# Working Together to Enhance Australian Aboriginal Students' Mathematics Learning

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This paper focuses on the social justice imperative to bring about improved mathematical learning outcomes for Aboriginal students. It provides comment whereby mathematics educators can appreciate more fully the context in which many Aboriginal students learn mathematics. Further, the paper reports on five mathematics education case study projects initiated by educational systems working collaboratively with Aboriginal communities. It examines each program using seven constructs: social justice; empowerment; engagement; reconciliation; self-determination; connectedness; and relevance. As an outcome, possible roles and responsibilities of mathematics educators for working collaboratively with Aboriginal communities to provide appropriate mathematics pedagogy for Aboriginal students are identified.

> Social justice is what faces you in the morning. It is the ability to nourish your children and send them to school where their education will not only equip them for employment but reinforces their knowledge and appreciation of their cultural inheritance. It is the prospect of genuine employment and good health: a life of choices and opportunity, free from discrimination. (Dodson, 1993).

Aboriginal people have been described as the most educationally disadvantaged group of people within Australia (Aboriginal and Torres Strait Islander Commission, 1995). As a group they do not participate equally with non-Indigenous Australians at all levels of education (Australian Bureau of Statistics, 1992; 1997). Many still live in geographically remote regions of Australia but most are urban and rural dwellers living in cross-cultural communities. Many Aboriginal students continue to be affected by poverty (Aboriginal and Torres Strait Islander Commission, 1999) and suffer health problems, including otitis media, which impact upon their school learning (Australian Bureau of Statistics, 2002). 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; 2002). Thus, educational equity for Australian Aboriginal students has been identified as a priority for Australia (Elson-Green, 1999).

Across Australia the number of Aboriginal students entering schools is increasing. Education systems are seeking to find appropriate strategies to enhance the learning and teaching of Aboriginal students. Aboriginal Educators have been employed to work with teachers to promulgate appropriate strategies and to improve the learning outcomes of Aboriginal students. Thus, there is an urgency in 'getting education right'. In New South Wales, the statement is often heard that the Basic Skills Tests show improvement in literacy and numeracy levels for Aboriginal students. It is correct to say that there appears to be improvement for all students but the gap is not closing between Aboriginal students and non-Aboriginal students. It remains wide. While schools achieve state averages for Aboriginal students the question remains, why can these students not achieve the overall state averages? What role and responsibility do mathematics educators and researchers have in helping to close the gap?

The terms *Aboriginal education* and *educating Aboriginal students* are often seen as synonymous. While it is clear what is meant by *educating Aboriginal students,* Aboriginal education lies entirely in the domain of those Aboriginal people who have a cultural knowledge base and who interact within a cultural interface to share knowledge with others (Nakata, 2002). Aboriginal education is different from educating Aboriginal students.

*Educating Aboriginal students* requires Aboriginal and non-Aboriginal teachers to understand the needs and cultures in which each Aboriginal student lives. All Aboriginal students are different. Teachers have a professional responsibility to develop a repertoire of teaching strategies in order to engage and empower Aboriginal students within a diversity of learning contexts (Schwab & Sutherland, 2001).

It is important for teachers to build partnerships and form networks with Aboriginal people. These networks need to acknowledge the diversity of Aboriginal cultures and avoid stereotyping Aboriginal people. There has to be a continuing sharing and a coming together of minds where educators sit and listen to Aboriginal people, Aboriginal educators and, more importantly, enter into meaningful dialogue with Aboriginal students.

> … a very special kind of listening, listening that requires not only open eyes and ears, but open hearts and minds. We 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)

## Supporting Aboriginal Students as Capable Learners

Within Australia, it has to be recognised that schools with diverse student communities and histories "must work within these histories in reforming and trans-forming culture and history through nurturing the development and growth of individuals" (Watson, 1988, p. 4). Such work must be based upon negotiation between school and community.

Common elements in many Aboriginal world-views are co-operation and co-existence (Harris, 1991). Aboriginal people are seeking a movement to pedagogies which reflect the contexts in which Aboriginal students learn. It is essential "that schools are places where Aboriginal students feel a sense of belonging" (NSW Department of School Education, 1996, p. 6). Education is never neutral. It reinforces the dominant beliefs of the society. Indeed, "[S]chooling will only perpetuate social inequalities and injustices unless they are directly challenged both within and outside education" (Hicks, 1999, p. 14). Thus, the challenge for educators is to listen and to act.

> [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 students thrive in a climate of collaboration and connectedness (Harris & Malin, 1994). If students 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). It is this biculturality that has profound significance on mathematics teaching, learning and curriculum (Watson, 1987). A

mathematics classroom that fosters affection and respect and personal decision-making can generate a context for meaningful learning (Wood, 1994).

### *Learning*

Aboriginal students respond best when there are positive personal relationships with teachers. “It is often more important who does the teaching than what is actually taught” (Collins, 1993, p. 7). Teaching methodologies that include strong teacher-pupil relationships, reduce competition, restrict verbal communication; limit direct questioning, and emphasise practical experience and group co-operation will benefit Aboriginal students (Frigo, 1999).

Expectations of students’ learning can have a major impact on the quality of this learning. Teachers have expectations of their students, themselves and the education system. Parents have expectations of, and aspirations for, their children and their schools. Students have expectations of themselves, perceptions of others’ expectations of them, aspirations for their futures and expectations of teachers and schools (NSW Department of Education and Training, 1998). The mathematics education of Aboriginal students must take these expectations into account. One suggested area of research to help achieve this 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, 1992, p. 22).

Often Aboriginal students 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 students' 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, while school learning is largely focused on two-way verbal interactions (Harris & Harris, 1988). Aboriginal students need to learn how to use language to learn at school (Graham, 1988a, 1988b) and they may feel shame if they are focused 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 students prefer to try things in private and demonstrate in public when they have acquired skills (Harris & Harris, 1988).

Aboriginal people are learners in two worlds (Watson, 1987). They consider that there are external factors affecting their lives and directing their progress (Harris, 1990). Parents, teachers and students need to "embark on a program of truly multicultural instruction which both recognises and actively utilises 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).

Cultural identity is a major issue for Aboriginal people. No matter where an Aboriginal child lives it is likely he/she will identify with aspects of Aboriginal culture (Gibson, 1993; Guider 1991). Identity is personal and evolves as individuals grow in the knowledge of their cultural backgrounds and as they respond to varying places and circumstances (Groome, 1995). A significant problem in educating Aboriginal students has been the failure

to recognise their Aboriginal identity – 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 students grow, develop and relate to those about them, including their teachers.

Aboriginal students come from generations of resistance. This means not only the land wars of the invasion period but also to the resistance to the inhumanity of official policies – a cultural resistance - including a resistance to Western education (Parbury, 1986). To move towards the achievement of potential by Aboriginal students it is important that Aboriginal culture and language are accepted in the classroom and students have a sense of belonging (French, French, Matthews, Stephens, & Howard, 1994). All education, including mathematics education, needs to be a ‘place of belonging’ for Aboriginal students. Aboriginal students need to feel that schools belong to them as much as to any other child. School success for Aboriginal students is dependent upon “cultural appropriateness, development of requisite skills and adequate levels of participation” (Elson-Green, 1999, p.12).

“The ethnic and cultural experiences of the knower are epistemologically significant because these factors influence knowledge construction, use and interpretation” (Banks, 1993, p. 6). Aboriginal societies are both person-oriented and information-oriented, emphasising the personal connections between teachers and learners. In referring to Aboriginal students from traditional backgrounds, Christie & Harris (1985) cited three significant areas of difference between the Aboriginal students and the non-Aboriginal teacher: the language of the classroom; the learning styles of Aboriginal students and the differences in “perspectives, expectations understandings and interpretations” (p. 82) of what happens in the classroom. Teachers should recognise the students’ abilities and their history as well as appreciating the role language, culture, experiences, expectations and physical factors play in student learning (Forbes, 1994; Roberts, 1990).

### *Mathematics*

Australian mathematics syllabuses reflect the values, activities and priorities of the dominant culture. The institution of school impacts upon teachers and students and the mathematics curriculum content. Many Aboriginal students

> lack the knowledge and understanding of the cultural values and the cultural activities that are associated with mathematical activities in the wider culture. These students need to know why and where as well as how if they are to share cultural goals in mathematics activity. (Crawford, 1989, p. 24)

More emphasis has to be placed on the students' experiences of mathematics in their everyday lives and the social context of school learning and teaching. Mathematics "will be more accessible to Aboriginal people if the trouble is taken to fit that mathematics sensitively onto and around the beliefs, values thinking patterns and problem solving processes contained in Aboriginal cultures" (Hunting, 1987, p. 10).

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 latter

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). 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).

Often student success is dependent and measured upon how well they grasp the meanings involving this language of mathematics. Aboriginal students need to understand the 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.

Aboriginal students must be provided with mathematics curricula that allow 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. 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 students 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 students to develop mathematical meaning through in real life experiences, discourse about those experiences and reflection on what they have learnt.

Aboriginal people want to learn mathematics and 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 needs to be recognised and explored. Such information can be gathered from the expressed beliefs of Aboriginal educators and the parents of Aboriginal students (Howard, 2001). Secondly, these beliefs need to be incorporated into making mathematics curricula relevant for Aboriginal students.

## Aboriginal Peoples' Beliefs About Mathematics Teaching and Learning

This section of the paper draws on data collected during an ethnographic study that investigated Aboriginal peoples' beliefs about the nature and learning of mathematics (Howard, 2001). Conversational interviews were held with Aboriginal educators and the parents of Aboriginal students. An overview of their comments about mathematics learning supports the previous literature and provides Aboriginal comment for directions that mathematics educators can consider in enhancing the mathematical learning potential of Aboriginal students.

### *Aboriginal Educators*

The Aboriginal educators spoke holistically of issues and influences impacting upon Aboriginal children's learning at school in general, with specific comments related to the children's learning of mathematics. 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. They identified two systems that Aboriginal children have to learn - a Western system and an Aboriginal system.

The Aboriginal educators identified two aspects in relation to the learning of mathematics, the theoretical and the practical. They believed Aboriginal children preferred the practical. Having to live and learn mathematics within these two systems holds implications for the language used in the mathematics classroom, the practical nature of learning mathematics and the establishment of positive teacher-student relationships.

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.

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.

There was the belief amongst the Aboriginal educators that the verbal and written mathematical languages are significant barriers to Aboriginal children's achievement in mathematics. 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. One implication is that there has to be greater congruence between teaching mathematics and assessment.

### *Parents of Aboriginal Children*

The parents willingly expressed their beliefs about a subject area in which many of them felt uncomfortable. 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 students' learning across the curriculum, including mathematics.

Mathematics was viewed by Aboriginal parents to be abstract and not relevant for Aboriginal students. Many parents were concerned that the current teaching of mathematics was different from the ways in which many of them were taught. These differences often led to conflict between parents and children when they tried to support their children in doing assigned mathematics homework. The level of frustration among parents was a recurrent theme.

The language of mathematics, both the terms and the symbols, as well as personal mathematical skills and knowledge levels were believed to be further constraints for parents helping their children learn, understand and complete their mathematics. Beliefs of hopelessness about mathematics and helplessness in supporting their children's mathematical learning emerged. The links between student 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 students' learning of.

There was a 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 Aboriginal educators and parents have voiced relevant issues that they believe impact upon Aboriginal children's learning of mathematics. Both groups expressed concern that the mathematical learning potential of Aboriginal students was not being achieved. The comments provide an informative source to begin to develop a set of constructs to examine mathematics pedagogy and mathematics programs designed to enhance Aboriginal students' learning of mathematics.

## Proposed Constructs: Providing Appropriate Mathematics Education

No one person has all the answers. An analogy with Rubik's Cube can be made. There are people who can put the cube together with relative ease but they have difficulty in teaching others this skill. One way in which this teaching might be achieved is to have a group working collectively towards a solution. The mathematical education of Aboriginal students is challenging, but if the mathematics education community and Aboriginal people work collectively towards solutions, the mathematical learning outcomes of Aboriginal students can be enhanced (Harris, 1991; Howard, 2001).

The following constructs have been derived from an appreciation of the contexts of Aboriginal education (NSW Department of School Education, 1996), national mathematics project reports (Department of Education, Training and Youth Affairs, 2000b), analysis of interviews with Aboriginal people (Howard, 2001) and national professional development initiatives (Australian Principals Associations Professional Development Council, 2003). They have assisted us in focusing the discussion around the imperative of acknowledging and appreciating the place of social justice in Aboriginal students' learning of mathematics.

*Social justice* is about treating all people with dignity and respect. It is about a community recognising and acknowledging injustices and the development of appropriate actions and processes to address these injustices for individuals or groups so that there is a degree of equality in the overall outcomes. It is about a freedom of choice. It is about living with your own rights and beliefs and not those imposed from others. It is about your right to be who you are. In this paper, it is about being Aboriginal.

*Empowerment* is gaining the necessary knowledge to impact upon change that is essential for effective educational outcomes. It is about Aboriginal people making decisions and sharing their knowledge and skills with others. Being empowered is about making a difference.

*Engagement* is being able to interact purposefully with the discourse around mathematics learning. It is about being excited about what you are doing. It is about being treated as a capable learner. It is about respect and positive interactions.

*Reconciliation* is about walking in someone else's shoes. It is about taking the time to listen and to care. It is about working together. It is about sharing and understanding the

diversity of culture. It is about appreciating people and their values, language and learning styles. It is about recognising and appreciating difference.

*Self-determination* is political. Aboriginal people are a minority people in their own country. To achieve self-determination, there need to be Aboriginal people in control and making decisions. It cannot happen when there is always a non-Aboriginal person with the power to say 'yes' or 'no' as to what can happen. Individually it can be achieved - you can determine for yourself if you have access to health, education and support.

*Connectedness* is a sense of belonging. A feeling of being accepted, knowing that you have as much right to be in a place as any other person. The need for Aboriginal students to know that people [teachers] like you, relate to you for who you are. It is about the need to implement the talk. It is about honesty, integrity, being a critical friend in what you bring to any given situation as an important person within the Australian society.

*Relevance* is about bringing the Aboriginal students' environments into the mathematics classroom. It is about providing Aboriginal students with the necessary mathematical skills to enable them to look beyond their horizons. It is about Aboriginal country, Aboriginal nations. It is about where an Aboriginal student lives and using that country in mathematics curriculum, teaching and learning. It is tokenistic to think of relevance being only the application of Aboriginal motifs to classroom materials. The relevance is in how, why, and who make the motifs and how materials are used.

These constructs form the basis for the examination of five programs designed to enhance Aboriginal students' mathematics learning.

## Innovative Mathematics Programs: Five Exemplars

The educational issue of the low levels of numeracy acquisition by Aboriginal students has been a recent focus of Commonwealth and State policy documents (NSW Board of Studies, 1996; Ministerial Council on Education, Employment, Training and Youth Affairs 1997; 1999; Department of Education, Training and Youth Affairs, 2000a). Since 2001, the following Aboriginal education initiatives have been implemented by educational systems in New South Wales to enhance the mathematical learning of Aboriginal students.

*Count Me In Too Indigenous: NSW Department of Education and Training Program [2001-3] (CMITI).* The Count Me In Too Indigenous program in NSW government primary schools is designed to build upon the successes of the Count Me In Too program by making mathematics more culturally and contextually appropriate for Aboriginal students in preschool to Year 2. CMITI was introduced into five primary schools in NSW during 2001 and provided an opportunity for teachers, Aboriginal educators, parents and Aboriginal communities to develop a local program to enhance students' numeracy development. The key to the program was the extended Schedule for Early Number Assessment (SENA) that provided a way for listening to Aboriginal students, and learning how they undertake certain mathematical problems (Howard & Perry, 2002).

*Counting On: NSW Department of Education and Training program [2001-2]. Counting On* is a program that supports low achieving students in NSW secondary school mathematics classrooms and in Year 6 classrooms. Though not directly focused upon Aboriginal students, there are many Aboriginal students in the *Counting On* program. It

focuses on the professional development of teachers by identifying and addressing the students' learning needs. It operates on a team approach involving a high school and one of its feeder primary schools in each geographical site (Perry & Howard, 2002).

*Mathematics in Indigenous Contexts [K-6]: NSW Board of Studies Project [2001-3].* This project was implemented in two NSW government primary schools (one rural, one urban) during 2002. The focus was twofold - the professional development of teachers and the development and implementation of contextual mathematics units through the establishment of learning networks including teachers, Aboriginal parents and mentors. Family involvement in Aboriginal children's learning in general, and mathematics learning in particular, is reported to be of critical importance in that it "provides students with significant positive social capital … heightens parental aspirations for their child's future as well as providing a focus for their expectations on the education system to provide the quality of education necessary to assist Aboriginal students achieve these aspirations" (NSW Board of Studies, 2002, p. 4).

*Mathematics in Indigenous Contexts [6-8]: NSW Board of Studies Project [2003-4].* This project is being implemented in 2003, in two rural locations within NSW. It focuses on primary and secondary schools, investigating the transition needs of Aboriginal students in the Key Learning Area of mathematics. The purposes of the project are to:

- increase teacher awareness of the numeracy needs of Aboriginal students;
- develop appropriate pedagogy in mathematics;
- develop collaborative curriculum development links between the schools and the Aboriginal community;
- identify the numeracy transition needs of Aboriginal students from Year 6 to 7; and
- explore the effectiveness of the use of learning teams on the professional development of teachers of mathematics.

*Aboriginal Students WII GAAY (Gifted Child) (Mathematics Camp: Armidale CSO Project [2003].* This camp was held in March 2003. It involved talented Aboriginal students aged 8-11 years who had been identified from the primary schools within the Armidale Catholic Schools Office (NSW). The purpose of the mathematics camp was to challenge these students in working and thinking mathematically as they used critical reflection in identifying the mathematical strategies they used in moving towards solutions to a number of problem based questions and activities.

Table 1 identifies which of the seven constructs appear to be evident in the development and implementation of these programs.

Table 1
*Matrix of Constructs and Mathematical Programs*

| | Count Me In Too Indigenous | Counting On | Mathematics In Indigenous Contests K-6 | Mathematics In Indigenous Contexts 6-8 | WII GAAY |
|---|---|---|---|---|---|
| Social Justice | X | X | X | X | X |
| Empowerment | X | X | X | X | X |

| | | | | |
|---|---|---|---|---|
| Engagement | X | X | X | X |
| Reconciliation | | | | |
| Self-determination | | | | |
| Connectedness | X | X | X | X |
| Relevance | X | X | X | X |

## Discussion

In examining these five programs it is evident that each has as a core construct what could be described as social justice. There is also evidence to suggest that each of the programs do attempt to provide activities and curriculum approaches that meet the terms used to describe empowerment and engagement; Counting On and WII GAAY primarily focus upon Aboriginal students, whereas the other programs attempt to empower and engage both Aboriginal students and Aboriginal communities. All programs except for Counting On attempt to develop connectedness and relevance through teaching activities, teacher professional development and Aboriginal community development.

The two constructs of reconciliation and self-determination appear not to be considered, either formally or informally, in the development and implementation of all programs. Perhaps a greater emphasis in these two constructs would enhance the effectiveness and ownership of the programs amongst Aboriginal communities.

The use of the proposed constructs provide a means by which mathematics educators can examine the appropriateness of the development of mathematics programs that attempt to enhance the learning of Aboriginal students.

## Conclusion

There is a body of mathematics education literature related to Aboriginal students and their learning of mathematics. There is a willingness from Aboriginal communities to be involved in the development of relevant mathematics curricula and pedagogy. There are innovative programs being developed and implemented attempting to enhance the mathematical learning potential of Aboriginal students. It is critical that in progressing the learning and research agenda:

- mathematics learning is placed within the Aboriginal student's historical, political, social and cultural backgrounds;
- mathematics education research into Aboriginal students' learning has to become an element of the mainstream research agenda;
- Aboriginal and non-Aboriginal people appreciate each other's beliefs about mathematics learning and teaching; and
- appropriate mathematics programs for Aboriginal students become both educational and social justice imperatives for Australian mathematics educators.

Mathematics education researchers can take a significant role in enhancing Aboriginal students' mathematical learning through undertaking research which will inform:

- an ongoing sharing of current research projects and findings from these projects among the various groups with a stake in Aboriginal mathematics education;

- classroom based multimedia materials that will assist mathematics teachers to develop a repertoire of teaching practices within an effective pedagogy;
- a professional development package that engages teachers in some critical reflection around how they teach mathematics to Aboriginal students;
- effective teacher education practices that specifically address the mathematical learning needs of all Aboriginal students; and
- a philosophy of mathematics learning and teaching developed through listening to and communicating with Aboriginal peoples.

Such research must be part of an agenda that investigates Aboriginal students' learning of mathematics in collaboration and cooperation with Aboriginal communities. This paper has proposed a set of constructs that curriculum developers and mathematics education researchers could consider as they consult, negotiate and develop mathematics education research and programs with Aboriginal communities. 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, can be voiced and as a result the mathematics learning of Aboriginal students will be enhanced. The aim is to bring the colours of the cube together.

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