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

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Creating Groups for Targetted Numeracy Learning

Derby District High School

Derby is a large regional centre located at the southern end of King Sound in The Kimberley and offers a comprehensive range of services. It was the first town settled in the Kimberley in 1883 and is well known for its 12m tidal variation – the largest in Australia and the second largest in the world. Surrounded by mud flats and mangrove swamps, water activities are a major source of recreation, although with crocodiles inhabiting the area, swimming is not one of these activities! Derby is well known for being the gateway to the Buccaneer Archipelago (and the Horizontal Waterfalls) and for barramundi fishing in the Fitzroy River. In the late 1800s, Jandamarra, an impressive warrior and Bunuba man, had a very active history in the Derby area, leading his people to try to reclaim their land.

Derby District High School caters for approximately 592 students with about 85% of the enrolments being Indigenous students. Students come from the town of Derby as well as two outlying communities – Mowanjum and Pandanus. The school caters for kindergarten through to Year 12. There is a preschool located on campus – Bundja Wulan Nunga. There is also an off-campus Early Years Learning Centre at Mowanjum that caters for Kindy and Pre-Primary students located at Mowanjum. A cohort of Indigenous students who attend regularly perform equally as well as their non-Indigenous peers, thus making a strong argument for attendance. The school has a number of initiatives to encourage attendance, including attendance awards each fortnight at whole-school assemblies, the Clontarf Academy, and the Girls Academy. Attendance is seen as an important influence on learning so is a key initiative at the school.

The school's motto – Diligence, courage and strength – is borne out in the programs offered by the school, where there is a strong emphasis on high expectations of learners. The community members have three priorities – family, community and country – and these influence actions by the community members and the practices at the school.

The school has several teachers who have been at the school for long periods of time, and this has helped to create a sense of stability in the school. The school also attracts many new teacher graduates. In recent years, the administrative team has been given greater autonomy, so there has been a more rigorous selection process than previously. As a result, the school is attracting teachers whose personal values align with the vision of the school. The teachers are able to adopt practices that they feel suit the needs of their learners, so there is no one school-wide approach to teaching numeracy.

Defining success

The school has performed well on NAPLAN. Success in recent years has been attributed to the funding that was allocated to the school through a number of initiatives, most notably the National Partnership. This funding enabled the school to put extra staff into numeracy, so that teachers had teacher support in class and were able to access mentors. In addition, the funding meant that a numeracy coordinator was available to work with staff to help them develop data-driven pedagogy.

The school has many Indigenous students who are performing at the same level as their non-Indigenous peers. Many of the Indigenous students are performing at national levels. These students are generally those who are attending regularly.

Assessment for learning and differentiating curriculum

There is considerable diversity at Derby DHS with student attendance varying considerably. Many of the Aboriginal students have parents who value education and/or are working in professional roles in the area; other students have parents where education is not seen as a priority. There is also a considerable diversity in language backgrounds and levels of literacy. Recognising the impact of attendance and literacy on learning, including numeracy learning, the school has opted for a process of grouping students by achievement in literacy. Many of the students in the higher groups are those who attend regularly, and who have a strong grasp of Standard Australian English.

Many of the students speak Standard Australian English (SAE) and Aboriginal English. They are very competent in code switching between SAE and Aboriginal English. When initially implementing the classroom organisation strategy, the school grouped students according to numeracy and literacy; however, the two groupings meant that students needed to change classes since there were marked differences in the literacy and numeracy performances. This created substantial re-organisation of classes during the first recess period when students had to transition into their other classes. It was also found that students did not like being taken from home classes, so the classes now are organised around literacy only. However, within a class, teachers differentiate between students on the basis of their learning in numeracy, as indicated by student assessments.

Consistency and Explicitness

Keeping practices consistent and explicit means that students feel more comfortable with lessons. When teachers changed routines, there was often a backlash with students being confused and creating challenges to teaching.

In each numeracy block, teachers undertake a transition session so that students can be calmed down and orientated towards the maths lesson. This could be through songs, distribution of fruit, using YouTube videos on mathematics, and so on. The medium and activity was chosen by the teacher but it was usually the same type of activity within a given class, so that students were familiar with the process.

Teachers also undertake a process to make explicit the learning intent of a lesson, so that students know what to expect. In addition, teachers make explicit the expectations regarding behaviour, how learning will be demonstrated, and how students will work through the lesson.

Assessment for learning

Under the National Partnership funding, the school was allocated resources to establish strategies across the school. After trialling a number of different numeracy tests, the school opted for the use of PAT maths to assess students. Student data is entered into a document so that progress is recorded, monitored, and stored. Teachers are able to access data from a shared drive through the school information system. Teachers use this student data, along with data that they collect in their classrooms, to create learning experiences that are targeted for the individual.

Due to the diversity within classes, there is a need to recognise the individual learning needs of the students as the basis of teaching. The differences between students are due to a number of factors, and the differences increase as students progress through the primary years. Many of the issues that impact on learning differences remain in place, and are exacerbated by the absenteeism of students. By the time the students reach the final years of primary schooling, there is substantial diversity within classrooms. Many of the upper-years students are performing at levels consistent with the early years, due to having been absent from school for long periods of time. To ensure that these students, along with those who attend regularly, have their needs met, regular assessments are undertaken. When entering the school, new/returning students are assessed so that learning can be matched to their needs.

Differentiating Learning

Most of the teachers use small-group strategies within the classrooms. These groups are targeted with learning appropriate to the identified learning needs of the students, and regular testing allows teachers to determine when students are ready to move into a group with different learning needs. The group to which a student is assigned may vary according to the content being studied. Students work individually within the groups.

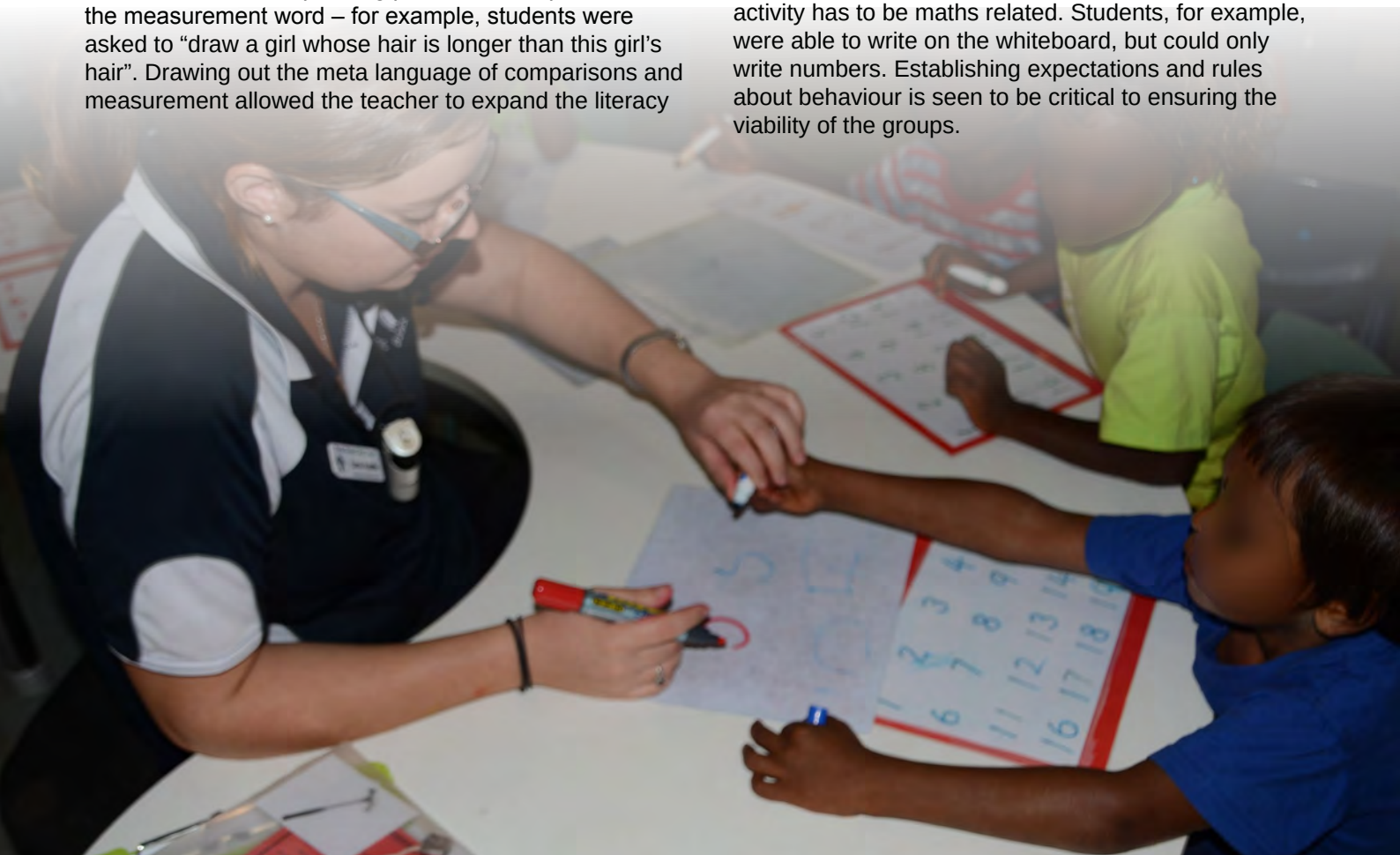
Group work

Most often a rotational group structure is used in the classroom. Group work in the numeracy lessons is not for the purpose of collectively working on activities; rather, the groups are designed to homogenise the group so that the group member are working on tasks that are targeted to the learning needs. The students work individually on these tasks. The groups reflect the diversity within a class. In many classrooms, one group works on a hands-on activity, as teachers feel that the students enjoy using hands-on activities for the learning. Another group works on a targeted mathematics activity, often working with the teacher, and another group undertakes a focused maths activity working on their own or with a teacher. The activities vary and are determined by the teacher.

The purpose of the teacher-led group varies with the intent of the learning – introducing new work, clarifying issues that had appeared in assessment, extending learning, etc. For example, in one lesson, the teacher focused on comparative language of measurement – taller, shorter, wider, more, less. Students were given pictures, and were asked to draw corresponding pictures that represented the measurement word – for example, students were asked to “draw a girl whose hair is longer than this girl’s hair”. Drawing out the meta language of comparisons and measurement allowed the teacher to expand the literacy demands of the task. This is an important strategy for learners whose language is different from the medium of instruction.

In some classes, different groups appeared to work on the same activities, however, the activities were modified for the individuals within the group. For example, in one teacher-led group, a group of students was seated around a table with a large number of items (brightly coloured plastic cars/trucks/trains). This group was asked to count out items, and the number of items was recorded on a small whiteboard. For some students, robust counting strategies were evident and easily noted by the teacher. In other cases, one-to-one correspondence was not evident and miscounting of objects became evident. The teacher was then able to intervene and address the learning. The second group to do this activity was given a more complex task. They were asked to count out some items and then another subset of items. These teacher recorded these instructions on the small whiteboard as an addition task (5 + 2) and then asked how many items there were altogether. The teacher also scaffolded the students on how to best represent their collections – placing them in a line made them easier to count, and placing them in pairs made them easier for skip counting. The strategy was contingent on students’ knowledge base.

Teachers work with the students at the start of the year to establish clear class rules for the groups. As early as pre-primary, students work on-task in a small ‘free choice’ group. In this group the students are able to choose activities, the only requirement being that the activity has to be maths related. Students, for example, were able to write on the whiteboard, but could only write numbers. Establishing expectations and rules about behaviour is seen to be critical to ensuring the viability of the groups.

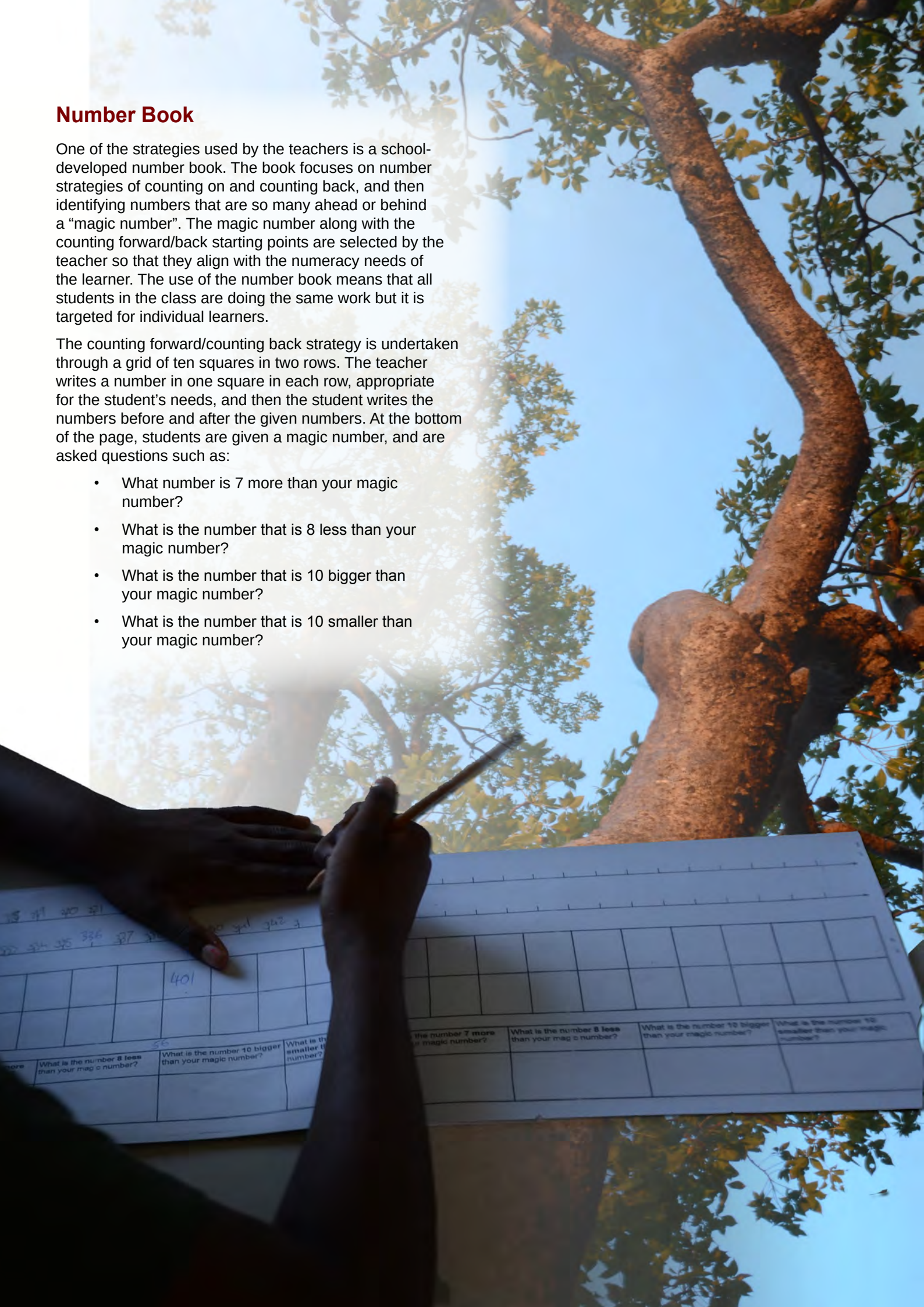


Number Book

One of the strategies used by the teachers is a school-developed number book. The book focuses on number strategies of counting on and counting back, and then identifying numbers that are so many ahead or behind a “magic number”. The magic number along with the counting forward/back starting points are selected by the teacher so that they align with the numeracy needs of the learner. The use of the number book means that all students in the class are doing the same work but it is targeted for individual learners.

The counting forward/counting back strategy is undertaken through a grid of ten squares in two rows. The teacher writes a number in one square in each row, appropriate for the student’s needs, and then the student writes the numbers before and after the given numbers. At the bottom of the page, students are given a magic number, and are asked questions such as:

- What number is 7 more than your magic number?
- What is the number that is 8 less than your magic number?
- What is the number that is 10 bigger than your magic number?
- What is the number that is 10 smaller than your magic number?



Language

It was widely recognised by the staff that language can be a barrier to success in mathematics. Many of the students can do the mathematical demands of the tasks but are hindered by the language demands of the tasks. Knowing this, teachers undertake a number of strategies to build the repertoire of language – words, grammar, and discourse. There is a considerable amount of incidental teaching of Standard Australian English (SAE) throughout mathematics lessons.

When working in small groups, teachers model SAE and appropriate responses. Some students tend to respond to questions with one-word answers. For example, when asked to identify the colour of their toy tweezers, some children responded with only the colour name. The teacher then scaffolded the appropriate response: "My tweezers are …"

In a Year 1 mathematics lesson on comparatives, the students were scaffolded in the use of comparative words. Although such words as "bigger," "smaller," "taller," and "shorter" may be familiar to students, other words such as "wider" appeared to be less familiar. Teachers worked with the students to draw attention to the words and use more familiar words to develop understanding. The new words were incorporated into the discussion and then reinforced.

Another strategy used to build language repertoire was the use of visual representations to illustrate the meanings of words. In a Year 7 lesson on angles, the teacher drew the angles and relevant mathematical symbols on the blackboard. The teacher felt that using visual stimuli to represent concepts provided another medium through which students could consolidate their understanding of mathematical terms.

Due to the challenges around language in mathematics, the teachers have adopted a strategy of read, write, say. Particularly in the early years and with students who are struggling with aspects of mathematics, the read, write say strategy helps build fluency with oral and written language.

Early-years teachers use a range of tools to foster the auditory patterns of number, and use digital media to support strategies. Interactive Whiteboards (Smart Boards) are used in all classrooms and early-years teachers often commence maths lessons with singing sessions around counting sequences. Numbers appear on the Smart Board with a pause on the turn of each tens, giving children the opportunity to determine the next number. Children sing along with the presentation, and this helps them to calm down after being outside over the recess period and orientates them to the mathematics lessons.

- Students use whiteboards to record their work but the writing can be wiped off when the students have completed their work. This helps shift the focus from representation (e.g., perfectly formed numbers) to a focus on recording thinking.
- Photographs of students working and students' work are used as a record of work. As teachers noted, Aboriginal families like to refer to images so having photos appeals to families while serving as a record of learning.
- Students can show their thinking using their fingers to show their numerical work, and can use thumbs up or thumbs down to agree or disagree with statements. Thus, students can demonstrate their knowledge without the pressure of having to write their thinking. This strategy also allows the teacher to observe what students are thinking without the students influencing each other's response.

Attendance

There is considerable diversity in attendance. A substantial number of Aboriginal students attend more than 80% of the time, and some attend close to 100%. Generally these students achieve at or above national averages. The school recognises the effect of attendance on learning, so has strategies to encourage attendance. The attendance rates have improved significantly in the past few years, so the strategies appear to be working. Most notably, there are two liaison officers who undertake home visits in the town and the two communities. One liaison officer visits the local community each morning to wake students in time for transporting to school. The school operates only one bus run each day. Previously, several bus runs were offered by the school but this was reduced to one. Derby bus services provides a bus run in the morning and the school also offers an extra one between 8am and 8.30am. Throughout the day, teachers also remind students overtly and subtly that attendance helps to build their knowledge. Teachers offer small rewards, such as a class trip to the local swimming pool, for >80% attendance.

As attendance can be sporadic for a considerable cohort of the students, teachers teach concepts several times through different approaches. Using this approach, the consistent attendees experience learnings in new ways, and those who attend sporadically are exposed to content that they may have missed.

Teachers are also expected to be involved in building strong relationships with families. Each teacher undertakes 5 positive home visits each term. The visits will be for any student in the classroom and for a range of reasons.

Benefits for learning and learners

Rather than teaching to the whole class in which there is considerable diversity, it is valuable to identify where students' mathematical understandings lie and then to provide learning experiences to build on that understanding.

Students experience learning that is appropriate for their needs. They are able to engage with learning and feel success. This helps to build confidence and extend learning.

Building language – both SAE and mathematical – is critical for learning. This is even more important when much of mathematics is problem based. Being able to access the literacy demands of problem-based mathematics is essential for success, particularly on tests such as NAPLAN where teachers are unable to support the learners to interpret questions.

Advice to teachers

In any one class, there is diversity. Teaching to the needs of the learner is key to success. Good assessment of students, though various modes, helps teachers know what their students need to learn.

Flexibility in groupings is important. Students need to be able to move around groups, depending on their success.

Attendance relates to success, so building attendance builds success.

Key messages – summary

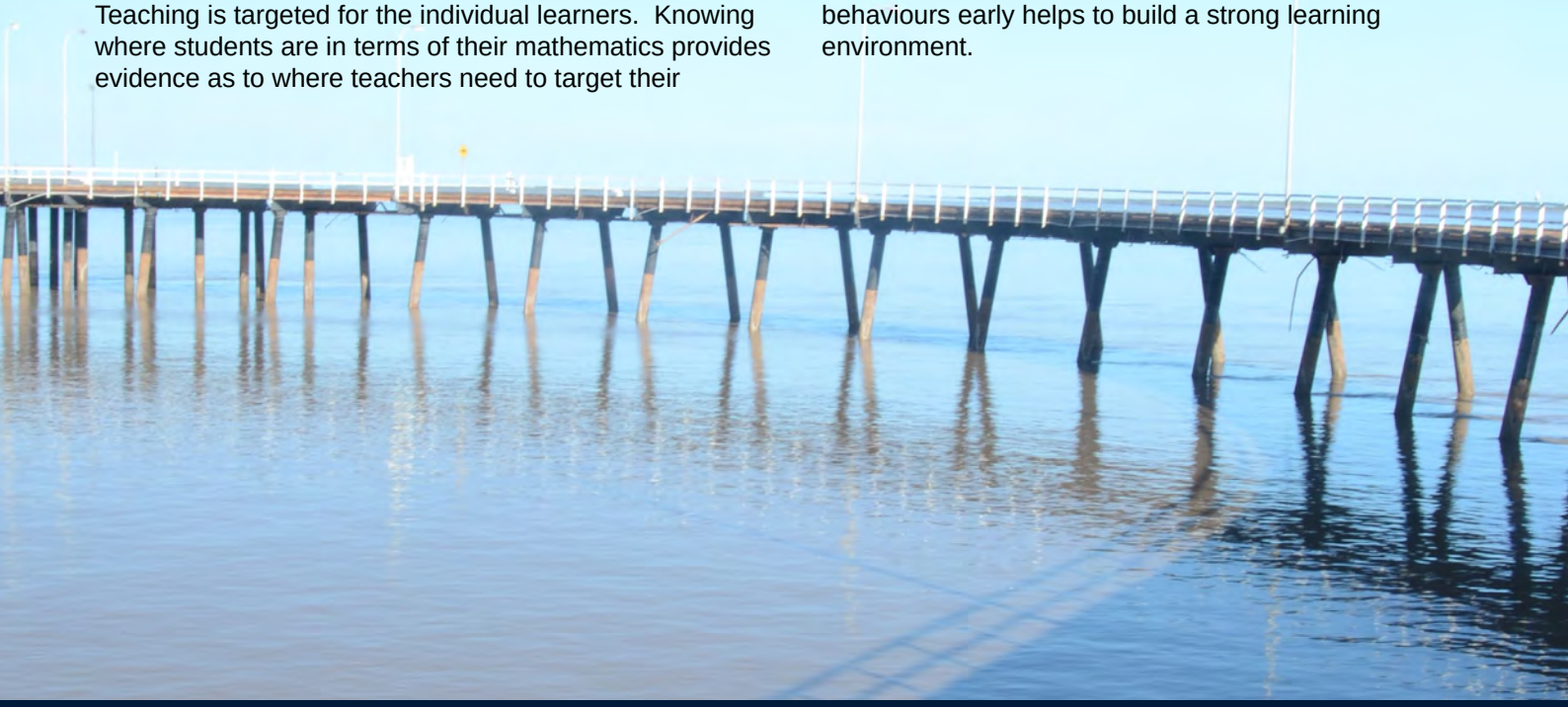
Because of the great diversity among learners, teachers undertake regular testing to find their current understandings and to be able to provide targeted learning based on their performance on tests. Students are placed in groups in mathematics lessons based on their learning needs.

Tests used do not always require written work, because students' literacy levels often hinder their performance in mathematics. Teachers can assess students through observations, recording of daily work, and discussions in small-group interactions, and results of these assessments become the basis of future learning experiences.

Teaching is targeted for the individual learners. Knowing where students are in terms of their mathematics provides evidence as to where teachers need to target their teaching. Working in small groups that are targeted for learning enables students to experience success and growth.

Often teaching focuses on building the skills of the poor-performing students. Grouping students so that their individual needs are taught to enables all students to have their learning needs met, including extension of higher performing students. Grouping is influenced by literacy, numeracy, attendance, and behaviour.

Behaviour is a key organiser for groups. All students need to be in environments where they can learn, so good on-task behaviour is essential. Building positive behaviours early helps to build a strong learning environment.



School demographics

Year range	K-12	FTE teaching staff	51.3
Total enrolments	592	Non-teaching staff	28
Location	Very remote	FTE non-teaching staff	22.7
ICSEA (school)	779	Indigenous students %	79%
ICSEA (distribution of students) *(bottom quarter to top quarter)*	58% | 23% | 15% | 4%	Enrolments: Girls/Boys	300/292
		Language background other than English	3%
Teaching staff	52	Student attendance rate %	69%

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