UNIVERSITY OF CANBERRA

Celebrating success:

Numeracy in remote Indigenous contexts

What makes for successful numeracy education in remote Indigenous contexts: An ethnographic case study approach

Stories on remote indigenous mathematics successes compiled by Professor Robyn Jorgensen

2015

An integrated approach to teaching mathematics

Lockhart State School

Lockhart River community is located on the Eastern Coast of the Cape York Peninsula. It serves a population of around six hundred people. The local people come from five different language groups but a common identity is established through the use of the term "Pama Malnkana" which means "people of the sand beach". The community is surrounded by the beautiful Iron Ranges and Quintel Beach -a pristine beach littered with massive boulders. The people speak Lockhart Creole thus making English as a second language.

Established in 1924 at the 'old town', the current location was established in 1971. A large building program is currently underway with six new homes being built and a further thirty planned for future development. The community is serviced by a large store, medical centre, library, and store operated by the Anglican Church. The well-known Lockartist initiative is represented and supported by the local art gallery. The Lockhart Gallery holds national and international exhibitions for the local artists, who are known as "The Art Gang". The Art Gang work in a number of media including paint, lithographs, pottery and wood.

The Lockhart River Council was established in 1987. Lockhart community is an alcohol-free community. Supplies are brought into the community via barge, air and in the dry season, by road. During the wet season, Lockhart is often cut off from road supplies due to flooding, and needs to rely largely on barge supplies.

Lockhart State School offers a broad curriculum with a focus on literacy and numeracy. The school is moving away

from a standard model of teaching across the school to one where teachers are able to make informed choices about approaches that work best for their groups of students. The time table blocks literacy and numeracy in the first two sessions. A dedicated block of time is allocated each Friday to culture programs. There is a strong pre-prep program, as well as an alternative program for the secondary students who remain in community rather than attend boarding schools. The School proactively encourages students to leave community at the end of primary school and take up boarding options in nearby urban settings.

For those students remaining in community (or returning to community), the secondary component of the school has implemented a barista vocational education program. Students undertook work in cafes in Melbourne to learn about coffee making and now operate a café in community.

An underlying philosophy of the school is one that is based on respect – respect of self, respect of others, and respect of the environment. The school is a member of the Reef Guardian Program which has been developed to support the Great Barrier Reef Marine Park.

Background to the school or initiative

Lockhart State School has built a program for learning mathematics that focuses on the reinforcement of concepts (consolidation); the automaticity of concepts the language of mathematics to support ESL learners; the use of hands-on materials to support learning; and a lesson structure to support learning and to make learning explicit. Teachers have some latitude to select programs and pedagogies that are best suited to their students given the diversity of needs across the school.

Defining Success

Lockhart State School regularly records student performance across a range of measures in numeracy (and literacy). These are displayed on data walls in the classrooms. Teachers encourage the students to increase their successes in testing schemes so that they are able to see their own progress and successes. Various displays are used to illustrate successes, shaped by the data collection tools. Data walls are a feature of all classrooms and all data are displayed publicly so students (families and teachers) are able to see how they are progressing. The public display of success and progress is a feature of the classroom displays.

Initiatives

There are a number of initiatives operating across the school, many new to the school, and are being assessed for their effectiveness of learning. The changes being adopted by the school will be assessed as to their effectiveness. The intent of on-going evaluations is to improve student learning outcomes. For example, in 2015, a significant change in the schools practices has seen the model of teaching and innovation move from a centralised system where the Head of Curriculum worked in close consultation with each teacher to develop a whole school approach and to help teachers develop their skills aligned with that approach. From 2015, there is now a more decentralised model where two teachers teach in each classroom to help with the management of learning and behaviour and individualise lessons. The view supporting this move is that teachers should have some flexibility around their teaching in order to meet the needs of their students. The school had also invested significant funds in some curriculum resources and packages and these are also being evaluated in 2015 for their effectiveness to support teachers and students. Similarly, a number of curriculum resources are being evaluated for their success at the school.

Grouping by Attendance and Behaviour

The school has adopted a system of grouping students by attendance, behaviour and achievement. There is considerable diversity across the student cohort in the areas of attendance, behaviour and achievement (all of which impact on each other). By clustering students in groups that may be more homogenous, the school is seeking to provide classrooms for students who are working at or close to their age-appropriate year level in order to meet their learning needs. For students who may have gaps in their learning or who need support (in education or behaviour), the classrooms will meet their needs without impacting on those students who are more advanced in their learning progression In essence Lockhart River is seeking to reduce the variability within classes so that high achievers' needs are met, students with learning needs are met, and students with behavioural needs are also met. In this approach, there is considerable room for negotiation with each learner's needs which will in turn improve learning outcomes.

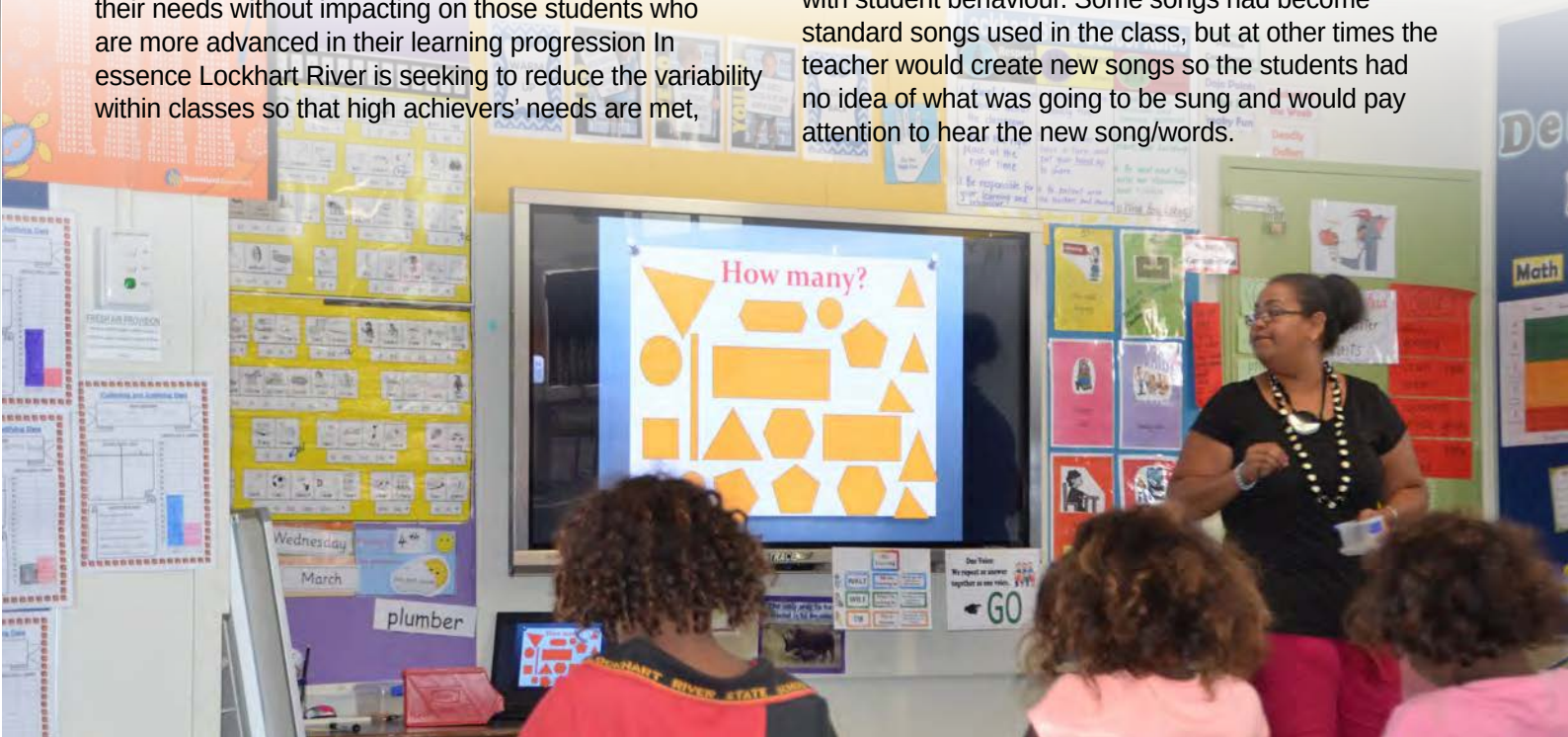
Singing for Transition and Behaviour Management

It is well recognised that music is a significant part of the lifeworlds for many Aboriginal and Torres Strait Islander students. It is usual practice in many classrooms for teachers to use a range of tools (such as a bell, or clapping patterns, or key words or even counting backwards) to gain students' attention. A very effective strategy used at Lockhart was for the teacher to sing a song. The songs were contemporary songs heard on various media but with the some of the key phrases retained and other phrases or verses changed to reflect actions in the school. For example, when a teacher wanted the students to listen, different songs were used to cue the students into listening behaviours.

Original song	Adapted verses
Everybody, everybody	*Everybody, everybody, everybody listening*
I'm dreaming of a White Christmas	*I'm looking for a class who's listening*

Songs were also built around many mathematics concepts so that students could sing their mathematics.

The use of the songs had a much more calming effect on the students than the usual tools for seeking compliance with student behaviour. Some songs had become standard songs used in the class, but at other times the teacher would create new songs so the students had no idea of what was going to be sung and would pay attention to hear the new song/words.



Lesson Format

Across many classrooms at the school, a lesson format model has been developed and maintained by teachers. This model has been informed by various research programs and is adopted by a number of schools across the Cape (in various forms). The model that has been adopted by many of the teachers is similar to that outlined in the NPASC story.

Consolidation

This phase of the lesson is where the teacher revises many of the concepts that have been covered recently or should be revised from time to time. The model for revision is one where the teacher recites concepts (either through written definitions or facts), the students recite back. Low level questions (recall) are posed and this is then followed by application of those concepts. Students are expected to show their work using tools such as small whiteboards so that teachers are able to assess for understanding. This enables them to move forward or recognise the need for further revision (class or individuals). Often the content that is to be used in the lesson to follow is also included in this phase so that students are revised of the concepts needed in the lesson. These strategies have the goal of bringing success and confidence to the learners along with helping to commit concepts to long term memory.

Fast facts, mental maths

Another component of the lessons is the revision of fast facts or mental maths. A number of programs are used across the school – depending on the teachers' own preferences and student needs – that are designed to help bring about automaticity with numbers and other mathematical concepts and processes. This phase of the lesson aims to bring success for learners while also helping to build automaticity with numbers and other strands of the curriculum.

Explicit teaching

Through the previous phases, and in the 'teaching' phase of the lesson, the explicit teaching model is used. Here the teachers adopt the "I do, we do, you do" model to scaffold learners in their mathematics and to support independence of work. The "I do, we do, you do" model is not confined to this phase of the lesson, and teachers make explicit reference to the various levels of work (I do, we do, you do) that are being profiled in the lesson so that students are aware of what is being done. Also, teachers make explicit reference to the learning intent of the lesson, and the criteria by which success will be determined.

Resources and Hands-on Learning

Across the school, there is a strong emphasis on hands-on learning. There is a consistent belief that Lockhart students learn best by watching and then doing. With this belief, the teachers embed hands-on activities in as many of their learning experiences as is possible. The school has created an extensive resource library for teachers so that activity packs have been built for teachers to use in their classroom. Strong links between the Australian curriculum and a range of commercial resources underpin the curriculum. The resources have been linked to the learning outcomes within the Australian Curriculum: Mathematics document.

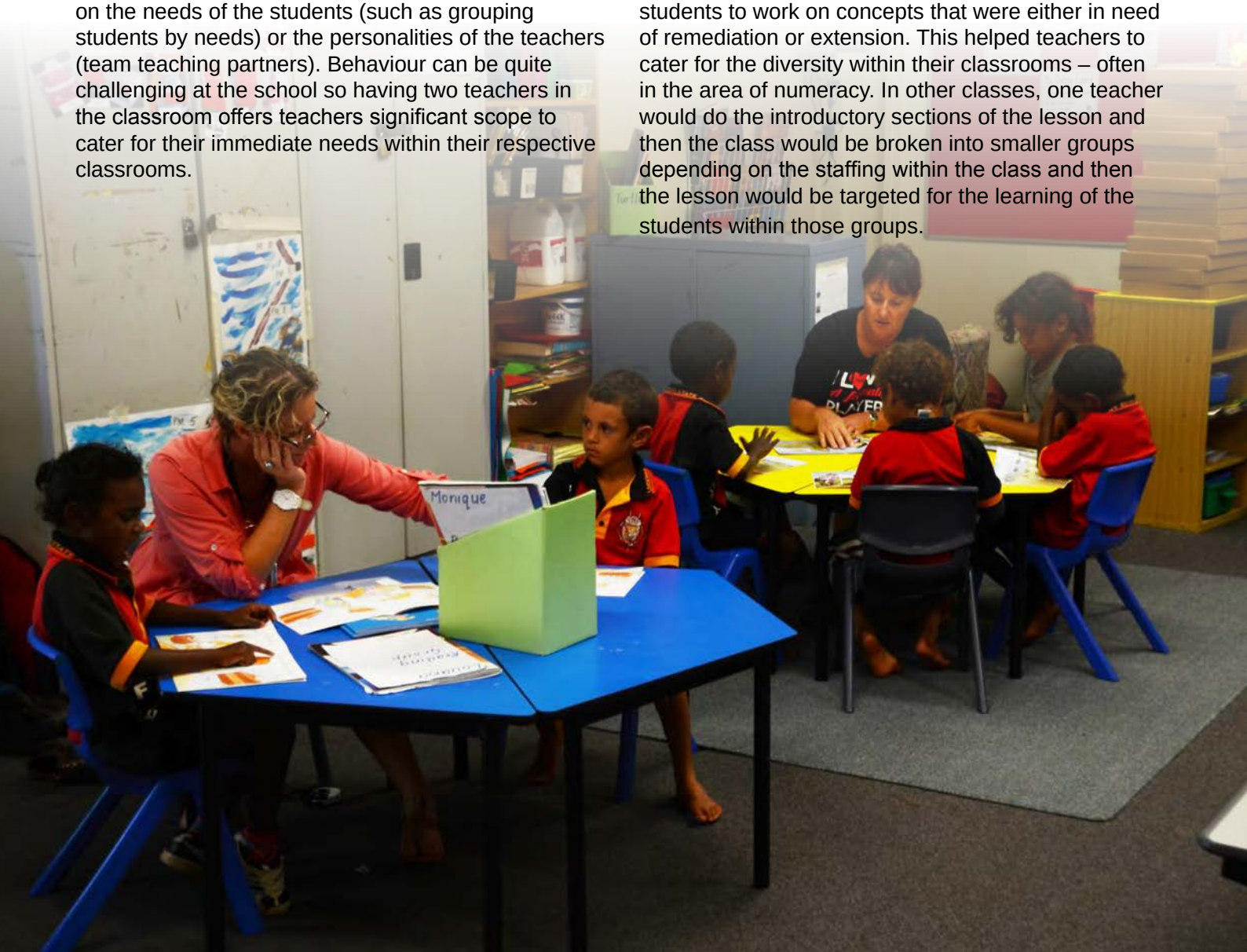
All teachers coming into the school have been given a curriculum plan for the year where the leadership team have created links between the learning outcomes and the resources. The teachers are then able to access appropriate resources to match their learning intents for lessons.

A large section of the compactus (rolling file vault) contains resource packs for the teachers. These are class sets of various curriculum resources that have been carefully matched to the learning intent of the Australian Curriculum: Mathematics; the goals stated in the curriculum resources; and the resources provided through the Queensland support materials (C2C). The resource packs have been intentionally designed for practical use by the teachers. They contact the full class set of the activities so teachers are able to take a pack and it is ready to use in the classroom.

Two-Teacher Classrooms

Funding through Education Queensland's "Great Results Guarantee" scheme has been allocated to the school to providing teachers with extra support in the classroom. Most classrooms have two teachers. These teachers interact quite differently depending on the needs of the students (such as grouping students by needs) or the personalities of the teachers (team teaching partners). Behaviour can be quite challenging at the school so having two teachers in the classroom offers teachers significant scope to cater for their immediate needs within their respective classrooms.

Team teaching was observed in some classrooms where the teachers worked as a seamless pair. In other classrooms, teachers worked with one teacher taking the whole class while the other teacher would withdraw individual students, pairs or small groups of students to work on concepts that were either in need of remediation or extension. This helped teachers to cater for the diversity within their classrooms – often in the area of numeracy. In other classes, one teacher would do the introductory sections of the lesson and then the class would be broken into smaller groups depending on the staffing within the class and then the lesson would be targeted for the learning of the students within those groups.



Professional Learning

As with most remote schools, Lockhart also experiences regular turnover of staff. There are a few teachers who have served more than two years at the school, and currently there are five new teachers to the school. Similarly, there are many new graduates at the school. The professional learning of teachers is important to support teachers. The school is trialling new approaches in 2015, but in the past, there had been a lot of in school professional learning where teachers were supported by a range of mechanisms including:

- A Head of Curriculum who worked with individual teachers on planning, modelling teaching, providing critical (but supportive) feedback;
- Walk throughs by the leadership team who would provide feedback to the teachers as well as being very supportive and encouraging;
- Identifying good practices of the teachers during walkthroughs which were then shared at staff meetings (by the teacher to her/his peers). This recognised the good practice but also enabled other teachers to know about the practice and trial in their own classroom. This meant that teachers could share good practice across the school;
- Teachers could observe other teachers in the classroom to see how they managed certain aspects of teaching in the Lockhart context;
- School-led and external support was offered to staff, including modelling on how to use the resources within the classroom;
- The School used the strengths of staff at the school to support the learning of peers; and
- The School created a large data bank of resources for teachers to use in the classrooms and modelled how to use some of these resources.

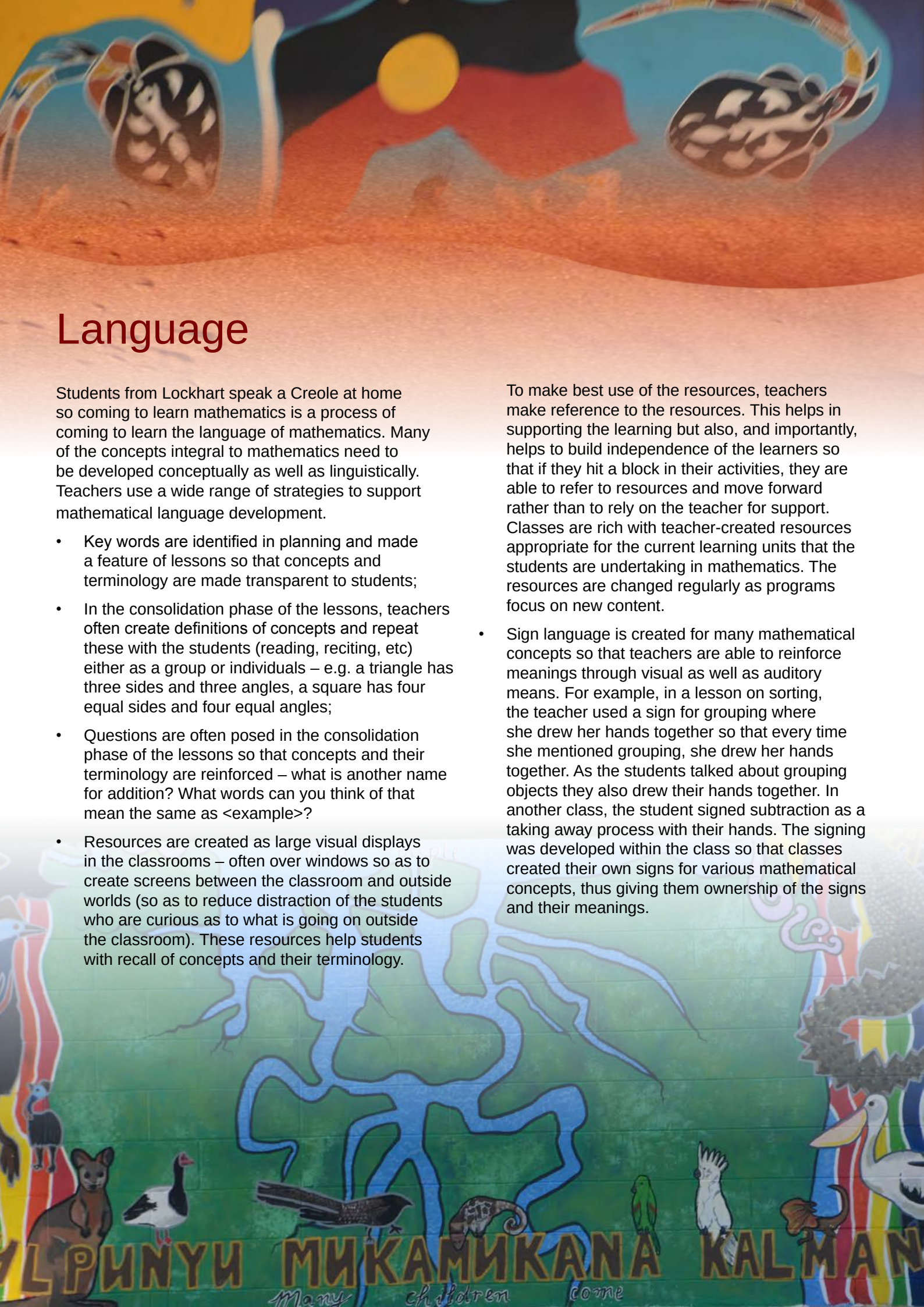
Language

Students from Lockhart speak a Creole at home so coming to learn mathematics is a process of coming to learn the language of mathematics. Many of the concepts integral to mathematics need to be developed conceptually as well as linguistically. Teachers use a wide range of strategies to support mathematical language development.

- Key words are identified in planning and made a feature of lessons so that concepts and terminology are made transparent to students;
- In the consolidation phase of the lessons, teachers often create definitions of concepts and repeat these with the students (reading, reciting, etc) either as a group or individuals – e.g. a triangle has three sides and three angles, a square has four equal sides and four equal angles;
- Questions are often posed in the consolidation phase of the lessons so that concepts and their terminology are reinforced – what is another name for addition? What words can you think of that mean the same as <example>?
- Resources are created as large visual displays in the classrooms – often over windows so as to create screens between the classroom and outside worlds (so as to reduce distraction of the students who are curious as to what is going on outside the classroom). These resources help students with recall of concepts and their terminology.

To make best use of the resources, teachers make reference to the resources. This helps in supporting the learning but also, and importantly, helps to build independence of the learners so that if they hit a block in their activities, they are able to refer to resources and move forward rather than to rely on the teacher for support. Classes are rich with teacher-created resources appropriate for the current learning units that the students are undertaking in mathematics. The resources are changed regularly as programs focus on new content.

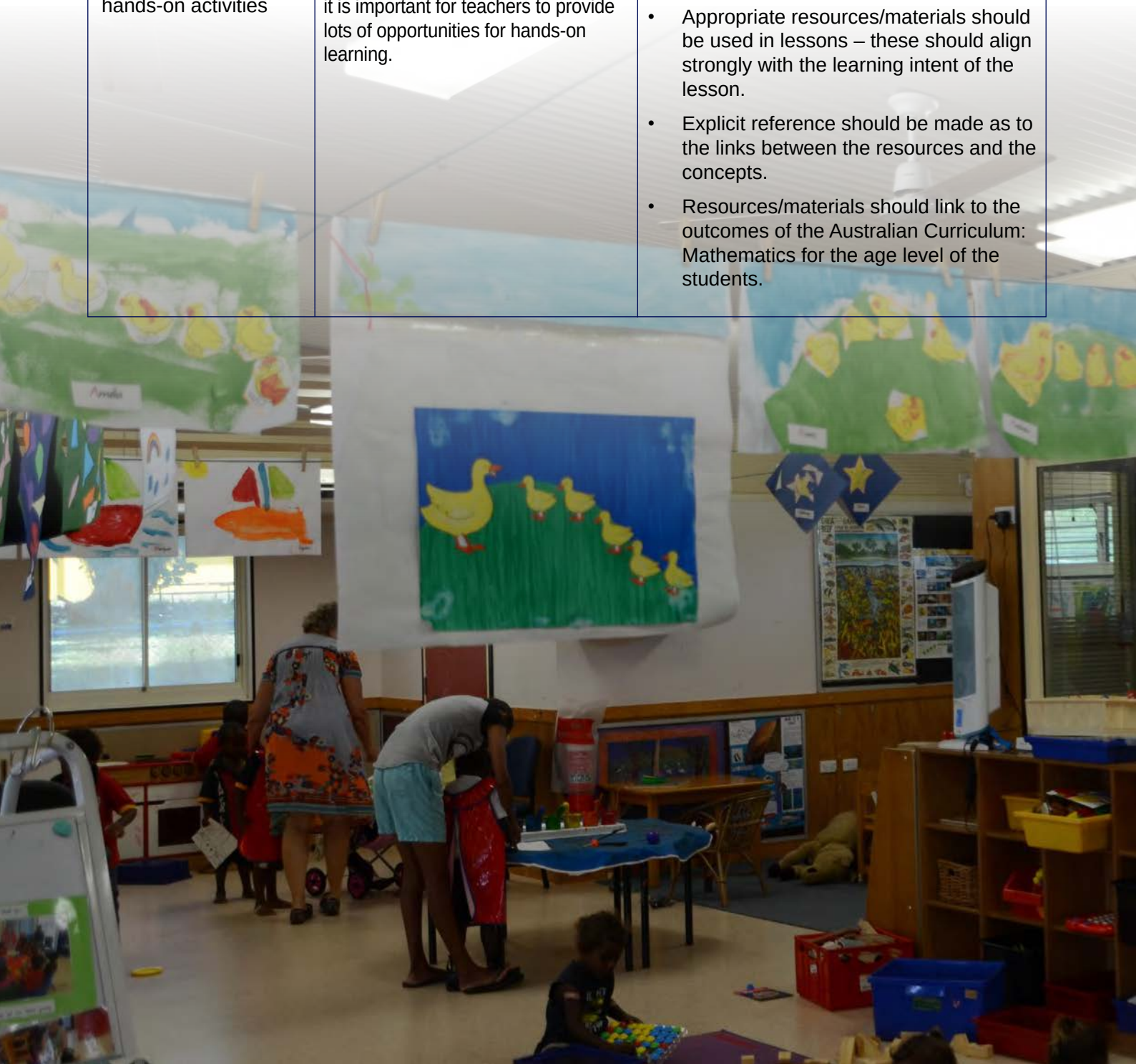
- Sign language is created for many mathematical concepts so that teachers are able to reinforce meanings through visual as well as auditory means. For example, in a lesson on sorting, the teacher used a sign for grouping where she drew her hands together so that every time she mentioned grouping, she drew her hands together. As the students talked about grouping objects they also drew their hands together. In another class, the student signed subtraction as a taking away process with their hands. The signing was developed within the class so that classes created their own signs for various mathematical concepts, thus giving them ownership of the signs and their meanings.



Model for Quality Learning

General Principle	Implications for mathematics	Focused strategies
Being explicit about teaching mathematics	Commence lesson with consolidation of previous learnings.	• Fast paced phase of the lesson where previously learned mathematics concepts and language are reinforced.
	Make explicit the learning intent of the lesson, the criteria for success, and the application of the mathematics to the worlds beyond schools, helps students engage with the lesson.	• Explicitly state, and write, the learning intent of the lesson – at the commencement of the lesson so that students know what they are going to learn about (e.g. counting in fives to 50). • Provide verbal and written advice as to how students will be deemed to be successful against the stated learning intent (e.g. demonstrate counting in fives on number ladder and two other media). • Provide applications of the learning intent so that students can see 'why' they should learn this content.
Explicitly teach and revise mathematical language	Students whose home language is not SAE often require translation of many mathematical concepts and processes.	• Explicitly teach mathematical language. • Provide definitions of mathematical terms. • Construct resources that exemplify mathematics concepts/language. • Aboriginal Teachers/Aides can help with translation and meaning making by creating bridges between home language and mathematical language. • Create many opportunities to revise and practice mathematical terms and processes.
Singing and music can be used in mathematics lessons	The calming effect of music and singing can help focus students' attention (and behaviours).	• Create songs from contemporary music that draws on the original song but which is then modified to the needs of the classroom – mathematical, behaviour.

Model for Quality Learning *(cont)*		
General Principle	**Implications for mathematics**	**Focused strategies**
Group students	Students can be grouped by attendance and behaviour so as to reduce the wide diversity found in standard classrooms.	• Students who are focused on learning and are achieving at (or close to/above) national benchmarks gain better results in mathematics when they are exposed to a curriculum that meets their needs. • Students who have issues of attendance and/or behaviour may be better placed in a targeted classroom so that their behaviours and mathematical learning needs can be targeted to their specific (individual) needs.
Provide many opportunities for hands-on activities	Hands on learning models much of the learning styles in community so it is important for teachers to provide lots of opportunities for hands-on learning.	• Students should be provided with resources to help build understandings. • Appropriate resources/materials should be used in lessons – these should align strongly with the learning intent of the lesson. • Explicit reference should be made as to the links between the resources and the concepts. • Resources/materials should link to the outcomes of the Australian Curriculum: Mathematics for the age level of the students.



Advice to Teachers

Many students have very unstructured lives outside school, so having a consistent approach within the classroom allows students to know what to expect each day as they enter the classroom. This helps them to engage successfully with the lesson as they understand the format of what will occur in mathematics.

Having support mechanisms across the school where teachers are able to work with other teachers to build knowledge about mathematics and mathematics curriculum/pedagogy helps with professional learning, particularly in remote communities where access to external consultants can be difficult and expensive. More experienced teachers are able to work with the new teachers (who are new to the school, and are often new to the profession). This also helps to build the confidence of the teachers who have been able to develop a particular repertoire of skills.

Grouping students by attendance and behaviour allows teachers to work with the students according to their mathematical learning needs. Classes where students are engaged with learning mathematics enables the students to engage with the lesson and progress. Other classes where students' attendance is less regular, and their learning needs are less likely to align with national curriculum outcomes, teachers are better able to cater for specific needs and have learning plans targeted for the individual students. This process can also help manage behaviours and reduce disruptions in the class.

Providing lessons and experiences that make link between the language of the students and the language of mathematics enables the students to gain understandings of mathematics. This is particularly important for ESL students – such as those at Lockhart whose home language is a local Creole.

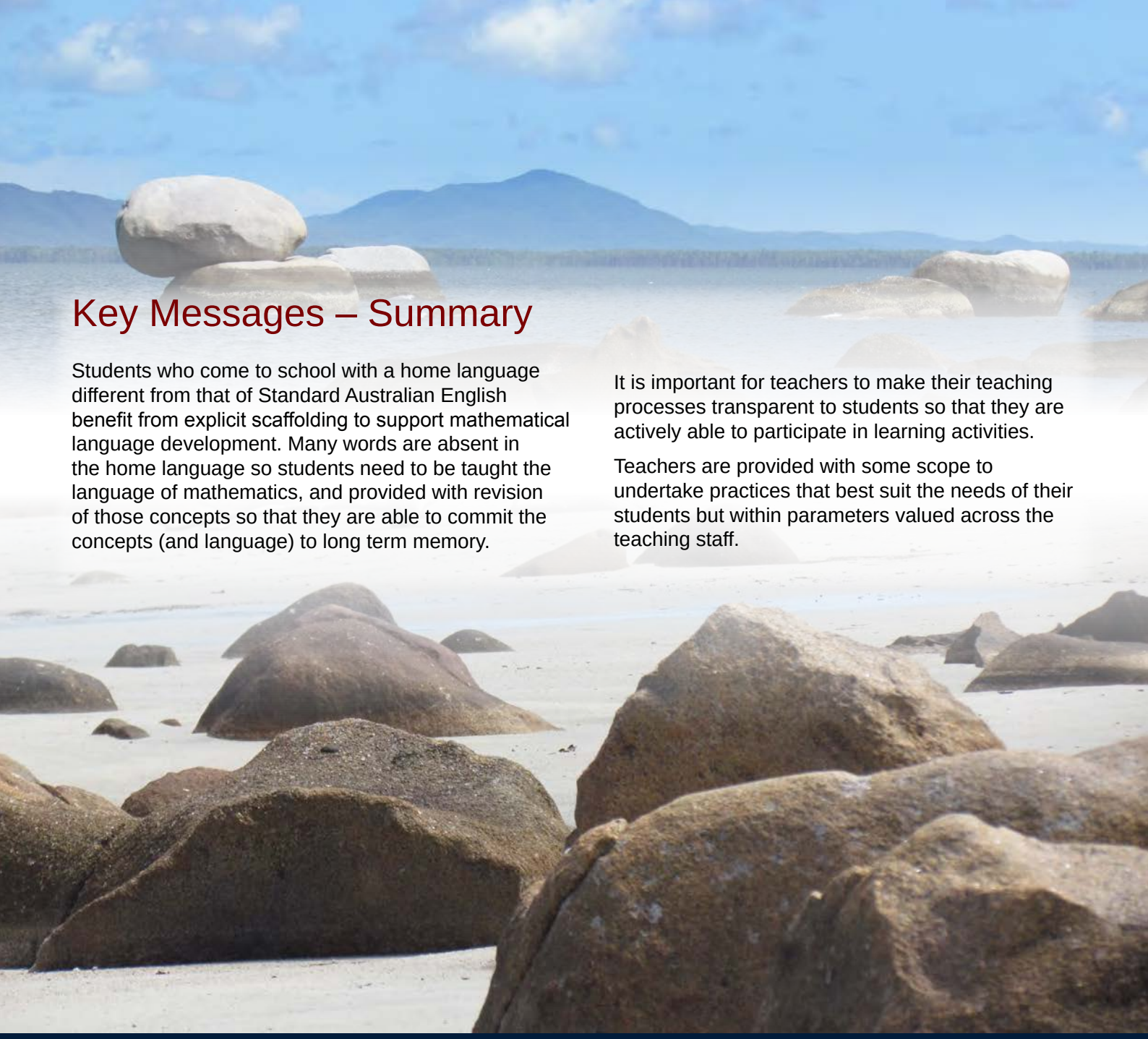
Hands-on lessons and activities are valuable for students whose ways of learning are based on 'apprenticeship' models of learning where they watch, learn and then model the activities. Hands-on activities support the learning modelled in community. The hands-on activities should align strongly with the learning intent of the lesson and be engaging for the students.

Benefits for Learning and Learners

Providing explicit teaching of concepts and the approaches being adopted, allows students to gain access to what is being taught. They do not have to 'second-guess' what and why teachers are doing things in particular ways. By making explicit the expectations of what students will be learning (learning intent), what they need to do to demonstrate their learning (success criteria), and why they need to learn particular mathematics concepts (rationale and application of mathematics), students can more readily engage in the mathematical learning. This is particularly important for students whose cultures are different from the mathematical and cultural norms that are used in the classroom.

Providing supportive and engaging learning environments for students helps them to engage with learning. Where there are ample resources around the classroom, and students know how to use those resources, students are more likely to become independent learners and move away from a reliance on the teacher/s.

Using materials to support learning through the use of hands-on materials, helps support the learning styles that many Aboriginal (and Torres Strait Islanders) bring to school. It helps to validate their learning styles and hence encourage engagement, learning and outcomes.



Key Messages – Summary

Students who come to school with a home language different from that of Standard Australian English benefit from explicit scaffolding to support mathematical language development. Many words are absent in the home language so students need to be taught the language of mathematics, and provided with revision of those concepts so that they are able to commit the concepts (and language) to long term memory.

It is important for teachers to make their teaching processes transparent to students so that they are actively able to participate in learning activities.

Teachers are provided with some scope to undertake practices that best suit the needs of their students but within parameters valued across the teaching staff.

School Demographics

Year range	P-12	FTE teaching staff	14
Total enrolments	124	Non-teaching staff	3
Location	Very Remote	FTE non-teaching staff	2.8
ICSEA (school)	630	Indigenous students %	98%
ICSEA (distribution of students) *(bottom quarter to top quarter)*	90% | 7% | 2% | 1%	Enrolments: Girls/Boys	71/53
		Language background other than English	85%
Teaching staff	14	Student attendance rate %	72%

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