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

2016

Culture, curriculum and community

Coonamble Public School

Coonamble is a small agricultural town of around 3000 people, located 575km North West of Sydney. It is well known for its various farming industries such as cattle, sheep, wool, wheat and cotton production. The town is located between the Warrumbungle Mountains and the Macquarie Marshes, on the Castlereagh River, which is an underground river where water only flows when floods occur in the region.

The Coonamble area was once home to over 30,000 indigenous people. The Gamilaroi, Kawambarai and Wailwan people all moved through the area and the name Coonamble is derived from the word 'gunambil' meaning 'full of dirt' in one of these language groups. The tribal boundaries were made up of geographical landmarks such as mountains and rivers but boundaries were crossed in times of drought and for trading tools, weapons and stories. Coonamble has many culturally significant artefacts, scarred trees, bora grounds, burial grounds, fish traps and paintings located along the Castlereagh River. The Wailwan people are the traditional custodians of the land.

The first Europeans arrived in the area in 1818 with the explorer, John Oxley. The first 'run' in the area was established in 1840 and was called Koonamble Station. The town is dependent on the Artesian water found in the area. The town of Coonamble was officially established in 1861 and the railway between Dubbo and Coonamble opened in 1903 which was a convenient method of transporting wool.

Unlike many other Indigenous communities in Australia, Coonamble was never a mission so the people who visited the area were able to move around freely thus its history is very different from many other communities. 'Tin Town' was a settlement which was not controlled by the Aboriginal Protection Board. This was one of the first areas that was allocated by the government so that the Aboriginal people

could access land for traditional uses in the 1800s. Most people lived in bark and tin huts called gunyahs.

Coonamble is famous for being the place where the last of the Ben Hall bush ranger gang was captured in a gun fight in 1865. These days it is known for holding the largest combined Rodeo and Campdraft in the Southern Hemisphere. This event is held every June long weekend and attracts around 1000 cowboys and cowgirls along with about 4000 spectators.

The first public school was built in Coonamble in 1869. The current Coonamble Public School has a student population of approximately 196 enrolled in classes Kindergarten through to Year 6. Coonamble Public School's mission statement indicates their belief that 'by building strong bonds between the school, parents and the community we aim to create a caring, co-operative learning environment that develops outstanding skills, attitudes and feelings that will prepare students for their future'. The school is supported by a number of initiatives including: Connected Communities, DET Preschool, Literacy on Track, the Reading to Learn Program, Early Action for Success, Middle Years Instructional Leader, Kids Matter, and Positive Behaviour for Learning. Children achieve in a safe, happy and culturally diverse environment through quality teaching practices, positive student welfare programs and constructive and supportive community involvement. Coonamble is part of the Connecting Communities program in NSW and has focused on bringing the voices of the community into the school. There is a strong focus on a program that reflects culture and language of the local people.

Defining success

Over the past three years, Coonamble Public School has directed considerable resources and energy into creating a coherent program across the school. This program has met with growing success as shown in the table below. Since using the model across the school, there has been a trend towards increasing the percentage of students who are meeting the benchmark levels.

	Percentage of students meeting early arithmetic strategies benchmark Years K-3		
YEAR	K	1	2
2015	90%	84%	95%
2014	96%	74%	82%
2013	74%	74%	89%
2012	100%	75%	59%
2011	95%	58%	58%

Table 1: Percentage of students achieving early arithmetic strategies benchmark.

NAPLAN data also show positive learning outcomes when compared with similar schools. Coonamble PS numeracy outcomes have shown a consistently positive story in comparison with similar schools.

	2011	2012	2013	2014	2015
Year 3					
Year 5					

Table 2: NAPLAN results for Numeracy since 2011.

There are two main initiatives impacting positively on success at Coonamble PS. The first is the inclusion of cultural perspectives into the school programs. This has helped to engage community in the school and enable the students to re-engage with schooling with the result of increased attendance and engagement. The second initiative has been to focus on teachers' knowledge in the teaching of mathematics.

Creating a Supportive, Cultural Approach within the School

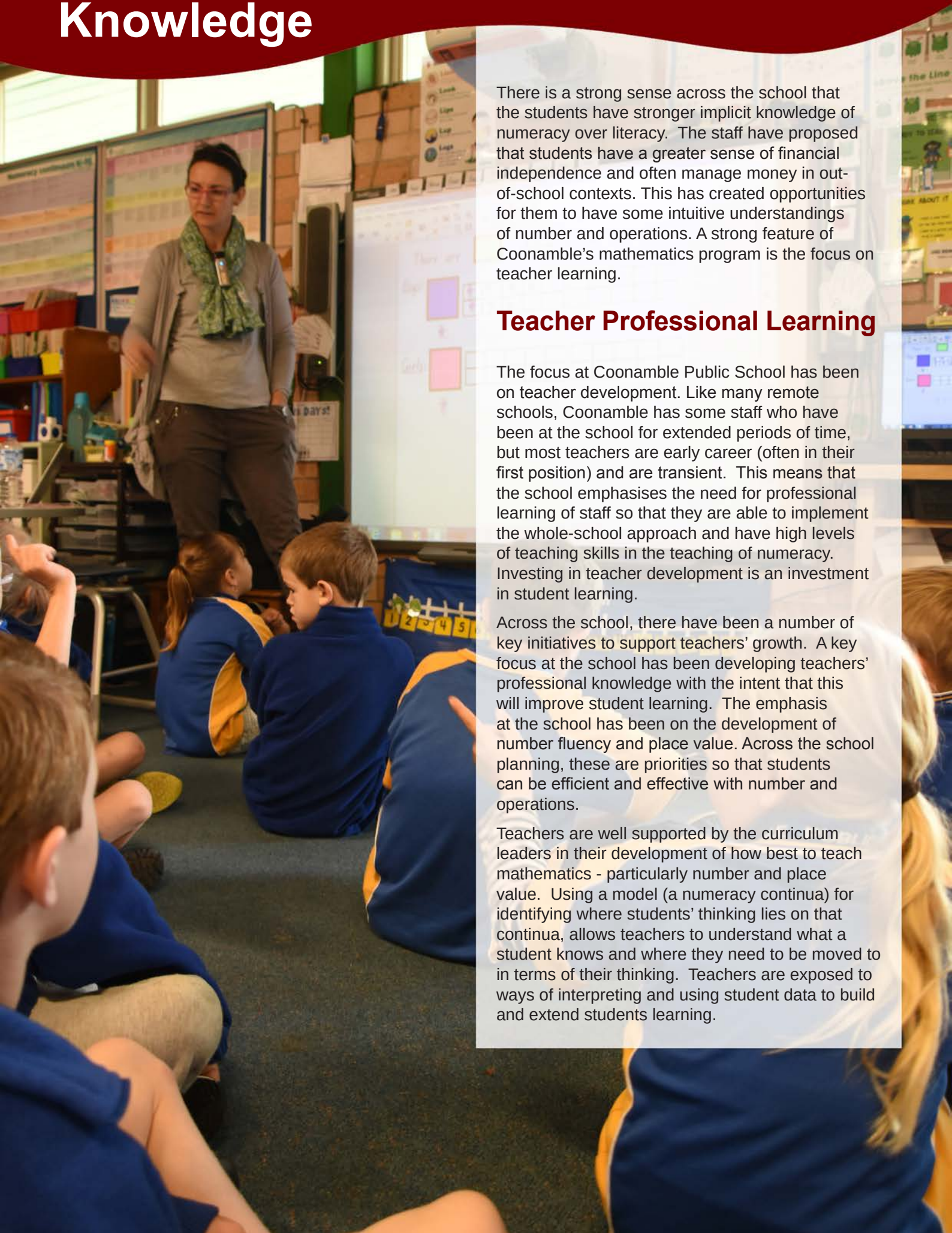
Since focusing on incorporating the views of the local community into the school programs, there has been a significant increase in attendance and engagement. Three years prior to this case study, attendance rates were at least 10% lower than their current levels which are usually above 90% with some classes regularly achieving 100%.

The school has introduced language classes in the local Gamillaraay which is taught by a local tutor. Alongside this, the students have culture lessons (once a week) which are taught by one of the Aunties from the community. This is supporting the maintenance and pride in language and culture for the Coonamble students.

The school has appointed a music teacher so that music is a key part of the school curriculum. Students can also take lessons after school for instruments (guitar, drums, clarinet, are taught) and this is very actively supported.

The school has also appointed a full-time psychologist to support students with their needs. As with most communities, there are high levels of trauma experienced by the students so providing support has helped significantly with behaviours and attendance as well as students' overall wellbeing.

Mathematics Pedagogical Content Knowledge



There is a strong sense across the school that the students have stronger implicit knowledge of numeracy over literacy. The staff have proposed that students have a greater sense of financial independence and often manage money in out-of-school contexts. This has created opportunities for them to have some intuitive understandings of number and operations. A strong feature of Coonamble's mathematics program is the focus on teacher learning.

Teacher Professional Learning

The focus at Coonamble Public School has been on teacher development. Like many remote schools, Coonamble has some staff who have been at the school for extended periods of time, but most teachers are early career (often in their first position) and are transient. This means that the school emphasises the need for professional learning of staff so that they are able to implement the whole-school approach and have high levels of teaching skills in the teaching of numeracy. Investing in teacher development is an investment in student learning.

Across the school, there have been a number of key initiatives to support teachers' growth. A key focus at the school has been developing teachers' professional knowledge with the intent that this will improve student learning. The emphasis at the school has been on the development of number fluency and place value. Across the school planning, these are priorities so that students can be efficient and effective with number and operations.

Teachers are well supported by the curriculum leaders in their development of how best to teach mathematics - particularly number and place value. Using a model (a numeracy continua) for identifying where students' thinking lies on that continua, allows teachers to understand what a student knows and where they need to be moved to in terms of their thinking. Teachers are exposed to ways of interpreting and using student data to build and extend students learning.

Middle-Leadership Team

Coonamble PS has developed a comprehensive support team to develop teachers' Mathematical Pedagogical Content Knowledge (MPCK). This includes a dedicated curriculum in the early years (infant K-2) and the middle/upper primary (Yrs 3-6); and assistant principals who also work across these two year levels, and a learning support teacher. Collectively the team of leaders work with the teachers to implement whole school approaches. The middle leadership team works with the teachers, and through one-on-one meetings as well as in-class support and team meetings, teachers are exposed to a variety of learning situations where they come to understand the approach being taken at the school. This knowledge specifically relates to the ways in which to best teach mathematics content. There is an explicitness around best teaching in mathematics in relation to the key number concepts that are formative for the school program. For example, teachers learn ways to teach place value or counting on and back.

The middle leadership team is also provided with system-based professional learning to build their capacity as advisors/mentors to the teachers.

Lesson Structure and Timetable

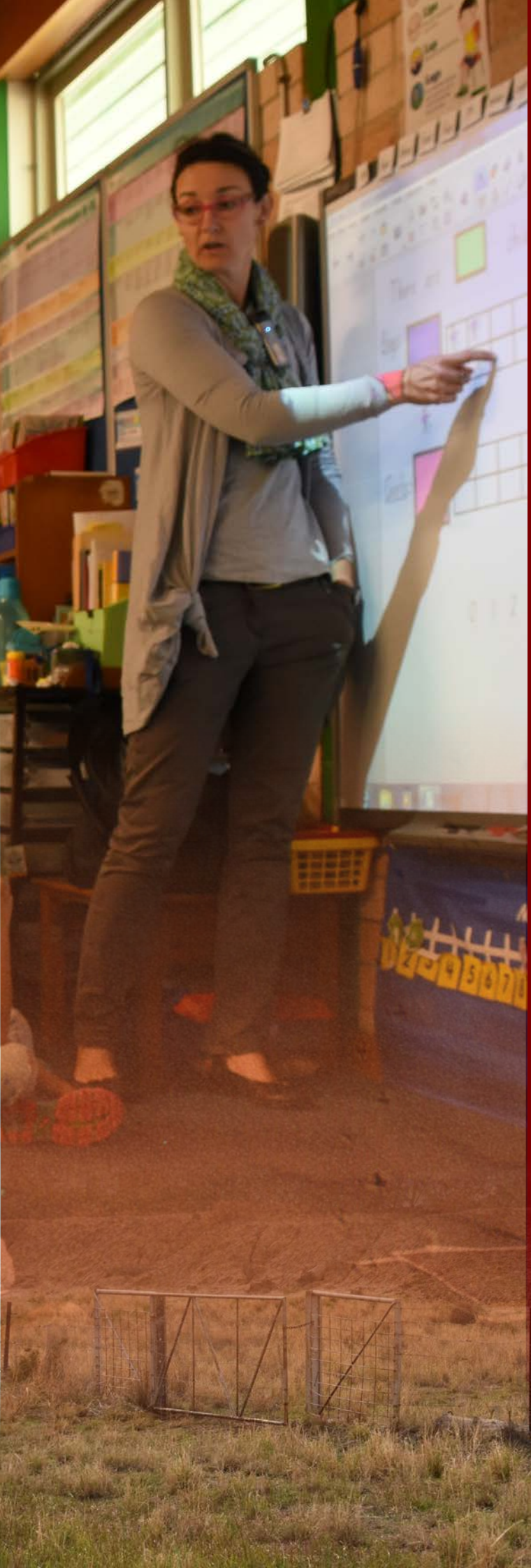
Mathematics lessons are generally undertaken in the second session of the day. The amount of time may vary from year level to year level, but the general structure across the school is for the lesson to be between 90 minutes and 2 hours for four days each week. There is usually 45 minutes of whole class teaching focused on a particular concept or strand. The class will then break into groups for approximately one hour, each with 15 minutes for each group activity. The teacher is most likely to work with the group working on a given number topic - often place value as this frequently requires direct teaching input. The level of the content of the teacher's group will be dependent on the needs of the learners - as a group or individually. Time is allocated at the end of a lesson for reflection and discussion on the strategies used by the students.

Plotting and Managing Students' Mathematical Growth

Across the school, there is a strong emphasis on the big ideas in number - counting, number recognition, and early arithmetic strategies in the early years (infants) and extending into place value in the middle/ upper primary years. The framework used by the school is one developed by the DET NSW. It is a comprehensive document that teachers use to provide a standard framework across the school. Students are tested regularly (every 5 weeks) but also monitored consistently through informal strategies. The students' success is plotted against the continua, whereupon teachers can identify what the students next need to achieve. This framework has provided a common platform across the school against which teachers are able to plot student growth, and plan for future teaching. It provides a common language for teachers to discuss mathematics teaching and learning, along with students' learning and intervention.

The continua provides cues or indicators for teachers to use to gauge students' success. Teachers, for example, use the early arithmetic strategies to plan their mathematics programs. The continua also provides teachers with examples of what to expect in terms of evidence for a student to be working at a particular level, and then they can see what they need to do to enable the student to move forward.

Emergent	Perceptual (Kindy)	Figurative (Yr 1)	Counting-on-and back (Yr 2)	Facile (Flexible)
Cannot count visible items	Counts visible items to find the total count	Visualises concealed items and determines the total by counting from one	Counts on and back to solve problems	Uses known facts and other non-count strategies to solve problems (using one and two digits numbers)



Strategies not Output:

There may be one correct answer but many ways to achieve it

A feature of the Coonamble PS approach is to focus on the strategies that students use to solve their mathematical problems. Throughout a lesson or in one-on-one interactions, the teacher prompts the students to talk through the strategies that they used to solve a problem. In teacher-student consultations/ interactions, teachers pose questions to enable the students to articulate how they solved their problems. The strategies used by the students are a greater focus in a lesson or teaching episode than the answer.

The approach taken in mathematics lessons is usually around small group rotations. These can be levelled or multi-levelled groups. One of the tasks within the group is for students to talk through (with their peers) the strategies that could be used. Through peer-tutoring within the group, as students talk about their personal strategies, other students can input, discuss, evaluate and revise the strategies that have been used within the group.

At the end of a lesson, there is a focused, whole group discussion in which students (or groups) report on their strategies in solving problems. Again, in this part of the lesson, students are able to share their strategies and as a whole class, there is discussion around the strategies that are used.

Within a class, there is also a recognition of differentiation where it is acknowledged that students may be working at different levels within the continua and so their strategies are likely to reflect their levels of mathematical thinking. The purpose of the discussions with teachers, peers and whole class is for students to see how their peers may be working on tasks and their personal strategies. In so doing, they are exposed to a wide range of strategies that might be used to arrive at the same answer. Depending on the purpose of a lesson or teaching episode, there may be the opportunity for student-led discussions to assess effectiveness of strategies.

Meta Language and Mathematical Concepts

Across the strategies used at Coonamble PS, there is a focus on the metalanguage of mathematics. This can be brought about through specific articulation of goals and intents of lessons (e.g. addition of two-digit numbers with regrouping in the tens) but equally through the discussion of strategies. When students understand the purpose of the lesson and the language used to outline the learning intent, then they are better able to appreciate the concepts.

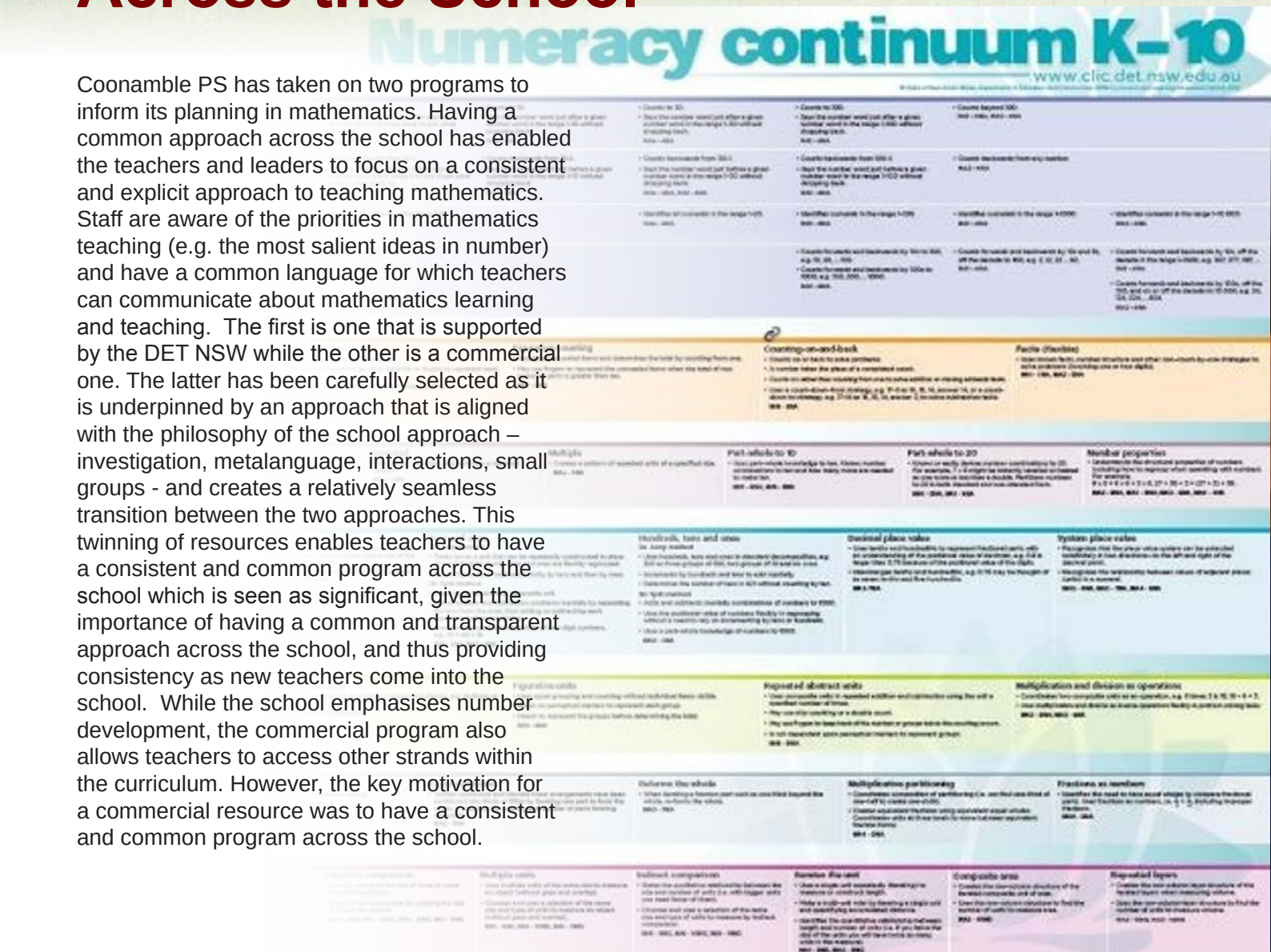
Similarly, having students articulate how they went about solving problems demands that they are able to talk through a range of mathematical concepts and processes and in doing so, develop an explicit awareness of the metalanguage of mathematics. For example in undertaking multi-digit addition, a common error is for students to line the numbers up from the left hand side. Specific talk about place value and what the 3 in 36 represents (i.e. 3 tens), then leads students to see the point in the strategy of lining columns up from the right hand side. The approach taken seeks to remove rote strategies (such as using a hundreds, tens, one frame) but for the students to see the purpose in having the tens in the tens column.

Hands-on Learning

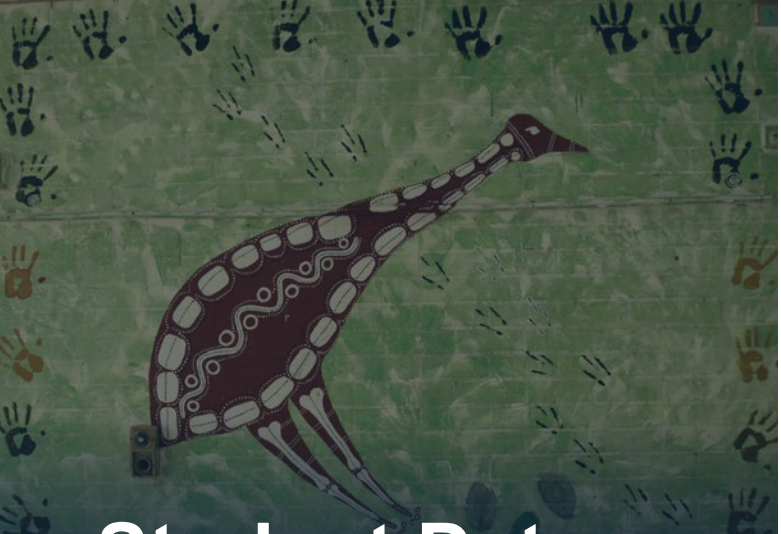
The group work activities are usually undertaken using a hands-on approach. This can be through the use of manipulative (such as counters, blocks etc.) or through a games-based approach (playing cards or using formal, commercial games). The hands-on approach was seen to engage the students more.

Within a group activity, the work being undertaken can be a common one in which all students are involved or a differentiated activity to meet the needs of individual learners.

Having a Common Program Across the School



Coonamble PS has taken on two programs to inform its planning in mathematics. Having a common approach across the school has enabled the teachers and leaders to focus on a consistent and explicit approach to teaching mathematics. Staff are aware of the priorities in mathematics teaching (e.g. the most salient ideas in number) and have a common language for which teachers can communicate about mathematics learning and teaching. The first is one that is supported by the DET NSW while the other is a commercial one. The latter has been carefully selected as it is underpinned by an approach that is aligned with the philosophy of the school approach – investigation, metalanguage, interactions, small groups - and creates a relatively seamless transition between the two approaches. This twinning of resources enables teachers to have a consistent and common program across the school which is seen as significant, given the importance of having a common and transparent approach across the school, and thus providing consistency as new teachers come into the school. While the school emphasises number development, the commercial program also allows teachers to access other strands within the curriculum. However, the key motivation for a commercial resource was to have a consistent and common program across the school.



Student Data

Teachers regularly assess students and enter the data into the school tracking system. Assessments are undertaken every five weeks but are not limited to the more formal testing. Informal observations are also undertaken and entered into the database. Once entered, teachers are able to see the level at which students are working; able to identify the next teaching that needs to occur in order to move students forward; and access ideas for teaching that concept. Data is fundamental to informing teachers' mathematical practices.

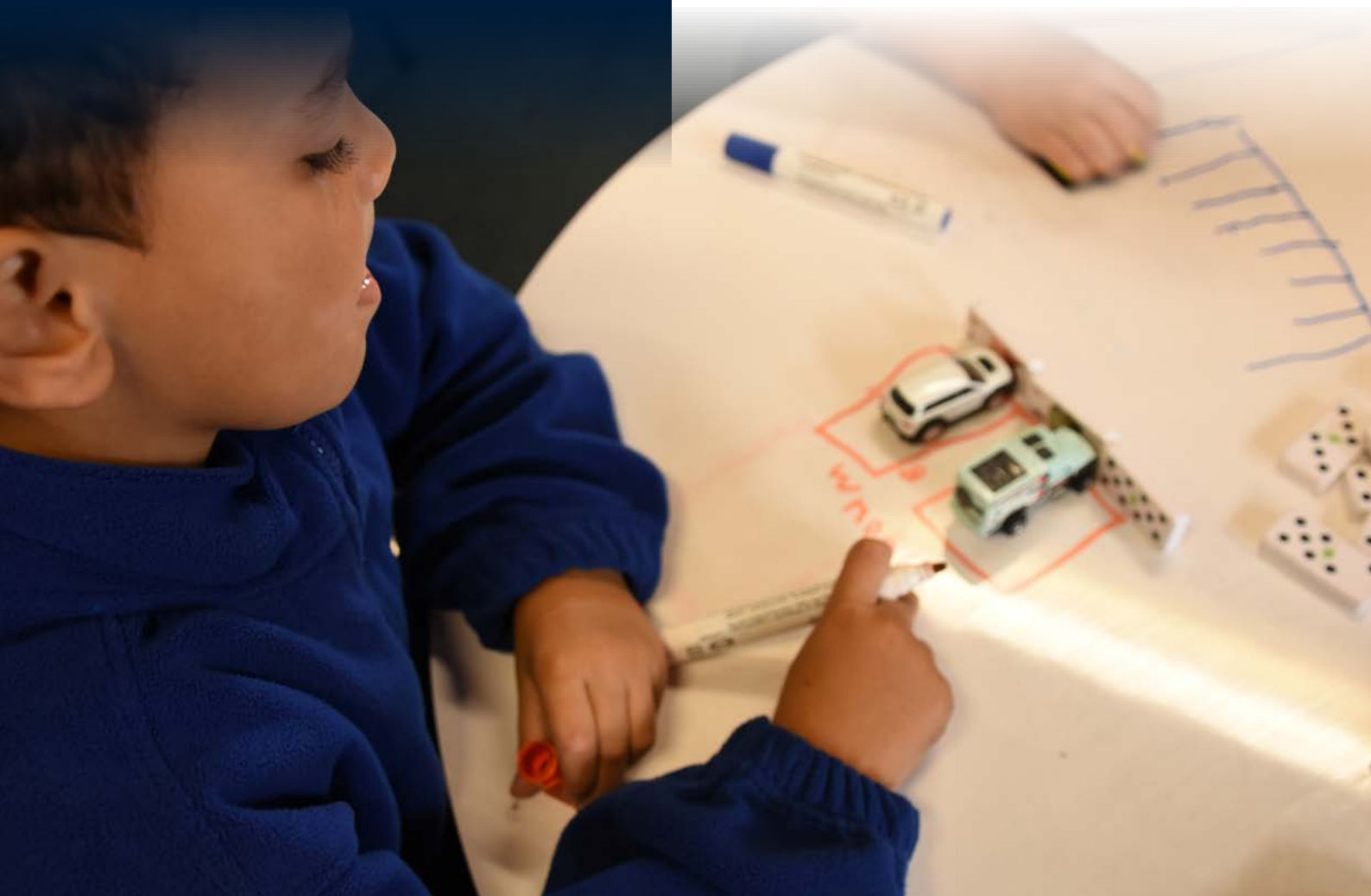
Benefits for Learning and Learners

The approach used at Coonamble PS has resulted in a number of outcomes – for community, for teachers, and for students.

Teachers have gained considerable knowledge on the effective teaching of key number concepts that are seen to be foundational in mathematics. There is strong knowledge of pedagogical processes directly related to the teaching of mathematics. The support provided by the middle leadership team has enabled teachers – both new-to-teaching and established teachers – to develop effective and targeted teaching strategies aimed specifically at improving students' learning in key number concepts. It has also brought about a whole-school approach to the teaching of these concepts.

The cultural approach has enabled students and families to reconnect with the school as evident in the attendance rates. These have improved and been maintained, along with a marked decline in behavioural issues. Having students coming to school, and remain at school, and a decline in behavioural problems has meant that teaching time has been substantially increased.

Students' fundamental number knowledge has been improving since the introduction of the program. Students have progressively improved in their number knowledge and this has been reflected in both NAPLAN and school-based assessments.



Advice to Teachers

Building relationships with community and incorporating local cultures into the school activities creates a sense of pride and connectedness with the school. This can turn around attendance, engagement and positive behaviours as school is a place that belongs to the community. Community involvement, genuine consultation and partnerships, and inclusion in school activities are an essential part of a community-based approach.

Creating supportive curriculum leadership models fosters a stronger numeracy/mathematics program across the school. The leadership team has strong mathematics pedagogical knowledge that can be shared with teachers and support staff.

Group work is a positive pedagogical tool for allowing teaching to be targeted for students. Knowing where students are (through assessments), knowing where they need to be taken (scaffolding) and catering for the diversity within a classroom can be achieved through group activities. Group activities can be organised in different ways – levelled to cater for specific learning or mixed levelled to cater for peer tutoring. Work needs to be undertaken to initially teach students group work skills.

Using digital resources such as iPads, interactive white boards, smart phones and laptops is a positive way to engage learners. Activities need to be carefully selected to meet the learning intent of lessons and should create a fun and engaging environment for students, particularly in group rotations. The interactive white boards can be used for whole class and small group work.

Having a recognised framework for learning, such a continua or scope and sequence allows teachers to plot individual student learning and to identify the next step in learning so as to move students forward.

Model for Quality Learning

Principle	Implications for mathematics	Focused strategies
Build school programs around the culture of the community	• Seek, value and enact feedback from community.	• Identify cultural activities to include (and validate) through mathematics.
		• Enable local people to be part of the teaching of mathematics.
Teacher Professional Learning	• Build a strong middle leader team to support teacher professional learning.	• Middle leaders engage in professional learning outside the school and then share this with their team members.
	• Create a whole school approach and focus and work with teachers to maintain that focus.	• The school uses a common framework against which students' performances are plotted. Once entered, teachers are then able to identify where to take students next in their learning of mathematics.

	• Instructional leaders to support teachers.	• Teachers are provided with one-on-one professional learning time with the instructional leader with regards to curriculum, assessment, intervention and pedagogy related to the numeracy program
		• Instructional leaders meet on a weekly basis with teachers to scaffold teachers' learning in mathematics education
		• Instructional leaders work with teachers to:
		  • improve their understandings of mathematics teaching and learning
		  • model teaching
		  • provide shoulder-to-shoulder support for the teacher in all aspects of mathematics teaching and learning
		  • provide support in assessment, interpretation of assessment outcomes, and where to build students' future learning activities.

Group work	• Students work in small groups with rotations throughout lesson.	• Group activities can be levelled or differentiated depending on the intent of the activities. Activities last about 15 mins before moving on to the next rotation. The activities within the group work are all focused on number work.
	• Sharing strategies, meta language.	• Sharing strategies allows students to see other ways to solve problems • Having to talk through strategies builds the metalanguage of mathematics.
	• Focussed teaching.	• Teachers can take a small group of learners and focus teaching the mathematical concept at the level of the learners within that group.
	• Digital media.	• Students enjoy and engage with digital media - interactive white boards, iPads, laptops. These should be included as one of the group rotations.
Whole class teaching	• Teaching across the mathematics curriculum.	• Whole class teaching across the strands (other than number), ensures that the curriculum demands are covered.

Key Messages – Summary

Coonamble Public School has made significant inroads into student attendance, engagement and positive behaviours through adopting a coordinated program that includes community consultation and involvement in the development of school programs. Incorporating local knowledge/s and culture/s into the school programs creates ownership of the school by the local community. This can bring about many positive changes to the school. Coonamble Public School's attendance has increased to over 90%; there are significantly less behaviour reports, teachers are happier with their work; teachers are remaining longer periods at the school, building a greater stability in the teaching force; the community feels connected to the school.

Curriculum support in numeracy is essential to building a school wide program. Middle leaders have an important and integral role in supporting teachers to develop strong and consistent mathematics programs across the school. Teacher support consists of developing/implementing a whole school approach; providing professional learning activities (such as fortnightly team meetings) for teachers to understand the approach being taken; providing in-class support including modelling of teaching and providing feedback to teachers on their teaching; assisting teachers in the design, implementation and interpretation of student assessment; working with teachers to support student scaffolding.

Creating a dynamic classroom environment where students can engage in substantial learning opportunities both in time and content requires careful planning of group work. Group rotations allow students to experience different ways of learning similar content, differentiating learning to meet the diverse needs of learners, and provides teachers with opportunities to undertake small group teaching to targeted groups of learners.

Providing opportunities for developing the metalanguage of mathematics and articulation of strategies builds a fluency with mathematics - content, language and symbolic – and can be achieved through questioning students around their strategies, using problem posing techniques and providing quality reflection time at the end of lessons.

School Demographics (Coonamble Public School)

Year range	U, P-6	FTE teaching staff	16.3
Total enrolments	196	Non-teaching staff	9
Location	Remote	FTE non-teaching staff	7.7
ICSEA (school)	711	Indigenous students %	88%
ICSEA (distribution of students) *(bottom quarter to top quarter)*	80% | 14% | 5% | 1%	Enrolments: Girls/Boys	85/111
		Language background other than English	0%
Teaching staff	15	Student attendance rate %	88%

Contact: Robyn Jorgensen | robyn.jorgensen@canberra.edu.au