the pressure they are under to cover content and to ensure children's mathematical knowledge by concentrating on the basics of mathematics. The teachers believe that external exams caused them to focus their teaching on tables and the operations. Aboriginal children would like to do more measurement, particularly temperature, working with 2D shapes and building 3D constructions. This contrast in emphasising the basics compared to the Aboriginal children's liking for measurement and
spatial activities may be one reason why Aboriginal children believe that teachers repeat mathematics content that they have experienced. The findings suggest that Aboriginal children like to do more measurement and spatial activities and through these activities the number basics could be reinforced.

The Aboriginal educators support the value of games, believing them to be fun for Aboriginal children and an important strategy for learning mathematics. Aboriginal children enjoy mathematics games. The use of mathematical games is one way in which trading and long multiplication, which Aboriginal children find quite difficult, could be taught. The Aboriginal educators believe that Aboriginal children are efficient at counting and performing mental calculations with money. This perceived calculating strength should be utilised as a learning activity in teaching the basic facts and four operations.

The findings of this study indicate that Aboriginal educators, Aboriginal children, parents of Aboriginal children and teachers should collaborate to:

- ensure more measurement and spatial work is planned for Aboriginal children in their learning of mathematics;
- identify the relevance, usefulness and appropriateness of games in Aboriginal children’s learning of mathematics.

Overview

The cultural diversity that occurs in mathematics classes with the presence of Aboriginal children requires the critical review of the teaching and learning strategies used in mathematics. Within Australia, there has been no previous reported study on the espoused mathematical beliefs of Aboriginal people living in rural communities about the mathematics learning of Aboriginal children in Years 5 and 6.

In this study the four voice groups provide valuable insights into the teaching and learning of mathematics to Aboriginal students. The Aboriginal children’s voices are purposeful in commenting on their context of learning and the importance of mathematics to them. The parent voices present their perceptions concerning their children’s feelings about mathematics and the context in which mathematics is learned. The Aboriginal educators are people who have encountered the education system, lived through it and are now working to have an impact upon the same system. Their voices display a particular concern for the differing contexts of Aboriginal students at home and at school and the impact this has on their learning. The teacher voices indicate the struggle they have in dealing with the range of abilities in their class, differing learning styles and curriculum demands.

The Aboriginal students appear to be reasonably satisfied with the way mathematics is taught. However, the Aboriginal educators and parents raise issues of concern with the Aboriginal educators, in particular, shedding light on critical issues affecting teaching and learning. With all the participants, context is an important category. The differences in the voices of the Aboriginal educators, parents and teachers in their understanding of the context indicate areas of the education environment with the potential for developing closer understanding by all.
Discussion and Recommendations

In the mathematics classroom, Aboriginal children's mathematical learning takes place within a social and cultural context. Those involved in the learning and teaching of mathematics bring to the classroom their own social and cultural backgrounds together with their beliefs about the nature and learning of mathematics. Aboriginal children are influenced by the beliefs that their parents and families hold about mathematics. The beliefs that teachers hold influence the ways in which Aboriginal children are taught and how their learning is assessed and reported. These beliefs affect Aboriginal children's mathematical learning and achievement. These participant voices provide evidence and present credence to various influences affecting Aboriginal children's learning of mathematics and show that the beliefs across participant groups do not always match.

The fact that Aboriginal educators are appointed to a school with Aboriginal children identifies that there are specific educational, social, cultural and political influences affecting their learning. The Aboriginal educators' voices focus upon the cultural, contextual and socio-economic issues affecting Aboriginal children's learning of mathematics. This key group of Aboriginal educators are able to provide valuable insights into the cultural divide affecting Aboriginal children's learning of mathematics. They emphasise the importance of positive student-teacher relationships and the learning links between literacy, language and mathematics.

There are differences in the beliefs held by the Aboriginal people involved in this study compared to those of the non-Aboriginal teachers. The Aboriginal children, parents and Aboriginal educators want the Aboriginal children to learn and to achieve well at school. The parents and Aboriginal educators highlight contextual and family concerns as significant factors impacting upon Aboriginal children's learning. The espoused beliefs of these teachers include beliefs about their teaching practices in mathematics and the ways in which they relate to their students in mathematics. The teacher's voices focus on their beliefs about organisational and management issues and teaching children in general rather than about teaching Aboriginal children. There is an espoused teacher belief that all children should be treated the same in their teaching of mathematics. There is not a sharp focus in their belief statements about Aboriginal children's mathematics learning.

This study highlights the existence of beliefs held by Aboriginal people about mathematics and mathematical learning. The identification and reporting of these mathematical beliefs help inform teachers and Aboriginal communities about required reform in mathematics teaching to enhance Aboriginal children's mathematical learning. These expressed beliefs need to be considered in attempts to make mathematics curricula relevant for Aboriginal students. Appropriate curriculum development would enhance the mathematics achievement of Aboriginal children through its relevancy, appreciation of the complexity of the mathematical language and in the presentation of practical mathematical learning activities. Further, the espoused beliefs provide a source of reflection for Aboriginal educators, teachers and parents as they critically evaluate the appropriateness of pedagogical strategies used in teaching mathematics to Aboriginal children.

It is important in teaching Aboriginal children that the social processes of learning as well as the social learning processes are recognised. Learning mathematics is a process of cultural interaction and all children, Aboriginal and non-Aboriginal, are going to meet cultural conflicts to varying degrees. For Aboriginal children, cultural conflict in the
mathematics classroom may occur through the teaching strategies being used, the lack of relevance of mathematics activities, confusion in the mathematics language being used or the lack of awareness of the social, cultural and historical issues that Aboriginal children bring with them. Educators require an understanding of where the school conflicts originate for Aboriginal students in order to implement effective pedagogy. Teachers have to become aware of and appreciate the cultural diversity and hence the cultural conflicts that can occur amongst teachers, Aboriginal children, parents and the curriculum content.

Such cultural conflicts and mismatches between school and home experiences are critical elements in the reasons why Aboriginal students are not achieving to their learning potential in mathematics. The language barriers and cultural conflicts that occur in mathematics classes continue as part of the struggle for educational equity and achievement for Aboriginal children. A concerted effort by educational systems and schools to link literacy, language and mathematics development has the potential to enhance Aboriginal children’s achievement in mathematics learning.

Developing a shared understanding and appreciation of the beliefs of the culturally diverse groups involved in mathematics learning would help lessen cultural conflict in the mathematics classroom and place more focussed attention on the learning potential of Aboriginal children. It is important to reform school environments where Aboriginal children learn “… [for without reform] methodology will tend to reproduce social inequalities of achievement and subordinate individual development to social domination” (Teese, 2000, p. 8). However, to achieve such reform will take “a very special kind of listening, listening that requires not only open eyes and ears, but open hearts and minds” (Delpit, 1988, p. 297). This thesis provides a unique record of the espoused beliefs of those involved in the mathematics learning of a group of Year 5 and 6 Aboriginal children in an Australian rural community. It identifies the mathematical beliefs expressed by the four participant groups, categorises, compares and contrasts the sets of mathematical beliefs before providing suggestions as to how the identified difficulties for Aboriginal children’s learning of mathematics might be ameliorated.

**Recommendations**

The recommendations that follow are based upon the rigorous comparison and contrasting of beliefs from Aboriginal and non-Aboriginal participants involved in Aboriginal children’s learning of mathematics.

**A. Recommendations concerning mathematical beliefs**

This study shows that each of the four participant groups espouses mathematical beliefs that are detailed and complex. Further, there is variance between the espoused mathematical beliefs of the various participants. There needs to be a greater appreciation and understanding of the differences between the espoused mathematical beliefs of the various participants to help lessen cultural conflict in the mathematics classroom and to enhance Aboriginal children’s mathematics learning. It is recommended that:

- teachers identify their espoused mathematical beliefs and reflect on how their mathematical beliefs impact upon their teaching of mathematics to Aboriginal children;

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- Aboriginal educators, Aboriginal children, their parents, and teachers collaborate in voicing, sharing, listening and reflecting on their beliefs about the nature, learning and teaching of mathematics;

- time and resources should be made available for teachers, Aboriginal children, their parents and Aboriginal educators to come together to discuss their beliefs about the nature, learning and teaching of mathematics.

B. Recommendations for practitioners

Aboriginal children are “often confronted with numeracy practices that have more in common with the experiences of children from completely different social backgrounds” (Kemp, 2001, p. 14). The Aboriginal children, Aboriginal educators and parents talk about the social and cultural context in which Aboriginal children learn mathematics. Teachers will have to focus more on identified teaching issues impacting upon Aboriginal children’s learning of mathematics. This study gives Aboriginal voice to these issues, and shows the willingness amongst Aboriginal people to effect change that will enhance Aboriginal children’s mathematical learning outcomes. It is recommended that:

- on-site action research involving Aboriginal educators, Aboriginal children, their parents and teachers be undertaken by these groups. Such research would involve the people in solving some of the problems themselves and be a motivator for improved attitudes towards the teaching and learning of mathematics.

- Years 5 and 6 Aboriginal children identify instances in their everyday lives in which they use mathematics.

- teachers, parents and Aboriginal educators collaborate to develop appropriate teaching and learning activities to support Years 5 and 6 Aboriginal children in the language learning required for mathematics.

- teachers implement appropriate teaching strategies to focus on the mathematical learning needs of Years 5 and 6 Aboriginal children.

- teachers appreciate the influence of humour in Aboriginal children’s mathematical learning.

- Years 5 and 6 Aboriginal children’s mathematics learning be immersed in language development and practical involvement leading to the development of theoretical mathematical concepts and ideas.

- assessment of the mathematics learning of Years 5 and 6 Aboriginal children emphasises discussion and practical strategies.

- teachers acknowledge the importance of personal teacher-student relationships in Aboriginal children’s learning of mathematics.

- parents of Aboriginal children need to be supported through school-community
action to overcome the frustration and shame they feel when they cannot help their children with mathematics, particularly mathematics homework.

- teachers, Aboriginal educators, parents and Aboriginal children address issues of Aboriginality, bi-culturality and cultural conflicts in Aboriginal children's mathematics learning.

- teacher education courses, teacher induction programs and teacher's continuing professional development better prepare and develop teachers to understand the complex nature and culture of mathematics classrooms, especially for Aboriginal children.

C. Recommendations for policy makers
There continues to be comment about the development of “culturally responsive school curricula because for many of our young Indigenous people, school is a place of failure” (Kemp, 2001, p.15). This damning admission by the Federal Minister for Education, Training and Youth Affairs that schools can be places of failure for Indigenous children emphasises the social justice dimension of the absolute necessity to enhance Aboriginal children’s mathematical learning outcomes. A just and civil society requires all children to have similar learning opportunities no matter their background. Both state and federal education systems should develop teacher professional development materials and teaching activities appropriate to the teaching of mathematics to Aboriginal children. Through such a perspective classroom teachers can be more informed of the factors that lead to Aboriginal children succeeding in mathematics. It is recommended that:

- education systems, both state and federal must develop teacher professional development materials emphasising pedagogical issues influencing Aboriginal children’s learning of mathematics.

- education systems, both state and federal must develop teaching and learning activities complementary to mathematics curricula that are relevant and appropriate to assist Aboriginal children learning of mathematics.

- education systems develop mathematics curriculum support documents that integrate the inter-relatedness of literacy, language and mathematics in order to support Aboriginal children’s learning of mathematics.

- materials for mathematics workshops for parents of Aboriginal children be made available to schools and Aboriginal communities through appropriate educational workshops to strengthen the school-home-community partnerships involved in Aboriginal children’s learning of mathematics.

D. Recommendations for researchers
The investigation of race, ethnicity, social class and achievement in mathematics has “a marginal status relative to mainstream mathematics education” (Secada, 1992a, p. 654). Such research is central to the social justice principles and personal empowerment that should be present in the learning and teaching of mathematics. In Australia, mathematics education research with Aboriginal people is,
of considerable ethical importance, and perhaps it is timely for mainstream researchers to foster environments in which Indigenous people are given further opportunity and support to facilitate a sharing of their work within mainstream forums. (Zevenbergen et al., 1996, p. 33)

Future collaborative research in mathematics education has to be based on the premise of researchers working in close co-operation with Aboriginal people based on a research agenda incorporating negotiation and consultation to identify ways of teaching mathematics that maintain the integrity of Aboriginal world views. It is recommended that:

• effective teaching strategies to make the implied processes and actions of the language of the mathematics classroom more explicit for Aboriginal children be identified.

• collaborative research focus on investigating the interactions which occur between Aboriginal children and teachers in mathematics classrooms.

• a collaborative research effort to link literacy and language development with Aboriginal children’s achievement levels in mathematics be implemented.

• investigation be undertaken to connect Aboriginal children’s in-school and out-of-school mathematics experiences, to make school mathematics learning more meaningful and relevant.

• the influence of mathematics homework on learning and the apparent conflicts that result within many Aboriginal families be investigated.

• the role that parents, particularly mothers, and others have in assisting Aboriginal children with their learning of mathematics and mathematics homework in the primary Years 5 and 6 be investigated.

• an evaluation into the role of Aboriginal educators in Aboriginal children’s learning of mathematics be undertaken.

Conclusion

To have Australian schools described as places of failure for Aboriginal children (Buckskin, 2001) and to have Aboriginal people described as the most educationally disadvantaged group of people in Australia (Aboriginal and Torres Strait Islander Commission, 1995; Kemp, 1999) has to be of critical concern for Australian citizens and government. Aboriginal children have to experience mathematics methodology and content “from the perspective of their own cultural identity” (Kemp, 2001, p. 14). For Aboriginal children to be continually failing to achieve their mathematical learning potential is socially unjust and mathematics educators have to consider such a situation as “unconscionable and untenable” (Secada 1992a, p. 654).

This study reports issues impacting upon Aboriginal children’s learning of mathematics in Years 5 and 6 based on the espoused beliefs of the Aboriginal educators, Aboriginal
children, their parents and the teachers involved in the learning process. The espoused beliefs reported in this study provide an insight into the complex nature of issues related to the social, cultural, economic and historical contexts in which the learning and teaching of mathematics involving Aboriginal children take place. The findings and recommendations present directions for the incorporation of an Aboriginal view of contextual, learning and teaching issues affecting Aboriginal children's learning of mathematics in Years 5 and 6. It provides an opportunity to share the espoused beliefs of Aboriginal people and non-Aboriginal teachers with other educators and communities to enhance the mathematical learning of Aboriginal children.

It is acknowledged that mathematics reforms of the past have not taken into account "the social construction of what counts as mathematics literacy and the problems it [school mathematics] should focus on" (Apple, 1992, p. 428). This is a significant reason why Australian schools continue to be a place of failure for Aboriginal children. What has to occur is school-community participant conversations across Australia between Aboriginal and non-Aboriginal people. Through such conversations, both the pedagogical issues and possible solutions as perceived and identified by those involved in the learning process - Aboriginal children, their parents, Aboriginal educators and teachers - can be voiced and as a result the mathematics learning of Aboriginal children enhanced.
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BELIEFS ABOUT THE NATURE AND LEARNING OF MATHEMATICS IN YEARS 5 AND 6:
The voices of Aboriginal children, parents, Aboriginal educators and teachers

by

Peter Thomas Howard

A thesis presented to the University of Western Sydney in partial fulfilment of the requirements for the degree of Doctor of Philosophy

November, 2001

© P. T. Howard October 2001
PLEASE NOTE

The greatest amount of care has been taken while scanning this thesis,

and the best possible result has been obtained.
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Both in undertaking and completing this study the support of several people needs to be acknowledged. These people placed their trust and faith in me to complete the task. It was with this trust, respect, personal support and assistance that this study was completed.

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When one has worked intimately with people over a long period of time it is difficult to single out people without, perhaps, offending some. I thank all those people with whom I have worked and whose support and friendship will always be appreciated.
Statement of Authentication

The work presented in this thesis, is to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare that I have not submitted this material, either in whole or in part, for a degree at this or any other institution.

[Signature]
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<tr>
<td>AEA</td>
<td>Aboriginal Education Assistant</td>
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<td>AEC</td>
<td>Australian Education Council</td>
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<td>ASSPA</td>
<td>Aboriginal Student Support Parent Association</td>
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<td>NCTM</td>
<td>National Council of Teachers of Mathematics</td>
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<td>NSW AECG Inc</td>
<td>New South Wales Aboriginal Education Consultative Group Inc</td>
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Glossary of Terms

Aboriginal people
There are two acknowledged groups of Indigenous people in Australia: Aborigines and Torres Strait Islanders. For this study the term represents those adults and children who identify as Australian Aboriginal people and who are accepted as Aborigines by their community.

Aboriginal Education Assistants
Within New South Wales Department of Education and Training primary and secondary schools with more than a designated number of Aboriginal children Aboriginal people are trained and employed to work as teacher assistants. These people are referred to as Aboriginal Education Assistants or Aboriginal educators in this thesis.

attitudes
Attitudes are opinions that people hold toward a given issue formed through the bringing together of one's beliefs.

beliefs
Beliefs are any simple proposition, conscious or unconscious, inferred from what a person says or does, capable of being preceded by the phrase, “I believe that…” (Rokeach, 1968, p. 2)

learning of mathematics
The term refers to those processes that exist in schools, the home and the community whereby people learn mathematics. If it is accepted that learning is best thought of as an active and productive process on the part of the learner several important implications arise.

“Learners construct their own meanings from, and for, the ideas, objects and events which they experience.
Learning happens when existing conceptions are challenged.
Learning requires action and reflection on the part of the learner.
Learning involves taking risks.” (AEC, 1990, pp. 16-17)

“Educational research offers compelling evidence that students learn mathematics well only when they construct their own mathematical understanding. To understand what they learn, they must enact for themselves verbs that permeate the mathematics curriculum: ‘examine’, ‘represent’, ‘transform’, ‘solve’, ‘apply’, ‘prove’, ‘communicate’. This happens most readily when students work in groups, engage in discussion, make presentations, and in other ways take charge of their own learning.

All students engage in a great deal of invention as they learn mathematics; they impose their own interpretation on what is presented to create a theory that makes sense to them. Students do not learn simply a subset of what they have
been shown. Instead, they use new information to modify their prior beliefs. As a consequence, each students' knowledge of mathematics is uniquely personal." (National Research Centre, 1989, pp. 58-59)

**mathematics**

Though the following view registers some controversy it is used in this study. "Mathematics is not a universal, formal domain of knowledge waiting to be discovered, but rather an assemblage of culturally constructed symbols, representations and procedures for manipulating these representations." (Stigler & Baranes, 1990, p. 258)

**mathematics classroom**

School site where the teaching of mathematics takes place.

**Murris**

Term used by Aboriginal people to represent those Aborigine groups living in north west New South Wales and Southern Queensland, Australia.

**non-Aboriginal people**

Those adults and children who are not Australian Indigenous people - that is, not Aborigines or Torres Strait Islanders.

**primary teachers**

Those qualified adults involved in the teaching of students in primary schools (Kindergarten to Year 6).

**teaching of mathematics**

"There is no definitive approach or style for the teaching of mathematics. The teaching of any particular mathematical concept will be influenced by the nature of the concept itself and by the abilities, attitude and experience of students. The teaching of mathematics facilitates mathematics learning which is likely to be enhanced by ... ... activities which build upon and respect students' experiences. ... activities which the learner regards as purposeful and interesting. ... feedback. ... using and developing appropriate language. ... challenge within a supportive framework." (AEC, 1990, pp. 18-20)

**Years 5 and 6**

The last 2 years of primary school in New South Wales when children are normally in the age range of 10 to 12 years.
Abstract

Background
Aboriginal people are the most educationally disadvantaged group in Australia. They have lower levels of participation at all stages of education than non-Aboriginal people, resulting in unacceptable levels of educational disadvantage. They have limited access to schooling beyond the primary years and they feel that their views are often not heard or even sought. It is vital that Aboriginal people be heard in an effort to improve the educational outcomes for Aboriginal children. Collaborative research partnerships amongst Aboriginal and non-Aboriginal people, working within a context of consultation and negotiation, are essential for this to occur. There has been little Australian mathematics education research conducted with rural Aboriginal communities. Indeed, Australian mathematics education research related to Aboriginal people is not vast and has focussed on the influences of language and culture on the learning of mathematics in geographically remote communities. However, little effort has been made to access the views and beliefs of Aboriginal people. Through the identification of such beliefs, specific factors that affect Aboriginal children’s learning of mathematics can be identified, leading to more appropriate teaching strategies being utilised.

Purpose
This ethnographic study investigated the espoused beliefs of Aboriginal children, their parents, Aboriginal educators and non-Aboriginal teachers towards the learning and teaching of mathematics in Years 5 and 6 in a rural community in New South Wales, Australia. The research questions for this study are:

1. What are the beliefs expressed by Years 5 and 6 Aboriginal students, in a rural community, about mathematics and the learning of mathematics?
2. What are the beliefs expressed by parents of Years 5 and 6 Aboriginal students, in a rural community, about mathematics and students’ learning of mathematics?
3. What are the beliefs expressed by Aboriginal educators, in a rural community, about mathematics and students’ learning of mathematics?
4. What are the beliefs expressed by non-Aboriginal teachers, in a rural community, about mathematics and students’ learning of mathematics?
5. How do these sets of beliefs compare and contrast?
6. What are the pedagogical consequences for the learning and teaching of mathematics based on these expressed beliefs?

Process
This ethnography was conducted in one rural community involving one primary school following trials in other sites. Over a period of six years the researcher had come to know the community and be known by the Aboriginal educators and teachers working in the primary schools. The researcher lived in the rural community for an extended period of time recording fieldnotes, negotiating appropriate protocols and consulting with various Aboriginal and non-Aboriginal groups before conducting conversational interviews. Interviews were transcribed and reviewed using a constant comparative method. From the transcript reviews sixteen core categories of beliefs across all participant groups were
identified. Not all sixteen categories were identified in each interview. The belief statements of the participants demonstrate the complex nature of the social, cultural, economic, historical and political contexts in which the learning of school mathematics takes place. The extent of the espoused beliefs highlights the need for teachers to be aware of and to seek out the beliefs of Aboriginal children, their parents, Aboriginal educators and to reflect upon their own held beliefs towards the learning and teaching of mathematics. Such beliefs inform teachers of the pedagogical issues affecting Aboriginal children’s learning of mathematics.

**Setting new directions**

Through the analysis of the participant’s voices a number of actions affecting espoused mathematical beliefs, pedagogy, curriculum development and future collaborative research to enhance Aboriginal children’s learning of mathematics are proposed.

A sharing of the espoused mathematical beliefs of non-Aboriginal teachers with the Aboriginal community can assist in a community-school appreciation and better understanding of the contexts within which Aboriginal children learn mathematics. Similarly, a shared understanding and appreciation of the espoused beliefs of Aboriginal people involved in mathematics learning and teaching can help lessen cultural conflict in the mathematics classroom and place more focussed attention on the learning potential of Aboriginal children.

Teachers require pedagogical strategies that address Aboriginal children’s learning of mathematics. Currently, Aboriginal children are not learning to their potential and there are critical social justice implications for mathematics teaching and the curriculum. Core issues, including the role of language in mathematics learning, teacher-student relationships, the learning context and specific pedagogical aspects including fun, teacher consistency and the relevance of mathematical experiences were raised in the study as critical elements for consideration in Aboriginal children’s learning of mathematics.

Educational systems, both state and federal, need to include an Aboriginal perspective in mathematics curricula to enhance the mathematical learning outcomes for Aboriginal children. Through such a perspective classroom teachers can be more informed of the factors that lead to Aboriginal children succeeding in mathematics.

Future collaborative research in mathematics education has to be based on the premise of researchers working in close co-operation with Aboriginal people, with Aboriginal people identifying research priorities. Such research has to incorporate honest negotiation and consultation to identify ways of teaching mathematics that maintain the integrity of Aboriginal peoples’ world views. The mathematics classroom has a role to play in the development of the person as well as being a learning site for teaching the chosen mathematical content. The complex nature of the cross-cultural social interactions of the mathematics classroom impacts upon Aboriginal children’s learning and the teaching of mathematics. The learning and teaching of mathematics is dependent upon the cultural and social contexts in which they take place. Thus, educators need to appreciate the cultural and social backgrounds of Aboriginal children in mathematics classrooms. The issue of what it means to be an Aboriginal child learning mathematics in varying classroom contexts and at varying ages requires further investigation.
Conversations between Aboriginal and non-Aboriginal people about the learning and teaching of mathematics have to occur. The Aboriginal voices in this study have raised issues of language, relationships, the importance of one's identity and specific pedagogical aspects including humour, teacher consistency and relevant mathematical experiences as critical elements for consideration in Aboriginal children's learning of mathematics. These beliefs, as stated by Aboriginal people, have not been considered in the past by mathematics curriculum developers. This is a significant reason why mainstream Australian schools continue to be a place of failure for Aboriginal children. Through such conversations, both the pedagogical issues and possible solutions, as perceived and identified by those involved in the learning process – Aboriginal children, their parents, Aboriginal educators and teachers – can be voiced and Aboriginal children's mathematical learning enhanced.