

**KIMBERLEY**  
SuccessZone

# Mathematics teaching in the Kimberley

Advancing professional conversations



This paper has been prepared for Kimberley  
Success Zone by the Australian Association of  
Mathematics Teachers (AAMT)



# 1. Background

In August 2013, Sue Thomas, Project Co-ordinator, Kimberley Success Zone (KSZ) and Caty Morris, National Manager Indigenous Programs, Australian Association of Mathematics Teachers Inc (AAMT) took a 2000 km, nine-day road trip travelling inland from Broome through the Kimberley. Visiting schools and communities, they identified and captured examples of exemplary practice in mathematics education of Aboriginal and Torres Strait Islander learners.

While visiting schools and communities Sue and Caty:

- spoke with principals, numeracy coaches, teachers, Aboriginal educators, students, parents and grandparents
- engaged in professional learning with a group of teachers and leaders from five schools
- observed exemplary classroom teaching
- held in-depth discussions with two committed Aboriginal educators about their perspectives on mathematics and teaching, their roles as educators and what teachers need to know
- presented sessions on the *Make it count: Numeracy, mathematics and Indigenous learners* project, and
- met with the principal, curriculum coordinator and mathematics coach from one of the largest schools in the Kimberley.

Highlights of their roadtrip included recognition of:

- professionalism of teachers
- quality and expertise of mathematics education specialists
- valuable contribution that Aboriginal educators make
- pockets of incidental research currently underway on a small scale, with a real potential to be developed and shared, and
- willingness to collaborate and learn from others and a real need to leverage the expertise.

Based on this journey, this paper explores some recent developments and initiatives in mathematics education for Aboriginal and Torres Strait Islander students in Australia. It is written mainly for classroom practitioners who want to develop their pedagogy and improve learning outcomes for their students.

## About the two initiatives

### Kimberley Success Zone (KSZ)

[ksz.edu.au](http://ksz.edu.au)

KSZ supports all Kimberley Government, Catholic and Aboriginal Independent Community (AICs) schools to improve outcomes for their Aboriginal and Torres Strait Islander students. It investigates ways of accelerating improvements for Aboriginal and Torres Strait Islander students and capturing and sharing leading practice. KSZ endeavours to enhance Kimberley educators' professional knowledge and expertise through professional learning opportunities, sharing knowledge and expertise, and building dynamic learning communities that stimulate professional conversations.

### Make it Count

[makeitcount.aamt.edu.au](http://makeitcount.aamt.edu.au)

The AAMT *Make it count: Numeracy, mathematics and Indigenous learners* (2009–2012) project consisted of eight clusters of four to six schools across five Australian states as the 'working unit' (35 schools in total; with over 1500 Aboriginal and Torres Strait Islander students among about 15,000 total enrolments). With the support of the AAMT project team, each cluster designed a program of professional learning and classroom research directed at improving Aboriginal and Torres Strait Islander students' engagement, achievement and attitudes in mathematics; as well as engaging parents and the wider community in Aboriginal and Torres Strait Islander students' learning of mathematics.

A characteristic of the project was diversity, both among the schools and between the approaches taken in the clusters. Each cluster was teamed with one or more 'critical friends' – mostly university academic researchers in the fields of mathematics education or Aboriginal and Torres Strait Islander education. The role of the critical friend evolved to be instrumental in supporting the gains made in the clusters and in producing an evidence base. Cluster findings, with examples of them in action, are highlighted throughout this paper. This is particularly important in devising localised solutions that honour diversity and build specialised mathematics knowledge and understandings.



# 2. Introduction

## Key factors for improving mathematics outcomes of Aboriginal and Torres Strait Islander students

The ‘pedagogic dance’ (Parkin 2013) between teacher and student is core to improving mathematics outcomes of Aboriginal and Torres Strait Islander students. This paper identifies six key factors that help ensure the ongoing development of such pedagogy:

1. Teachers’ perceptions of mathematics impact on what mathematics they teach and how they teach it
2. Teachers have a repertoire of teaching practices
3. Aboriginal and Torres Strait Islander educators play a key role<sup>1</sup>
4. Teachers need to engage in professional learning
5. Professional learning communities are essential for developing pedagogy
6. Support and engagement from leadership.

Section 3 unpacks and expands these key factors through an in-depth look at current effective professional knowledge, practice and engagement of teachers of mathematics with Aboriginal and Torres Strait Islander learners.

The paper draws on experiences from KSZ schools and *Make it count* cluster findings (detailed cluster findings can be accessed at [mic.aamt.edu.au/Findings](http://mic.aamt.edu.au/Findings)). It discusses mathematics pedagogy that is responsive to Aboriginal and Torres Strait Islander learners and identifies the conditions for developing such pedagogy.

There is also input from other projects and initiatives, as identified at the AAMT 2012 Numeracy, Mathematics and Indigenous Learners National Conference in Adelaide<sup>2</sup>.

### 1 Teachers’ perceptions of mathematics impacts how they teach mathematics and what mathematics they teach

If teachers’ own experiences as students in the classroom were not good or they have a fear of mathematics, chances are they will have an aversion to teaching it and their perception of what is mathematics is very limited. According to Dr Chris Matthews<sup>3</sup>, mathematics is ‘beautiful’ and should not be seen as just a discipline that is taught in the classroom. The beauty of mathematics is that it *‘is alive: a knowledge that connects with all people,*



Maths all around us – even in the playground.

*allowing different expressions of ideas and the emergence of new ideas’* (Matthews 2012, p. 110). If teachers are able to see the ‘beauty’ in mathematics and are able to teach it with passion, this surely has many implications for student learning outcomes.

### 2 Teachers have a repertoire of teaching practices

In order to be responsive to the learning needs of Aboriginal and Torres Strait Islander students, classroom practitioners must have a repertoire of teaching practices based on deep understandings of pedagogy that they can draw on at any one time. These practices include being able to teach explicitly, use scaffolding, contextualise mathematics and make appropriate and relevant cultural and social connections so that mathematics is seen as purposeful, relevant and important.

### 3 Aboriginal and Torres Strait Islander educators play a key role

Aboriginal and Torres Strait Islander educators supporting classroom practitioners play an essential role in the classroom and in the development of a teacher’s mathematics pedagogy. They are integral to a teacher’s connection with students, family, community, language and culture. Like teachers, they should have the relevant professional learning opportunities to support their own learning, so they too have a ‘pedagogical voice’.



Caty noticed all the maths around her and recognised the importance of different languages children bring with them to school.

#### 4 Teachers need to engage in professional learning

Classroom practitioners need to be continually learning about the craft of teaching mathematics, about the mathematics content they are teaching, and about (and from) their students, so they are continually evolving their pedagogy.

There are many 'cultural immersion' programs within different education jurisdictions around the country and many of these can be localised or adapted to suit individual communities.

In mathematics education, many primary school teachers are seeking more structured, deeper learning or understanding about mathematics content knowledge and pedagogic knowledge. It is important that these three areas of learning are connected to have a more meaningful and purposeful impact on teaching and learning.

#### 5 Professional learning communities are essential for developing pedagogy

Professional learning communities are effective vehicles for professional learning, mentoring people new to a school and peer-to-peer support. They offer a powerful mechanism when well-constructed and supported, collaborative and inquiry-based, simultaneously challenging and safe for those involved.

Time and funding are essential for leaders, teachers and Aboriginal educators to participate in these communities. These communities offer a space for generating that vital new knowledge and practice that will improve learning outcomes. They can also offer strategies for coping with turnover of staff in schools,

which in the past has led to a lack of continuity of knowledge and experience. It is vital that educators are continually given opportunities for development in this specific area.

Professional learning communities can be effective for:

- **Classroom research and inquiry** for teachers prepared to put their practice under a lens. Where there are partnerships between educators and researchers (or critical friends) this offers a powerful means to developing new knowledge through inquiry with an evidence base. University researchers can play a role that goes beyond just data collection and analysis. They can provide an outsider's informed perspective, up-to-date theoretical knowledge, and support to educators.
- **Cluster-of-schools collaborations** are very effective as well as collaboration between clusters. These collaborations need not be confined by geography but should be reaching out nationally through the use of technology. They offer opportunities for the sharing of expertise, ideas and knowledge, and provide a multitude of connections and relationships between people and communities.

#### 6 Support and engagement from leadership

Leadership at all levels within a school is a key factor in generating school change and creating effective learning communities. Leaders who are leading successfully at the intersection of Aboriginal education and mathematics education, cultivate and demand a culture of high expectations of Aboriginal and Torres Strait Islander students and their teachers. They invest in Aboriginal and Torres Strait Islander educators as mathematics educators and as leaders in the school and community. They ensure a culture of expectation that pedagogy is constantly evolving, with teachers continually monitoring, refining and reflecting on their work in the classroom. These, and many other actions required to successfully lead a school to really make a difference in this area, reflect the appreciation that there is no single, universal answer to the question of how to teach mathematics to Aboriginal and Torres Strait Islander students—there is a constant focus on improvement.

#### Context

Many experts in mathematics education believe the teaching of mathematics is a specialised craft requiring specialised knowledge. For teachers working with Aboriginal and Torres Strait Islander students, it is essential that they have both the specialised craft and knowledge to effectively teach students from a range of ability levels. However, they must also have specialised knowledge about Aboriginal and Torres Strait Islander education, people and culture, and the competency to work effectively with Aboriginal students, their families and communities that translates into quality learning outcomes in the mathematics classroom.

There is a rapidly growing interest in the development in mathematics education that is responsive to the learning needs of Aboriginal students, focused on high expectations and constantly improving outcomes. This was evident at the AAMT 2012 Numeracy, Mathematics and Indigenous Learners National Conference held in Adelaide. This conference was probably the first of its kind ever conducted in Australia with a focus specific to Aboriginal and Torres Strait Islander learners and mathematics and involving practitioners, researchers and policy makers. The conference had strong representation from the Kimberley region and many other areas around Australia. It was clear that educators across the country are increasingly demanding appropriate support and resources to further develop teaching practice that is responsive to the learning needs of Aboriginal and Torres Strait Islander students.

Interestingly, and importantly, business and industry such as large mining companies, have also begun to see the need to work more closely with specialised education providers to support the employability and employment opportunities for Aboriginal and Torres Strait Islander young people as they work towards increasing Aboriginal and Torres Strait Islander employment. Many of these large corporations now have reconciliation action plans and social investment strategies in place. There is also a rise in the number of programs and initiatives, such as the Science, Technology, Engineering and Mathematics (STEM) to equip students with skills and aspirations for employment in STEM areas (Office of the Chief Scientist 2013).

This growing interest is not before time as the data continues to reveal the gap in mathematics learning outcomes between Aboriginal and Torres Strait Islander students and their non-Indigenous counterparts.

## What the data is telling us

In their 2003 research, ACER reported the lack of significant difference in achievement between Aboriginal and Torres Strait Islander and non-Indigenous students on entering school. It was concluded that the numeracy achievement of Aboriginal and Torres Strait Islander students appeared to be similar to the main sample of students. However, from the beginning of year 1 the gap widens (Frigo et al 2004).

This gap in school mathematics outcomes between Aboriginal and Torres Strait Islander students and non-Indigenous learners is evident in the first few years of schooling. Consider, for example, the NAPLAN results for the last few years. Generally, data reveals that by year 3, across Australia, there is already about a two-year gap between Indigenous and non-Indigenous students (ACARA 2012) and this gap size is maintained through to year 9. *'In each jurisdiction, the percentage of Indigenous students who achieved below the national minimum standard is more than twice the percentage of non-Indigenous students who achieved below the national minimum standard'* (NAPLAN 2012, p. 63) for year 3.

The Organisation for Economic Co-operation and Development (OECD) Programme for International Student Assessment (PISA)<sup>4</sup> 2012 results reveal once again that from the 1991 *'Australian Indigenous students'* who participated in the assessment, the *'mean score difference of 90 points between Indigenous and non-Indigenous students equates to more than two-and-a-half years of schooling'* with an *'under-representation of Indigenous students at the higher end of the mathematical literacy scale and an over-representation of Indigenous students at the lower end of the scale'* (Thomson et al 2013, p. 18). The 2012 results also reveal that out of the three subject areas tested (mathematical, scientific and reading literacy), mathematical literacy suffered the most and *'declined significantly between PISA 2003 and PISA 2012'* (Thomson et al 2013, p. 23).

Literacy has been at the foreground of Aboriginal and Torres Strait Islander education – and education generally – with numeracy often tacked on, with limited focus and attention directed at improving teaching and learning. As with literacy, mathematics education is increasingly being seen as vital to improving life outcomes for Aboriginal and Torres Strait Islander students. For this very reason, KSZ and *Make it count* have been working hard to put more focus on mathematics education.

### 3. Summary of findings, outcomes and recommendations

The findings, outcomes and recommendations from *Make it count*, reinforced throughout the Kimberley trip<sup>5</sup>, are summarised into three domains to reflect those of the Australian Professional Standards for Teachers from the Australian Institute of Teaching and School Leadership (AITSL, 2012).

1. Professional Knowledge of classroom practitioners
2. Professional Practice of classroom practitioners
3. Professional Engagement of classroom practitioners.

These three domains are expanded upon through seven standards in line with the AITSL Standards. These standards 'are interconnected, interdependent and overlapping' (AITSL, 2012).

#### PROFESSIONAL KNOWLEDGE OF CLASSROOM PRACTITIONERS

The Australian Professional Standards for Teachers' description of Professional Knowledge includes:

*Teachers draw on a body of professional knowledge and research to respond to the needs of their students within their educational contexts. (They) know their students well...they know how the experiences that students bring to their classroom affect their continued learning.*

*Teachers know the content of their subjects and curriculum. They know and understand the fundamental concepts, structure and enquiry processes relevant to the programs they teach (AITSL 2012)*

#### STANDARD 1

##### Teachers know Aboriginal and Torres Strait Islander learners and know how they learn

To really 'know' their students, teachers must be able to tap into the 'funds of knowledge' Aboriginal and Torres Strait Islander students bring with them to the classroom. Accessing this knowledge, such as stories, language, skills, conceptual understandings and ways of learning, is an essential part of being able to teach responsively (and to forming productive relationships between teachers and students).

#### KSZ EXPERIENCE

In the Kimberley, effective educators know:

- students bring conceptual understandings to school and access these to teach school mathematics language in Standard Australian English (SAE)
- how students' physicality<sup>6</sup> and numerosity<sup>7</sup> can help to develop western mathematics concepts
- that students' stories or stories familiar to students can be a great way through which to teach mathematics
- the important role that Kriol and Aboriginal English can play in the teaching of mathematics

- that non-verbal communication from students such as gesture can also convey mathematical meaning. This can apply for teachers and Aboriginal educators as well.

These effective Kimberley teachers see the knowledge and understandings in the everyday lives of their students and incorporate these into their teaching and learning programs. They also know that there may be knowledge and understandings students bring to school that are invisible to them as teachers and it is their job to find out, in respectful ways, what these might be. Aboriginal educators, including parents and other community members, are critical in helping to make things visible for non-Aboriginal teachers.

Through working closely with Aboriginal educators, teachers are able to better understand students' knowledge and understandings and use these to deepen students' mathematical conceptual understandings while building their repertoires of SAE.

An example from a Kimberley school, Ngalangangpum School in Warmun, involved transcribing the story 'Goldilocks and the three bears' into Kimberley Kriol with local contexts and character names (eg. the bears' house became a cave). The story was full of many mathematical concepts such as 'on' (as in 'on the table'), 'beside', 'at the back', 'at the front', and subtraction (eg. eating one of the three bowls of porridge). Aboriginal educators can play a key role in re-interpreting, re-contextualising, re-explaining the mathematics not just for the students, but for teachers as well.

The following is an example script taken from a numeracy lesson in years 1/2 at Yiyili Aboriginal Community School. The teacher is speaking SAE and the Aboriginal and Torres Strait Islander educator (an Aboriginal Education Worker [AEW]) is speaking Kriol:

Teacher: *On the weekend, Miss Delaine and I went fishing and I caught a really big barramundi. It was bigger than Miss Delaine's barramundi.*

AEW: *No, Miss Tili! I bin gajim prapa bigiswan bulga den yu. Yu bin gajim only lilwan bulga, det lilbala, en I bin gajim prapa bigiswan.*

Teacher: *Do you think your barramundi was bigger than my barramundi?*

AEW: *Yeah! My bulga him be prapa bigiswan.*

Following the story, the teacher and the AEW draw students' attention to the two languages used and the different words used to describe the same idea (Baxter and Gilligan 2012, p. 3).

Kulkarriya School at Nookanbah presented a great example of the development of many mathematics concepts through students' physicality or physical prowess. Early years students were taken out to the play equipment where they took part in playground activities such as climbing, jumping and turning in circles. These sorts of school-based activities provide perfect opportunities for using mathematical language with students while they are playing and can be readily followed up in the classroom.

At another community a discussion with two young boys who were telling a story about their walk to the river revealed many examples of measurement language. The boys talked about (and gestured very effectively with their hands) the direction of the river, how big the crocodiles were and how far it was to walk to the river. This rich mathematics knowledge and understandings were conveyed through informal conversations. This is an excellent example of mathematics being all around us; we just need to open our eyes and ears to hear and see it.

Regarding non-verbal communication, Matty Braid from Yakanarra Community School suggests that '*learning by watching might be a pedagogical approach that could be adapted to the teaching of mathematics*' with the realisation that students '*seemed to like to explore mathematics concepts for themselves and to watch when processes were modeled*' (Braid and Sullivan 2012, p. 1).

## MAKE IT COUNT EXPERIENCE

The *Make it count* project describes a number of cluster findings relating to Standard 1:

- Know that a sense of community and belonging is a powerful vehicle for engagement in learning.
- Know what is significant in the daily, lived reality of learners so mathematics learning can be culturally relevant and connected and academically rigorous.
- Know that learners may prefer to collaborate rather than compete in their mathematics learning.
- Know that fostering relationships grounded in genuine care and respect are essential to engagement.
- Know that each student is an individual and has his or her own preferences for learning.

At Orange Public School in NSW, the *8 Aboriginal Ways of Learning (8ways)* framework<sup>8</sup> was instrumental in developing teacher understanding of Aboriginal students and their cultural backgrounds (and in the development of their pedagogy).

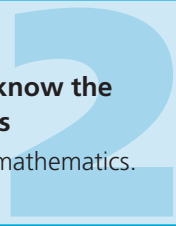
The school worked with their critical friend, Dr Tyson Yunkaporta<sup>9</sup>, to learn more about their Aboriginal students and how they learned and expressed themselves through 'how we learn – culture way':

1. We connect through the stories we share.
2. We picture our pathways of knowledge.
3. We see, think, act, make and share without words.
4. We keep and share knowledge with art and objects.
5. We work with lessons from land and nature.
6. We put different ideas together and create new knowledge.
7. We work from wholes to parts, watching and then doing.
8. We bring new knowledge home to help our mob. (8ways, 2013)

## STANDARD 2

### Teachers know the mathematics content (this includes mathematics language) and know the different ways to teach it effectively to Aboriginal and Torres Strait Islander learners

To be effective in the mathematics classroom teachers need to have deep understandings about mathematics.



#### KSZ EXPERIENCE

Effective Kimberley educators know:

- the big picture in mathematics, the big ideas around it and how they are connected. They have a sound understanding of mathematics through the year levels as many of their classes have a range of learning levels and a diversity of learning needs. At the same time they are able to break down the concepts into increments and teach them step-by-step.
- mathematics terminology and have a very good understanding of it. They know which terminology can be confusing for students.
- a repertoire of activities and teaching strategies they can draw on and use in the classroom at any one time for targeted teaching (as opposed to 'busy work').
- how to identify and access the mathematics in students' stories, including the concepts and languages that students are using, and use these to deepen students' understandings of mathematics and their own understandings of the child's world, knowledge and language/s.
- how to access and use resources effectively. Like effective leaders, they know there is no single solution to improving mathematics outcomes of Aboriginal and Torres Strait Islander students and chasing this distracts educators from focussing on developing their pedagogy.

An example of the effective use of resources comes from Yiyili and relates to a 'maths book' that supports the AICS Numeracy Strategy<sup>10</sup>.

*'This resource gives teachers insight to the maths ... the AEWs found this part of the resource really helpful as it allowed them to develop a deeper understanding of the mathematics within the activities they were working on with the students... teachers began planning with AEWs, using their valuable language knowledge and code-switching skills to enhance explicit maths language learning'. (Baxter and Gilligan 2012, p. 2).*

#### MAKE IT COUNT EXPERIENCE

The *Make it count* cluster findings relating to Standard 2 include:

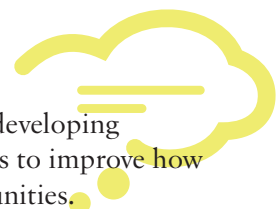
1. Know that teachers and education officers must continually improve their mathematical content knowledge and pedagogical content knowledge.
2. Know the mathematics curriculum and how each mathematical concept can build on, connect with, and lead to other concepts dynamically, not necessarily vertically.
3. Know how mathematics links to contexts beyond the classroom so it can be taught through rich, life-like activities.
4. Know that as a mathematician establishing a community of practice in the classroom, your attitudes and beliefs about mathematics impact learners.

Knowing the mathematics deeply, knowing your students well and knowing how to teach mathematics to Aboriginal and Torres Strait Islander students are critical for effective professional practice.

#### REFLECTION

- What does that mean for us?

We, as educators, need to continuously focus on building on our knowledge, developing deeper understandings of mathematics language and content and finding ways to improve how we work with Aboriginal and Torres Strait Islander students and their communities.





## PROFESSIONAL PRACTICE OF CLASSROOM PRACTITIONERS

In the domain of Professional Practice, the AITSL description includes:

*Teachers are able to make learning engaging and valued. They are able to create and maintain safe, inclusive and challenging learning environments. (They) have a repertoire of effective teaching strategies and use them to implement well-designed teaching programs and lessons. They regularly evaluate all aspects of their teaching practice (AITSL 2012)*

### STANDARD 3

#### Teachers plan for and implement Responsive Mathematics Pedagogy for Aboriginal and Torres Strait Islander learners that is culturally, academically and socially inclusive

This Standard calls for teachers to be 'culturally, academically and socially inclusive' in their pedagogical practice. This means the teaching of mathematics needs to be responsive to the cultural, academic and social learning needs and interests of students and that connections are made between them.



### KSZ EXPERIENCE

For example, effective Kimberley educators:

- are clear about teaching the 'why' of mathematics and connecting with real life, ie. 'why do we need to know this?' This is explained clearly when the learning goal is articulated at the start of the lesson.
- plan for the mathematics language that students need to use and the development of mathematical language – from home language to structured classroom talk to mathematical language (Clarkson 2013). They take advantage of students' ability to code switch.
- are responsive to the fact that students may be having to code switch in their heads as they translate between languages, eg. 'less than' to 'lilbit than dijun' (Treacy and Button 2013). They are also responsive to the intonation of wording that can determine different meanings, such as emphasis on particular syllables to add size or length, eg. 'long way' is not quite as far away as 'loooooong way'.

Many Aboriginal and Torres Strait Islander students are multi-lingual, unlike many of their teachers. In the Kimberley, students may come to school speaking Kriol, Aboriginal English, a variety of traditional languages, with limited exposure to SAE. In relation to his work in Papua New Guinea, Clarkson suggests that in knowing students' languages, teaching needs to be sensitive to content, language and cultural issues. He advises that students will switch languages during the learning process and that teachers often do not realise this. For all students all the way through school, much of their mathematics is coded in their everyday language. For English Language Learner students, what mathematics they know, both Western and their own cultural mathematics, is often coded in their first everyday

(home) language, and beginning to code some in their second language. Hence an encouragement to use their first language in the solution process is appropriate, and builds on what many already do.

In Kimberley Kriol there are no word clusters, such as 'more than' and 'less than', and yet these words are used often in mathematics. Through working with the Aboriginal educators, Treacy (2012) found that within the home languages, directional words can be used and connected to these phrases, thus accommodating students' starting points in language. This project is helping teachers and Aboriginal educators to identify difficult English words and to connect home language with them.

In teaching mathematics it is important to take students from the concrete or physical interaction with mathematics and its representations, to the abstraction of mathematics and vice-versa and make connections between them. An example at Warmun was a lesson with middle primary students where students interacted with the mathematics both physically and abstractly and in different ways to represent the mathematics. The task was to collect rubbish in the playground, group the items they had collected and then use the tiled pathway outside their classroom to graph the rubbish, ie. each piece was put into a concrete tile (the pathway was made of columns of tiles) with each column labeled according to the groups or types of rubbish already identified such as glass, paper and plastic. Before they began the lesson, the teacher clearly articulated the learning goal. Students then estimated which type of rubbish would have the greatest number of items. Students were given various roles, including data recorder and photographer. After completing the 'outside' graph, students then worked with the teacher to enter the data into a computer to produce a digital graph.

The following day they were to repeat the activity in the community so the children were asked to predict and provide justification for any variations they anticipated. The oral language component of the activity, discussing findings and predictions, enabled children to express their knowledge and understandings in their first language and demonstrated engagement and sharing of their understandings with the teacher.

In the *Maths in the Kimberley* project<sup>11</sup>, an Australian Research Council funded initiative from 2008 to early 2010 undertaken by Professor Robyn Jorgensen, Professor Peter Sullivan and others, the researchers identified the *'real advantages in planning coherent sets of experiences with the key ideas clearly articulated'* (Jorgensen et al 2011, p. 86). They also suggest *'that the use of home language in the classroom can be of benefit to both the students and the communities'* (Jorgensen et al 2011, p. 114).

## MAKE IT COUNT EXPERIENCE

The *Make it count* project found Aboriginal and Torres Strait Islander students made substantial gains when the following elements were embedded in teaching and learning.

*Make it count* cluster findings relating to Standard 3 are:

### Being intentional

- Design mathematical learning experiences that have family and community significance.
- Practice explicit and scaffolded teaching with a defined and planned learning goal for each lesson that is shared with students to orient them to the learning.
- Explicitly teach learners mathematical language and symbols so they can articulate and represent what, how and why they are learning and understanding.
- Explicitly help learners develop and maintain positive attitudes to mathematics. Develop positive dispositions, resilience, and skills that equip learners to solve problems whatever the context.
- Have a theoretically informed framework that enables teachers to plan authentic and meaningful learning with the flexibility to take advantage of 'teachable moments'. ***Be aware that a research-based, locally tailored program that is flexible and responsive to local contexts and students delivers higher outcomes than imported commercial programs.***

### Being responsive

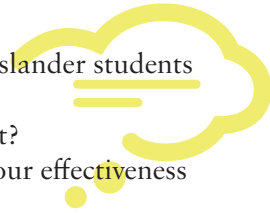
- Realise that responsive mathematics pedagogy builds on student voice, recognition of diverse ways of learning mathematics and connection to worlds beyond the classroom (both local and non-local).
- Use kinaesthetic pedagogical practices as a point of entry to abstract mathematics knowledge.
- Include multiple pathways and approaches to learning that allow students to investigate a range of mathematical concepts and methods and strategies.
- Use narrative and discussion to allow students to feel personally connected to the mathematics.
- Take advantage of spontaneous, unexpected teaching and learning opportunities.

### Being effective

- Backward map the learning sequence. Begin with the outcomes and final product that will go home to parents/family/community and then backward map the process and progression of knowledge.
- Encourage learners to represent their learning and thinking in a range of formats (eg. verbally, physically, symbolically and with technology and not just pencil and paper).
- Stimulate a passion for mathematics in teachers by finding intersections with other fields of knowledge (eg. the arts).
- Recognise that the most effective practices for Indigenous students are also of benefit to all students; so avoid segregation of mathematics curriculum.

The *Make it count* Gladstone cluster in Queensland used problem solving tasks with Aboriginal and Torres Strait Islander students in the middle years of schooling to engage students more deeply in mathematics so they would be more inclined to choose senior years mathematics subjects. The rich tasks offered multiple entry and exit points and multiple representations of mathematics including hands-on, visual and symbolic representations, and catered for mixed ability classes. For example, in a lesson called 'Chocolate Cake'<sup>12</sup> that investigates making fractions, the teacher began the lesson with an actual chocolate cake which was soon represented by sheets of paper and then symbols.

## REFLECTION

- What does this mean for the way/s we teach Aboriginal and Torres Strait Islander students in the Kimberley?
  - How intentional are we in what mathematics we teach and why we teach it?
  - How responsive are we to students' learning needs and are we measuring our effectiveness appropriately?
- 

## STANDARD 4

### Teachers create and maintain learning environments in which Aboriginal and Torres Strait Islander learners feel safe and supported

Teachers ensure student participation and safety in the classroom so students can actively engage in learning. They ensure cultural safety and identity of Aboriginal and Torres Strait Islander students. This safety will require a two-way learning relationship between students and teachers in classrooms where Western mathematics is being taught within a non-Western world but can be jeopardised if a Western teacher's ignorance or naivety about his or her students and their culture, combined with low expectations or assumptions, prevents them from knowing what might be invisible in the Western mathematics to students.

## KSZ EXPERIENCE

The following example illustrates Standard 4 quite well. A Kriol equivalent for teaching the concept of 'through' (as in 'through the pipe') does not exist, and as such the concept and the language may need to be taught explicitly. Using familiar language and contexts to teach this unfamiliar language and concept, such as a toy dog entering a pipe and then going through it, and being clearly expressed in Kriol 'Loogim orlu dog and piep, walkum thud dog insideway lu thud piep' (Treacy and Button 2013) should be followed with the equivalent in SAE using mathematical language being taught explicitly.

While being able to take advantage of unexpected teaching moments, the teacher needs to be able to also explicitly teach the tools, language and concepts so the mathematics, and its applications, are clearly visible to students. Many schools in the Kimberley build on this two-way approach and have experienced real gains in building capacity of Aboriginal educators and non-Indigenous teacher, while growing a professional relationship that is mutually beneficial for teachers, Aboriginal educators, and students. In this way too, the progression of learning is obvious to the student's family and reinforces culture and identity.

In the Kimberley, effective educators:

- know what might be invisible to students in the Australian Curriculum Mathematics (ACM) and make it visible by explicitly teaching the cultural tools as well as the language and concepts necessary to do the mathematics
- engage with Aboriginal educators in teaching and learning. They capture their expertise and plan for this as part of everyday classroom practice to ensure safe and supported learning environments.

Using narrative or story to teach mathematics was mentioned earlier in this paper. Narrative and story offer a powerful approach to teaching language and concepts prescribed in the ACM and help to bring the mathematics to the surface so students are able to see and grasp it more easily. This approach is also a great means to cultivating curiosity, especially for students coming from an oral tradition who are skilled at sharing information. Within narratives there are often meaningful chunks of text or parts of a sentence that can be used to teach mathematics terminology. Unfamiliar mathematics

language is taught within the safety of a familiar context rather than being taught in isolation. It is being taught as part of some meaningful information. That is, the mathematical language is embedded within the text. There are many examples of chunks of text within engaging narratives that are steeped with mathematical language such as 'The doorbell rang' by Pat Hutchins (1986) that refers to 'Share them (cookies) between yourselves', 'I made plenty' and 'That's six each'. For many communities this notion of sharing is an important cultural practice and which is being reinforced through classroom mathematics.

## MAKE IT COUNT EXPERIENCE

The *Make it count* cluster findings relating to mathematics learning environments for Aboriginal and Torres Strait Islander students reinforce the role of relationships and high expectations in student learning.

In *Make it count*, teachers:

- recognise that learning happens most effectively when relationships between learners and teachers are positive, and when connections between family and school are mutually supportive.
- hold and convey high expectations of learners and of themselves as teachers of Aboriginal and Torres Strait Islander learners.
- remember that mastery of a skill in mathematics produces the confidence and enthusiasm to master further skills – a cycle that can be nurtured to produce exponential growth.
- encourage risk taking – this is an integral part of mathematics learning – in an environment that prepares students adequately for an ultimately successful outcome from risks taken.
- promote successful role models of learners and mathematicians, both Indigenous and non-Indigenous, to raise expectations and contribute to improving levels of student engagement and attendance.
- use older students as mentors for younger students as this improves the mathematical understanding of both.

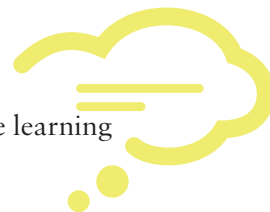
In the *Make it count* Dharug cluster, the Monday Maths Mob (MMM) identified that relationships were integral to the success of this initiative. The MMM, for early years learners, brought parents and family into the mathematics classroom where mathematics was being taught through cultural activities by the teacher and Aboriginal educator while developing and maintaining

relationships and safe learning environments for students and their families.

In the Goldilocks story referred to on page 7, older students played an integral role in the creation of the resources and in the story transcription for younger students reinforcing the learning relationship between students.

## REFLECTION

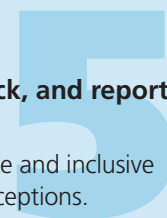
- What does this mean for us?
- What are the factors that determine whether or not our classrooms are safe learning environments? And how do we know?



## STANDARD 5

**Teachers develop and use tools that assess both affective and cognitive learning outcomes specific to Aboriginal and Torres Strait Islander learners, provide feedback, and report on student learning**

Teachers use standard testing such as NAPLAN but also develop tools that are culturally appropriate and inclusive to their school and community. These tools can collect data about achievement, attitudes and perceptions.



## KSZ EXPERIENCE

Effective Kimberley educators:

- use diagnostic tools and tasks for identifying mathematical misconceptions, preconceptions and partial conceptions and to inform planning
- know the power of the video in assessing teaching and learning and that it is a valuable form of data.

For example, the AICS Numeracy Strategy:

*'...is data driven, which means that teachers are encouraged to use assessment before they start teaching a concept. This helps them to work out what mathematics students know already and hence what they need to learn. Teachers and AEWs are supported to use this information as the basis for their planning. In this way teachers are encouraged to become more efficient and effective in their teaching, more targeted in their daily lessons'* (Treacy 2012).

This strategy is about genuine, child-centred learning and evidence of using data effectively to build on the knowledge children bring with them to school.

At Halls Creek, Deputy Principal Di Tomazos knows and uses the power of video for a number of reasons, including video of students taken early and then again late in the year to reveal their conceptual and linguistic growth. Video is also used where teachers collaboratively view teaching and learning and discuss and critique it to inform practice. This helps them to consider appropriate focus questions to draw out students' thinking and understandings.

## MAKE IT COUNT EXPERIENCE

Teachers in the *Make it count* project used both standard and self-generated data tools. Those tools designed locally, related specifically to their cluster focus and the pedagogy they were developing.

In *Make it count*, teachers:

- use a reflective planning model – plan the lesson, teach the lesson, refine the lesson. They review the effectiveness of the learning and allow this to shape the next lesson.
- recognise and act on students' mathematical misconceptions.
- help students recognise what they know well, what they need help with and what they still need to learn.
- provide feedback that is timely and promotes success in future learning.

The ongoing development of pedagogy is crucial to improving mathematics outcomes of Aboriginal and Torres Strait Islander students. In both the Kimberley schools and the *Make it count* clusters, the professionalism of teachers and their willingness and courage to 'have a go' were backed by ongoing reflection, assessment and evaluation of both teaching and learning of themselves and their students.

## Three ways to catch a kangaroo

### Responsive Mathematics Pedagogy Framework

*This story is about three ways to catch a kangaroo.*

*The first way is to use a boomerang and throw it at the kangaroo. The boomerang hits the kangaroo in the head and knocks it out and there you have it. (Consider the mathematics in this strategy - the physics in relation to velocity, wind, distance, strength and accuracy of the thrower for example).*

*The second way is where a group of people circle the kangaroo and close in on it and capture it as it has nowhere to escape.*

*The third way is to dress up like a kangaroo. You cloak yourself in a kangaroo skin so that the kangaroo thinks you're one of them and you sneak up on it and pounce.*

Stories can be a very useful approach through which to teach mathematics, but mathematics can also be seen as telling stories and can allow 'students to express themselves through mathematics'<sup>13</sup> (C Matthews, K Price ed, 2012, p. 105).

The story 'Three ways to catch a kangaroo' is a great metaphor for the key message of this paper, namely that there are different ways of teaching mathematics, just like there are different ways to catch a kangaroo. They highlight the need to be competent in a number of ways so that at any time, given the circumstances and context, an appropriate strategy can be called upon or even a combination of strategies.

From the *Make it count* project, a number of different ways of teaching mathematics evolved across the clusters with either an academic, social or cultural emphasis, or a combination of these. Over time, clusters began looking at what other clusters were doing and began developing their own pedagogy to incorporate aspects of other pedagogic practices. From this, the Make it count project concluded that teachers needed to be able to teach in a balanced way within all three approaches and developed a model to describe this, naming it 'responsive mathematics pedagogy'.

**Being academically responsive** is about the academic mathematics, the Western mathematics prescribed and required by the ACM. It is about academic inclusion and teaching to the academic needs of Aboriginal and Torres Strait Islander learners. For example, the Noarlunga cluster in South Australia adapted the principles of Accelerated Literacy to the development of explicit, scaffolded mathematics pedagogy. Mathematics concepts and language were taught through an organised teaching sequence.

**Being culturally responsive** includes teaching mathematics through culture, Aboriginal ways of learning, Aboriginal pedagogy, and teaching mathematics through the cultural needs and knowledges of learners. The '8ways' from Orange Public School (see page 7) is an example of this in action. This Aboriginal pedagogy framework is described by Yunkaporta (2012):

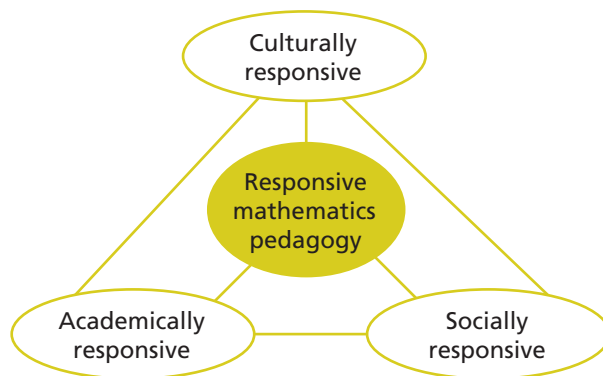
*'This Aboriginal pedagogy framework is expressed as eight interconnected pedagogies involving narrative-driven learning, visualised learning processes, hands-on/reflective techniques, use of symbols/metaphors, land-based learning, indirect/synergistic logic, modelled/scaffolded genre mastery, and connectedness to community. But these can change in different settings.'*

Orange Public School adapted this to develop their own 'unique' pedagogy using these eight ways as a starting point for dialogue with school and community to localise their ways of doing things.

**Being socially responsive** is teaching mathematics through social contexts (relevant, contemporary contexts but also other contexts that might be new for students) and is about social inclusion and perspectives. Making links to potential employment contexts in business and industry should be a part of this too. Students see that learning relates to their social worlds but can also lead to important career, lifestyle and community advantage later on in life. An example of this from the Kimberley relates to a school working with park rangers and the potential for developing learning opportunities in bush mathematics such as in the axes of symmetry in flowers, the spiral formations in millipedes and weather patterns, the geometry in the landscape or in beehives, or the lines in a creek bed.

Not only are the students learning mathematics, they are also being prepared for career opportunities that may emerge such as working in environment and planning organisations and land councils.

In the *Make it count* project, the Alberton cluster linked mathematics and context through the deliberate acts of ‘mathematisation and contextualisation’ (Thornton, Statton & Mountzouris 2012). Teachers were challenged to consider how they could make teaching and learning more meaningful by ‘embedding it in contexts such as art, design, technology, sport and enterprise’ (Morris et al 2012, p. 7). Within this, familiar and popular contexts were applied such as the ever popular television program ‘Masterchef’, which gave opportunities for the development of many hands-on mathematics concepts such as measurement and number.



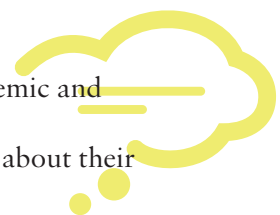
**Diagram 1:** Responsive mathematics pedagogy that is culturally, socially and academically responsive to the learning needs of Aboriginal and Torres Strait Islander students.

Schools working with this model for responsive mathematics pedagogy will balance these three dimensions in different ways depending on their community, their context and their students. For example, for a school with a focus on a cultural activity, such as using a dilly bag for collecting and carrying food, the mathematics focus could be on estimation, number, measurement: how many oranges will a dilly bag carry, what is the volume of the dilly bag. This will make links to practical social activities, such as buying food for a party or cooking a meal for the family.

*Note: This story is told with the kind permission of the conveyor of the story and comes from Eora Country in NSW. It is highly likely that the story has many variations in other areas across the country.*

## REFLECTION

- What does this mean for us? Are we incorporating aspects of social, academic and cultural responsiveness in our mathematics teaching?
- What are the implications for what and how we give feedback to students about their learning?



## PROFESSIONAL ENGAGEMENT OF CLASSROOM PRACTITIONERS

AITSL includes in its description of Professional Engagement:

*Teachers model effective learning. They identify their own learning needs and analyse, evaluate and expand their professional learning, both collegially and individually. (They) demonstrate respect and professionalism in all their interactions with students, colleagues, parents/carers and the community. They are sensitive to the needs of parents/carers and can communicate effectively with them about their children's learning.*

*Teachers value opportunities to engage with their school communities within and beyond the classroom to enrich the educational context for students. They understand the links between school, home and community in the social and intellectual development of their students (AITSL 2012).*

### STANDARD 6

**Teachers engage with colleagues in professional learning communities in ongoing, action oriented, professional learning and are prepared to push the boundaries and to move outside their comfort zone. They strive for collegial innovation in both Aboriginal and Torres Strait Islander education and mathematics education**



### KSZ EXPERIENCE

Effective Kimberley educators:

- engage in research and action learning with others and understand the 'power of the peer' in developing themselves as mathematics teachers of Aboriginal learners. They see the value in collaborations and have a clear willingness to learn from others.
- engage in partnerships with Aboriginal educators to learn cultural and linguistic knowledge and to help develop their pedagogy.
- mentor and support others eg. those new to a community.
- share resources and expertise. They identify colleagues with expertise and have them facilitate professional learning.

In one Kimberley community it was evident there were high levels of professionalism and dedication in the teachers and leaders. At Ngalapita Remote Community School, the principal facilitated a Saturday workshop on measurement. Educators from Government and AIC schools from surrounding communities participated in rich discussions about the mathematics of measurement, how it links to the other mathematics strands in the ACM and the ways for teaching measurement using relevant, local contexts. One example of a local context was about station work with cattle and the possibilities such as droving cattle (distance) and size and capacity of cattle yards (area).

In some schools in the Kimberley, professional learning of teachers runs parallel to the professional learning of Aboriginal educators on the premise that *'it is really helpful for teachers and AEWs to have a deep understanding of the mathematics content they are teaching and to have an idea where students are at in their learning of the content'* (Treacy 2012, p. 1).

### MAKE IT COUNT EXPERIENCE

Professional learning for educators should generate and share new ideas and knowledge, new thinking and new language. In the *Make it count* project, a 'new space' or a new field in education evolved as educators began to see the connections between, and development of, new ideas. Their engagement in professional learning in the two areas of mathematics education and Aboriginal education and, more specifically, in mathematics content and pedagogic knowledge, and in cultural competency<sup>14</sup> generated new knowledge and language about improving mathematics outcomes of Aboriginal and Torres Strait Islander students.

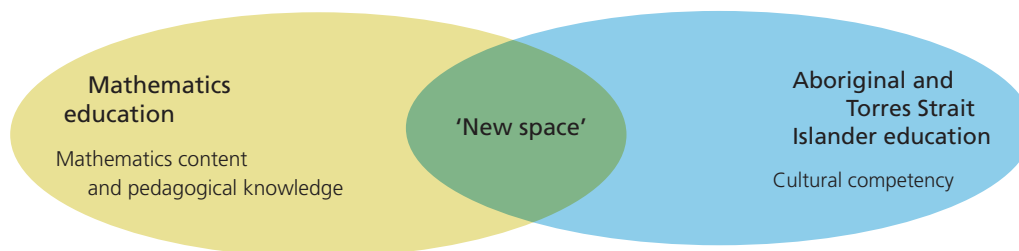
The project developed a model for understanding and describing this 'new space' (see Diagram 2, page 16).

A number of *Make it count* clusters had a dual focus in their professional learning: one on the development of cultural competency of their teachers and the other on mathematics content and pedagogical knowledge. Learning in one area catalysed new thinking in the other area, creating an interesting intersection of knowledges and creativity. For example, in one of the *Make it count* clusters a deeper understanding of the cultural importance, connections and expressions through dance saw new perceptions and understandings of mathematics. Students at a mathematics and culture camp were given a mathematical expression, such as  $4 \times 3 = 12$ , and told that they had to create a story for their expression and then create a dance for the story and perform it (Matthews 2012).

Schools and professional learning communities that want to improve their pedagogy might use this model as a starting point.

**Diagram 2:**

A new space in education – the intersection of mathematics education and Aboriginal and Torres Strait Islander education



As the two specialisations – mathematics content and pedagogical knowledge, and cultural competency – become more developed in teachers thinking and practice, the intersections between the two and the development of new knowledge become more prevalent, complex and sophisticated. This generation of new ways of thinking and new language is essential to the development of Responsive Mathematics Pedagogy. The professionalism and strong focus on improvement throughout the Kimberley reinforces that the culture and learning environments within schools are conducive to this type of challenge and open up many exciting learning opportunities for teachers and students.

The value in professional learning communities cannot be underestimated and can draw together pockets of classroom research that already exist. For remote schools like those in the Kimberley the use of technology can help overcome isolation. Within the *Make it count* project, learning communities existed within learning communities with interconnections and sharing of knowledge and ideas occurring at school, cluster and national levels. These interconnected learning communities were dynamic and productive.

In *Make it count*, teachers engage:

– with colleagues, they

- have a focused, structured approach to what they want to achieve as a team and establish common core values and attitudes
- share expertise between schools to grow and enrich professional learning communities
- are both a mentor and a learner, as the act of giving and receiving feedback establishes safe, respectful relationships conducive to critical engagement and change

- participate in action learning or research where they design, act, observe and reflect. This involves examining data to determine current progress and future planning
- foster the openness and courage necessary for a school to adapt diverse models to their school's unique model, based on common beliefs and values.

– in professional learning, they

- focus on the development of critical self-reflection so they are more able to actively challenge deficit views and assumptions they and others may have about Indigenous learners and their communities
- focus on a specific area of professional learning and collaborate through professional relationships on a common goal
- develop pedagogy through site-based, whole-school, collegial, data-driven professional learning that builds on a strong established research base. For teachers, lesson observation and feedback is at the heart of sharing professional knowledge
- engage critically with external resources to gauge their appropriateness and relevance for Indigenous learners and compatibility with their aspirations for pedagogic improvement.

There are online learning communities such as 'Connect With Maths Indigenous'<sup>15</sup> and, in particular within that forum a Kimberley Success Zone group, which offer educators the chance to learn from others at their own pace and when it suits them. They can pose questions, share or seek resources and engage with 'experts'.

## REFLECTION

- What does this mean for the way we currently engage professionally with others?
- How serious are we about our individual and school professional learning in mathematics for Aboriginal and Torres Strait Islander learners?
- Should we be engaging with a 'critical friend'?
- We need to make sure we are fostering an environment that keeps developing a passion for Aboriginal and Torres Strait Islander education and mathematics education.



## STANDARD 7

### Teachers engage with Aboriginal and Torres Strait Islander educators, parents, families and community in two/three-way dialogue

It has been made very clear throughout this paper how crucial it is for teachers to work closely with Aboriginal educators. Where this is not possible it may mean identifying a community leader or parent with whom they can engage with in dialogue based on learning from each other.

#### KSZ EXPERIENCE

In the Kimberley, effective educators:

- build strong relationships with Aboriginal educators, students and families.
- engage with Aboriginal educators and are open to learning.
- are very positive about their schools and communities and speak very positively about students and families.

A lengthy conversation at Yiyili Aboriginal Community School with two Aboriginal educators, Lizzy Gilligan and Frances Dawson, about language, teaching mathematics and working in partnership with teachers revealed the significant contribution of Aboriginal educators to the teaching and learning cycle. Some of their important insights were about the knowledges Aboriginal students bring to school, for example, the numeracy concepts students already have (such as subitising<sup>16</sup>) and how teachers and Aboriginal educators need to be able to 'draw students' attention to the two languages used and the different words used to describe the same idea' (Treacy 2012). Teachers need to understand and access these to teach the SAE mathematics language required by the ACM. Treacy's work with Aboriginal educators also reveals the misguided assumptions that teachers can make when they assume a child has not demonstrated understandings, when in fact the student has the conceptual understandings but the language interference causes them to lack confidence in their responses.

#### MAKE IT COUNT EXPERIENCE

In *Make it count*, not all schools had access to Aboriginal and Torres Strait Islander educators. However, they were able to identify community people to work with.

In *Make it count*, teachers:

- consider Indigenous parents' own experiences in schooling and in learning mathematics, and build their confidence to talk positively with their children about mathematics, reconciling past experiences with current aspirations.
- work with Indigenous education officers as they can be critical to building strong connections, resilience and trust between schools and their communities and families. Ensure they have a central role in curriculum development.
- challenge commonly held beliefs that teaching mathematics is limited to following a curriculum, or culture-free. Promote mathematics as a living human endeavour that is part of the fabric of everyday life.
- provide the community with opportunities to have voice and ownership and make decisions about curriculum to ensure that learning experiences have family and community significance.

For some *Make it count* clusters there was not an identifiable Aboriginal and Torres Strait Islander community. For example in some metropolitan areas where only a few Aboriginal and Torres Strait Islander families live and who might come from different areas of Australia. These clusters set about to create and build communities within the schools with a focus on mathematics. One of these communities was instrumental in advising the cluster about culturally inclusive mathematics activities for a mathematics program in the middle years of schooling.

#### REFLECTION

- What sorts of classroom experiences might parents and families of our students have had?
- How can we work with our Aboriginal and Torres Strait Islander educators to engage families in positive experiences or build on positive experiences they may have had?
- What exciting opportunities are presenting themselves to us to build on our relationships and knowledge together?

## Summary

Given the latest PISA results and the ongoing gap in NAPLAN results reported at the start of this paper, it would appear that there needs to be a major re-think about mathematics education for Aboriginal and Torres Strait Islander students. Teachers and Aboriginal educators are the ones best placed to make a difference and there are many examples in this paper of effective mathematics teaching of Aboriginal and Torres Strait Islander students. These great educators are potentially great leaders and need to be nurtured to become leaders of innovative schools. These leaders will be advocating and supporting ways forward in the teaching and learning process.

Effective leadership in Aboriginal education has been a focus in education for some time. Take for example the Stronger Smarter Institute which has had significant impact in schools and communities across the Kimberley (and Australia generally) with many individuals reporting that they have been 'transformed' on both professional and personal levels. Many Kimberley educators are building school cultures that demand high expectations from their teachers and students. This involves delivering quality education, and mathematics teaching and learning needs to be a large part of the process.

There are however, few strategies for the development of leaders in mathematics education of Aboriginal and Torres Strait Islander learners and some consider that this is the result of the continuing spotlight on literacy education. Leadership at the intersection of Aboriginal education and mathematics education is a rarity, and is a relatively new space in education which requires further development and consideration.

This paper has outlined many ways forward, based mainly on what is happening in the classroom in the *Make it count* project and in KSZ. They are examples of what is happening in other schools around Australia and illustrate the importance of connecting people, ideas and expertise across Australia in a concerted effort for change, to improve the mathematics and numeracy outcomes and life opportunities for Aboriginal and Torres Strait Islander students.

### Further resources

Kimberley Success Zone website [ksz.edu.au](http://ksz.edu.au)

*Make it count* website [mic.aamt.edu.au](http://mic.aamt.edu.au)

Connect with Maths Indigenous online learning community [connectwith.indigenous.aamt.edu.au](http://connectwith.indigenous.aamt.edu.au)

5 themes with tips from the AAMT Numeracy, Mathematics and Indigenous Learners Conference 2012 [mic.aamt.edu.au/Resources/Professional-reading](http://mic.aamt.edu.au/Resources/Professional-reading)

*Make it count* cluster findings [mic.aamt.edu.au/Findings](http://mic.aamt.edu.au/Findings)

AAMT Numeracy, Mathematics and Indigenous Learners Conference papers by Corrie Baxter and Elizabeth Gilligan, <https://custom.cvent.com/AC1461E6AC63400FB8AAA2E83F2C2C45/files/7882d770fd454db895bb665a302a7b3f.pdf>

*Make it count* online resource for school leaders offers many entry points and practical pathways for leaders wanting to develop themselves as leaders. It is a course that requires registration.

[mic.aamt.edu.au/Resources/Leaders-pack](http://mic.aamt.edu.au/Resources/Leaders-pack)

8 Aboriginal Ways of Learning wiki

[8ways.wikispaces.com](http://8ways.wikispaces.com)

### Endnotes

- 1 Not all schools have Aboriginal and Torres Strait Islander educators. Schools may need to identify a community leader or parent with whom they can work. In this paper, 'Aboriginal and Torres Strait Islander educator' refers to Aboriginal Education Workers, Aboriginal Education Assistants, Aboriginal and Torres Strait Islander Education Officers etc.
- 2 The Numeracy, Mathematics and Indigenous Learners Conference, convened by AAMT, brought together respected workers in the field to discuss the key issues, opportunities and challenges in improving the educational outcomes for Aboriginal and Torres Strait Islander students in numeracy and mathematics. It was held 14–16 October 2012 in Adelaide.
- 3 Dr Chris Matthews is a Noonuccal man from Minjerribah (Stradbroke Island), Quandamooka First Nation (Moreton Bay) in Queensland. Chris completed his PhD in Applied Mathematics in 2003. He is Chairperson of the Aboriginal and Torres Strait Islander Mathematics Alliance (ATSIMA). During 2009–2012, Chris was the patron of the *Make it count* project and a member of the project's Expert Advisory Group. He was also a critical friend to many of the clusters. Chris is involved in research in the area of mathematics education and also works with the Yumi Deadly Maths team at Queensland University of Technology. He is currently Senior Lecturer at the Griffith School of Environment.
- 4 Information on PISA at [oecd.org/pisa](http://oecd.org/pisa)
- 5 There are a number of other initiatives across Australia focused on improving mathematics outcomes of Aboriginal and Torres Strait Islander learners. These are mostly working in isolation of each other. *Make it count* and much of what was observed in KSZ schools throughout the road trip use resources and expertise from various programs, such as *First Steps in Mathematics* and *Yumi Deadly Maths*, to further develop their own knowledge, practice and engagement.
- 6 'Physicality' in this paper refers to the physical actions of students, specifically those which convey information about them (and perhaps their culture, identity and character). It's about the way they behave and act physically. Their physical movements can communicate to teachers about how they might be feeling for example.
- 7 'Numerosity' means sense of number or quantity. For example, in everyday life this could be having a sense of how much food will need to be cooked to feed a family of seven or thereabouts.

- 8 8 Aboriginal Ways of Learning wiki [8ways.wikispaces.com](https://8ways.wikispaces.com)
- 9 Tyson Kaawoppa Yunkaporta is a Bama man of Nungar and Koori descent. Tyson was a critical friend for the *Make it count* Orange cluster and also worked across the clusters. He was also a key advisor to the *Make it count* project generally. Tyson has worked in K–12 classrooms, as a university lecturer, as a senior executive in the Department of Education and as an Aboriginal pedagogy mentor. On completion of his PhD in Education at James Cook University, Tyson was awarded the medal for excellence with his thesis titled 'Aboriginal pedagogies at the cultural interface'.
- 10 The AICS Numeracy Strategy is working towards making significant improvements in students' understanding and skills in mathematics and numeracy. The project includes the development of an online portal to support teachers and Aboriginal and Torres Strait Islander education workers to assess, plan and teach students efficiently and effectively.
- 11 The *Maths in the Kimberley* project aimed to 'address the issue of underperformance of remote Indigenous students in mathematics through using a framework of high demand mathematics along with an innovative pedagogical model'. Chief investigators were Professor Robyn Jorgensen, Professor Peter Sullivan and Associate Professor Peter Grootenboer who were also part of the *Make it count* project: Jorgensen on the Expert Advisory Group, Sullivan as a critical friend for the Healesville cluster and Grootenboer as a critical friend for the Nerang and Gladstone clusters.
- 12 *maths300: Supporting excellence in mathematics teaching*, Education Services Australia project [maths300.esa.edu.au](http://maths300.esa.edu.au)
- 13 Mathematics can be viewed like it's telling a story with a beginning, a middle and an end, for example, starting with a thing/number/etc, something happens to it (such as an operation), and this is the result/answer.
- 14 Cultural competency is described by McAllister and Irvine (2000) as 'one who has achieved an advanced level in the process of becoming intercultural and whose cognitive, affective, and behavioural characteristics are not limited but are open to growth beyond the psychological parameters of only one culture' (p. 4).
- 15 Connect with Maths Indigenous online learning community [connectwith.indigenous.aamt.edu.au](http://connectwith.indigenous.aamt.edu.au)
- 16 Subitising is the ability to instantly recognise the number of objects in a small group, without counting, eg. when you can see there are five dogs without having to count.

## References

- Australian Association of Mathematics Teachers Inc, *Make it count* online resource: [mic.aamt.edu.au](http://mic.aamt.edu.au).
- Australian Curriculum, Assessment and Reporting Authority, NAPLAN Achievement in Reading, Persuasive Writing, Language Conventions and Numeracy: National Report for 2012, ACARA, Sydney, 2012.
- Australian Institute for Teaching and School Leadership website: [teacherstandards.aitsl.edu.au](http://teacherstandards.aitsl.edu.au)
- C Baxter & E Gilligan, 'Teachers and AEWs using the AICS Numeracy Strategy at Yiyili Aboriginal Community School', paper presented at AAMT Numeracy, Mathematics and Indigenous Learners Conference, Adelaide, 2012, viewed 14 January 2014, <https://custom.cvent.com/AC1461E6AC63400FB8AAA2E83F2C2C45/files/8a7a82dee0a647c2964412e0ef8d4e2a.pdf>.
- M Braid & P Sullivan, 'Learning by watching: Teaching mathematics with less talking', paper presented at AAMT Numeracy, Mathematics and Indigenous Learners Conference, Adelaide 2012, viewed 14 January 2014. <https://custom.cvent.com/AC1461E6AC63400FB8AAA2E83F2C2C45/files/5c6108fc4e94434b112da628096039c.pdf>
- T Frigo, M Corrigan, I Adams, P Hughes, M Stephens, D Woods, *Supporting English Literacy and Numeracy Learning for Indigenous Students in the Early Years*, Australian Council for Education Research, 2004.
- P Hutchins, *The Doorbell Rang*, Harper Collins, 1986.
- R Jorgensen, P Sullivan, P Grootenboer, R Niesche, S Lerman and J Boaler, *Maths in the Kimberley: Reforming mathematics education in remote indigenous communities*, Griffith Institute for Educational Research, Brisbane, 2011.
- C Matthews, 'Maths as storytelling: Maths is beautiful', in K Price (ed), *Aboriginal and Torres Strait Islander education: An introduction for the teaching profession*, Cambridge University Press, Melbourne, 2012.
- G McAllister, & J Irvine, 'Cross cultural competency and multicultural teacher education', *Review of Educational Research*, 70(1), 2000.
- C Morris, K Toberty, S Thornton, J Statton, 'Numeracy, mathematics and Aboriginal learners: Developing responsive mathematics pedagogy', viewed 14 January 2014, [www.mes7.uct.ac.za/Morris%20et%20al\\_Paper.pdf](http://www.mes7.uct.ac.za/Morris%20et%20al_Paper.pdf)
- Office of the Chief Scientist, *Science, Technology, Engineering and Mathematics in the National Interest: A Strategic Approach*, Australian Government, Canberra, 2013.
- P Clarkson, presentation at the Australian Association of Mathematics Teachers Conference, Melbourne, 2013.
- B Parkin, *Make it count* writers' workshop, Victor Harbor, 2013.
- S Thomson, L De Bortoli, S Buckley, PISA in Brief: Highlights from the Full Australian Report: PISA 2012 – How Australia Measures Up, ACER, 2013.
- S Thornton, J Statton, & S Mountzouris, 'Developing mathematical resilience among Aboriginal students', in J Dindyal, L P Cheng & S F Ng (eds), *Mathematics Education: Expanding Horizons*, Proceedings of the 35th Annual Conference of the Mathematics Education Research Group of Australasia Inc, vol. 2, 2012, pp. 730-737.
- K Treacy, 'Aboriginal independent community schools numeracy strategy and portal', paper presented at AAMT Numeracy, Mathematics and Indigenous Learners Conference, Adelaide, 2012.
- K Treacy & D Button, 'Everyday English and Kimberley Kriol in the mathematics classroom', handout for Buunji Conference, 2013.
- T Yunkaporta, '8 Aboriginal ways of learning', viewed 15 August 2012, [8ways.wikispaces.com](https://8ways.wikispaces.com)

## There are different ways of teaching mathematics, just like there are different ways to catch a kangaroo.

This paper explores recent developments and initiatives in mathematics education for Aboriginal and Torres Strait Islander students in Australia, with particular reference to the Kimberley. It draws on experiences and expertise from KSZ schools and *Make it count* cluster findings.

Findings, outcomes and advice are summarised into three domains, to reflect those of the Australian Professional Standards for Teachers from the Australian Institute of Teaching and School Leadership (AITSL 2012).

The target audience is classroom practitioners and school leaders who want to develop their pedagogy and improve learning outcomes for their students.

This paper is written by Caty Morris, National Manager of Indigenous Programs for the Australian Association of Mathematics Teachers (AAMT) in collaboration with KSZ Co-ordinator Sue Thomas. Sue assisted in shaping the paper, provided feedback and facilitated conversations with Kimberley educators.

### About the author



Caty Morris is National Manager of Indigenous Programs for the Australian Association of Mathematics Teachers (AAMT). In this capacity Caty managed the *Make it count: Numeracy, mathematics and Indigenous learners project* 2009-2013. She has worked in Aboriginal Education in both NSW and SA for about 15 years in remote, regional and urban settings. She began her career as a primary school teacher in the Adnyamathanha community of Nepabunna in the northern Flinders Ranges teaching from CPC–Year 8 and later principal; was Coordinator of Aboriginal education in the Western Area of SA based at Port Augusta; taught at Redfern and Darlinghurst Primary Schools and Ultimo TAFE in Sydney; was a Project Manager for the Aboriginal Education Directorate in NSW and Aboriginal Education in SA; a Math Consultant in the Bronx District of New York City; and Primary Years Curriculum Manager in DECD SA.

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