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

A Supportive On-line Tool for Assessing and Planning Mathematics

Association of Independent Schools Western Australia

The collection of Aboriginal Independent Community Schools (AICS) encompasses 13 schools across Western Australia. They are members of the Association of Independent Schools of Western Australia who provides support to Independent schools across the state. The AICS schools were established by their communities under community control as independent schools. The schools are independent and managed through a Board of Directors who are elected from within the communities. The Board has control over the general running of each school, including the employment of staff and programs within the schools.

The schools vary in size and composition, ranging from quite large schools of around 100 students and spanning F-12 and with 7 full-time teachers, through to quite small schools with only 2 teachers. Most of the schools are remote, and serve Aboriginal communities in the Kimberley and Pilbara. Goldfields and Esperance are not remote but include residential schools attended mostly by students from remote locations.

The AICS Numeracy Strategy initiative arose as a result of a governing bodies conference at which all parties voted and agreed for the implementation of the portal. The two main foci of the strategy were the professional development of teachers on quality mathematics education and the AICS Numeracy Portal.

Stories on remote Indigenous mathematics successes compiled by Professor Robyn Jorgensen

2014

Across the schools there had been a strong emphasis and focused effort on the use of Accelerated Literacy (AL) for their literacy programs, but there was a need for something in numeracy. Adoption of AL across the schools meant that a culture had developed around the approaches embedded in AL, such as strong scaffolding and the use of consultants who worked closely with the teachers in targeted ways. Initial ground work for the portal began in 2010 with consultants undertaking base-line data collection. The on-line tool went live in 2012.

The development of the AICS Numeracy Portal was based on a number of issues that are common to remote education. Typically, these include teachers who are new to the career; teachers from across Australia and internationally; teachers for whom mathematics is not an area of strength or interest; teachers who do not typically remain in remote schools for extended periods of time (although it is noted that the teachers in the Kimberley schools tend to stay the two years or more); and leadership teams that often include early-career principals (sometimes graduating from being a teacher in one of the AICS schools). The issues concerning students are similar to those in many other Aboriginal communities: Attendance rates in some schools are low; there is high transience between schools (and sectors); the home language is not English; and there can be challenging behaviours. Not unique to this context was the need for something that was sustainable and would be easily accessed by teachers to support them in their mathematics teaching and learning.

The AICS Numeracy Portal

The AICS Numeracy Portal is an on-line tool that has evolved from consultants working with teachers in remote schools. The tool is designed to support teachers through the provision of assessment tasks that are targeted for particular mathematical concepts and processes. This mathematics is mapped on a comprehensive scope-and-sequence chart. Teachers are able to identify learners' current levels of mathematical understanding and then access teaching ideas to scaffold targeted learning in order to bring about deeper levels of mathematical understanding. Teachers record students' progress via the portal so that as student transfer between AICS schools, their learning pathway is accessible to other teachers/schools.

Defining success

Because the portal has been developed to support teachers to support their students, there are three aspects of success for this initiative: learnings for teachers, learnings for students and learning for the Aboriginal Education Workers (AEWs).

Teacher learning

Teachers who have used the portal have gained considerable knowledge about mathematics, planning, assessment and learning. This has enabled them to better understand learning pathways for their students, to diagnose current levels of understanding, and to scaffold learning.

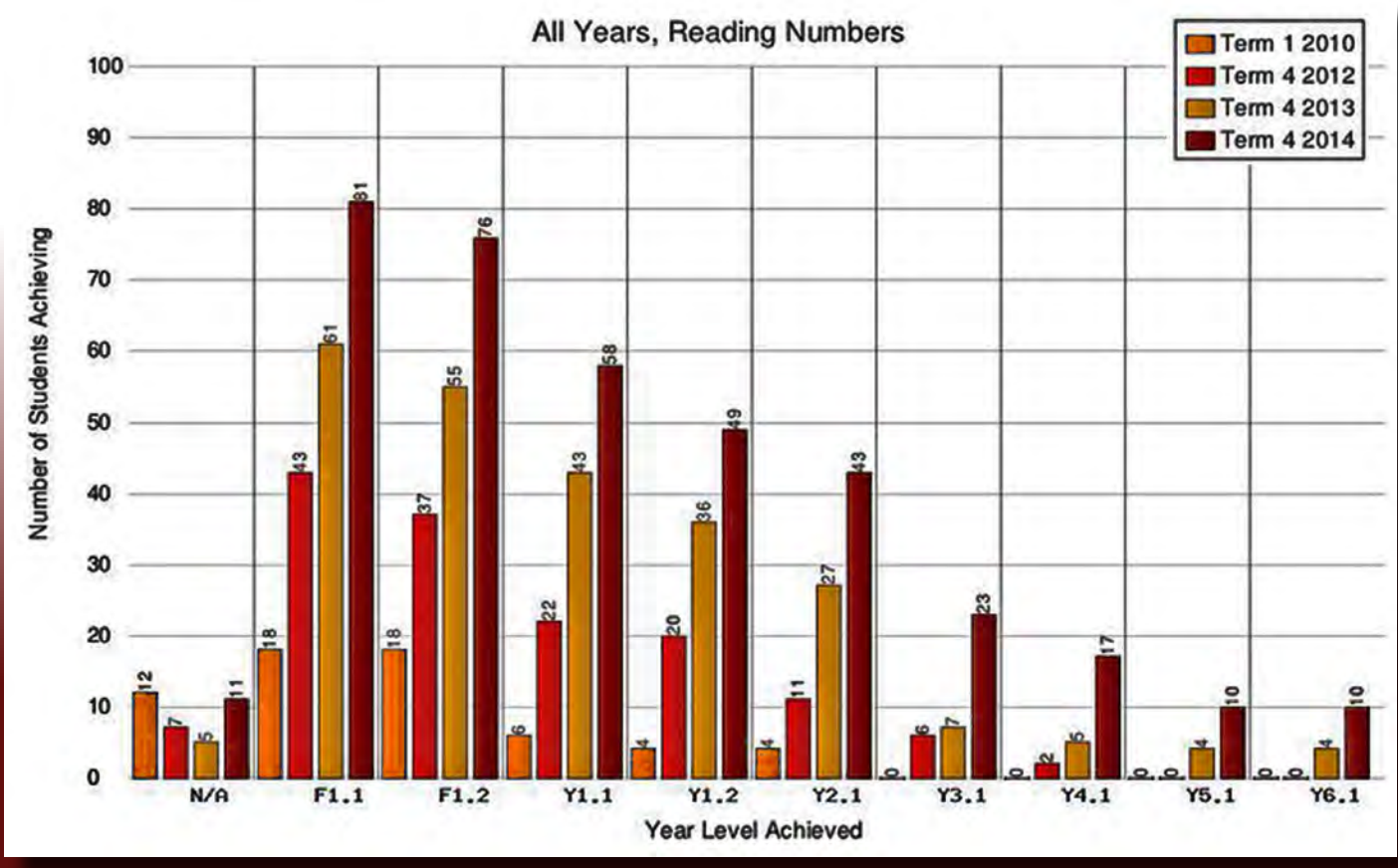
Student learning

When the initiative commenced, the mathematics achievement of students in the upper years of schooling, that is, Grades 9 to 12, often peaked around the Grade 3 level. Current assessment data show that, since the portal was implemented, the mathematics achievement of students in the upper grades has increased to the Year 6 level, thus suggesting that learning has moved three years for the cohorts. The fact that the portal allows recording of results for assessments that measure only up to the Year 6 level might hide the true extent of the students' learning.

It has been noted by teachers using the portal that student attendance is better than when the portal has not been used. This is thought to be due to the fact that the activities presented in the portal allow children to connect with mathematics and to learn; the resulting interest and confidence encourages children to attend school.

Aboriginal Education Workers (AEWs)

AEWs are also able to access the portal and have used the portal to enhance their learning in much the same way as the teachers.



The Numeracy Strategy

The portal evolved from a strategic investment that focused more on strategy than on the product. The funding for the Numeracy Strategy was acquired through the Closing the Gap initiative. Funding was for $1.8 million, and schools also allocated some of their recurrent funding to help with the strategy. The money was used to employ, for two years, five consultants across the regions served by AICS. Since the Federal funding has ceased, AISWA has redirected funds to continue with the on-going professional development of teachers and further development of the portal.

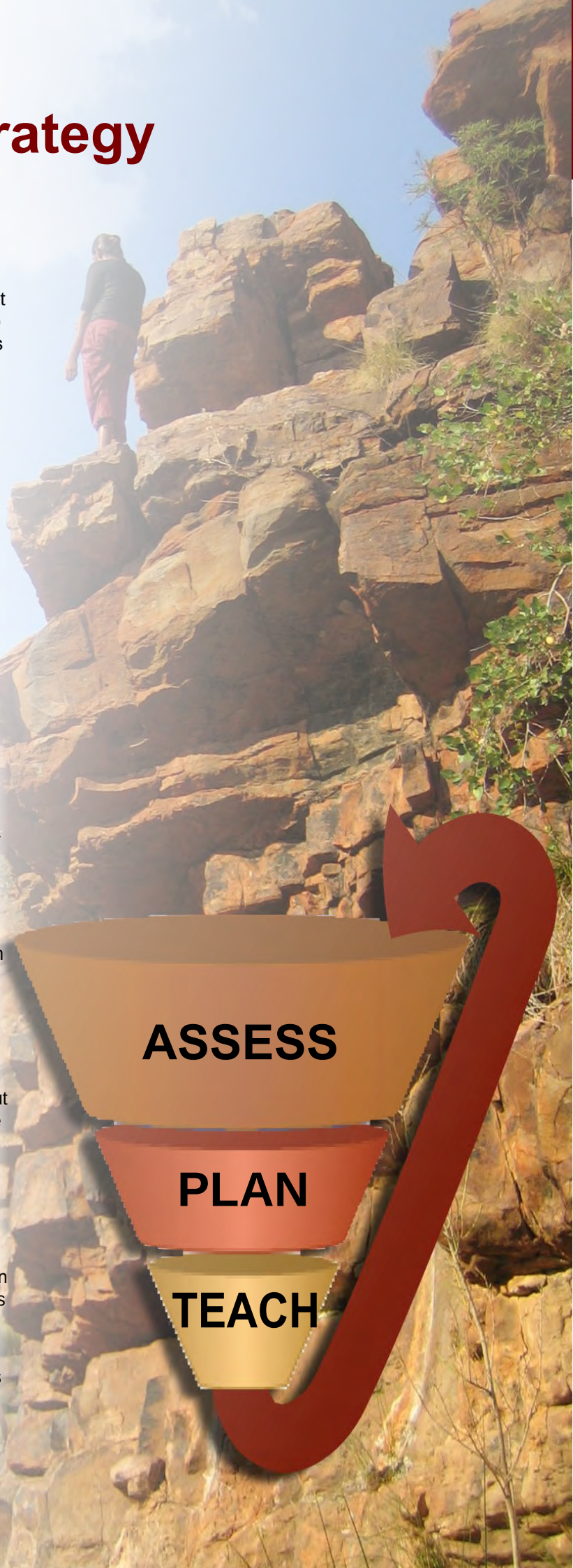
Getting started

The start-up of the strategy involved using and examining some of the existing practices used in professional development in literacy. At a general level in education, it is often assumed that what works in literacy education can be transferred to numeracy education, but this is not always the case. Because the demands of literacy are quite different from those of numeracy, other models for professional learning may be required. Modifying the practices that were inherent in literacy education consistent with something more suitable for numeracy was possible because the testing undertaken via the Numeracy Strategy provided evidence for the teachers to support/challenge various assumptions held with regard to learning numeracy. The Numeracy Strategy is very evidence based, so is underpinned by the assessment-for-learning approach. As a source of considerable data on the students, the Numeracy Strategy provided evidence as to the success (or not) of practices being adopted.

Part of the philosophy underpinning the Strategy was that teachers need to know what students know, so that they can target teaching to the needs of the learners. An assessment tool was needed to support teachers with this task. The first stage of development of the portal was the

concurrent writing of scope and sequence and the accompanying assessment tasks. It was not possible to write one without the other. The scope and sequence laid out the critical areas of mathematics across the year levels. The assessment tasks were written to help teachers to identify where students where up to in their mathematics learning in these critical areas. 'Critical areas of mathematics' were those aspects of mathematics that students absolutely have to know and understand if they are to continue to make progress in their mathematics. This was a significant task – to define these and to then to write them out in a progression in a way that was easily understood by early career teachers was significant work. These documents where then trialed and reviewed by the team.

The assessment tasks identify key learnings in mathematics rather than all learnings. These key learnings are the ones that are critical for learning. Often referred to as or big ideas in mathematics, the key areas were identified through a comprehensive analysis of key documents that inform mathematics teaching – First Steps in Mathematics



Diagnostic Map, WA Numeracy Net; WA Progress Maps, Australian National Curriculum (draft version); the NZ Numeracy Strategy framework; the NCTM Principles and Standards for School Mathematics and Victorian Essential Learnings (VELS).

An iterative process was undertaken by the Numeracy team writing the Scope and Sequence continuum and the tasks. These were then trialled by the whole team, who reviewed the items and then they were rewritten based on their findings.

Professional Learning

Initially First Steps in Mathematics was used as a resource for teachers until the team had developed their own document. The first draft Scope and Sequence and the assessment tasks were introduced, and then linked with First Steps. Teachers then planned programs of work for students based on baseline data, using First Steps. The focus was on:

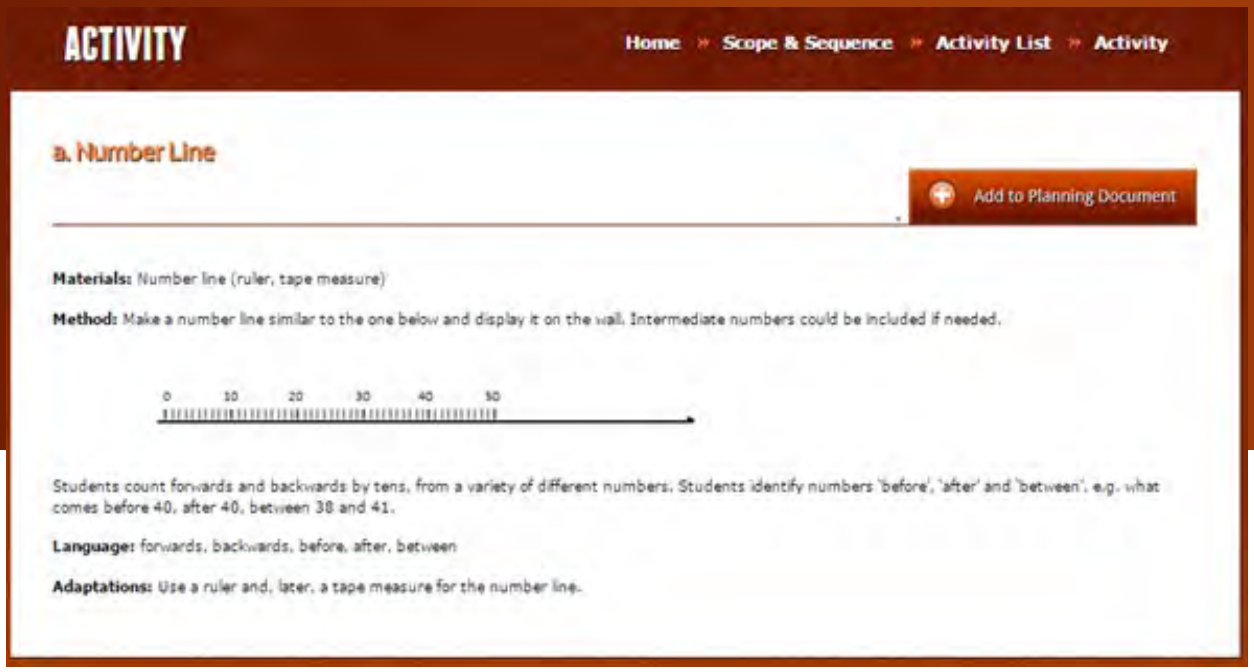
- using data to plan;
- helping teachers to develop a deeper understanding of the mathematics they would be teaching; and
- introducing the assessment tasks and the Scope and Sequence.

Now that the Strategy is well developed and embedded in many schools, teachers undertake two days of intense exposure to the Strategy and Portal prior to the commencement of the teaching year, in either Perth or Fitzroy Crossing. Approximately 75% of the two days is spent working on the Portal so that teachers can become familiar with the technology and how it can be used in their day-to-day work once they return to their communities. Initially, teachers look at assessment, the scope and sequence profiles, what they should be teaching, and what activities can be used. The following sessions focus on the features of a quality lesson. By the end of these two days, teachers are familiar with the Portal and have been able to build lessons for their first few weeks in their schools. This is very comforting and empowering for the teachers. As student data has been entered into the Portal, teachers have a reasonable idea of their students' levels of mathematical understanding. These activities are undertaken within the clusters of the AICS schools across the state. A major focus in the first two years was also on doing PD at the school during a visit. This was tailored to the needs of the school. This has become less of a feature over the last couple of years with less consultant time available. Last year, with the introduction of the Numeracy Leaders role in the school, the idea was that the schools would have ongoing support within their school, and therefore would not need the professional development from the external consultant. In 2014 the role has met with limited success as most schools have been unable to provide classroom release time for the Numeracy Leader.

Of particular concern is the need for professional learning at the point of most need – in the schools. When there was sufficient funding from the Closing the Gap funds, a team of consultants aimed to spend one week in each school in each term. This was a costly enterprise but proved to be a valuable approach in terms of teacher and student learning. AISWA still proactively supports this model. School site visits were undertaken by the numeracy (and literacy) consultants and the forms of support offered in the schools were dependent on the needs of the individual teachers. Consultants provide support by informally observing classrooms and providing teachers with feedback on how to improve their practice, modelling good teaching practice, working with teachers on their assessments of students in order to establish what students know, and helping teachers build plans to work with their students. Although there had been a culture of consultants assessing the students (from the AL model), the Numeracy Strategy takes the approach that teachers need to assess their students so that they are empowered by the knowledge of what their students are doing, thinking, and understanding.

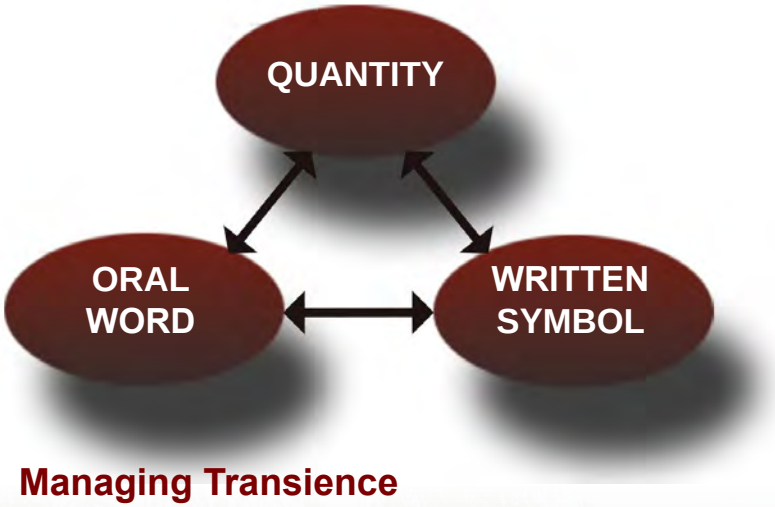
The emphasis of the professional learning built into the workshops and the work with teachers in context is that teachers' first task is to ascertain what their students know. Teachers use this data in order to plan lessons to meet the needs of their students, providing efficient and effective, focused teaching, allowing students to move on in their mathematics understanding. This approach, whereby assessment is the starting point of teaching, is initially quite challenging for teachers because, for many, assessment had traditionally been the end point of teaching.

Professional learning has also focussed linking home language with mathematics language within the classroom. Two numeracy consultants and an AEW worked across 3 communities in the Kimberley to explore the relationship between home and school language in mathematics. Tasks were initially given to the children in English. If they were able to successfully complete the task it was assumed that they understood the mathematics behind the task. Where students could not answer the task correctly the AEW would then pose the task in Kriol. If the student could then complete the task it was assumed that language was the mitigating factor. This process enabled the team to develop a richer understanding of language factors impacting on mathematics. These learnings have informed subsequent professional development sessions with AICS teachers and provide support within the Maths Book (theory section) and the activities on the portal where language is a high priority. We have worked extensively with AEW's in this areas to encourage collaboration between teachers and AEW's to help students to engage more fully in the language of the mathematics lessons.



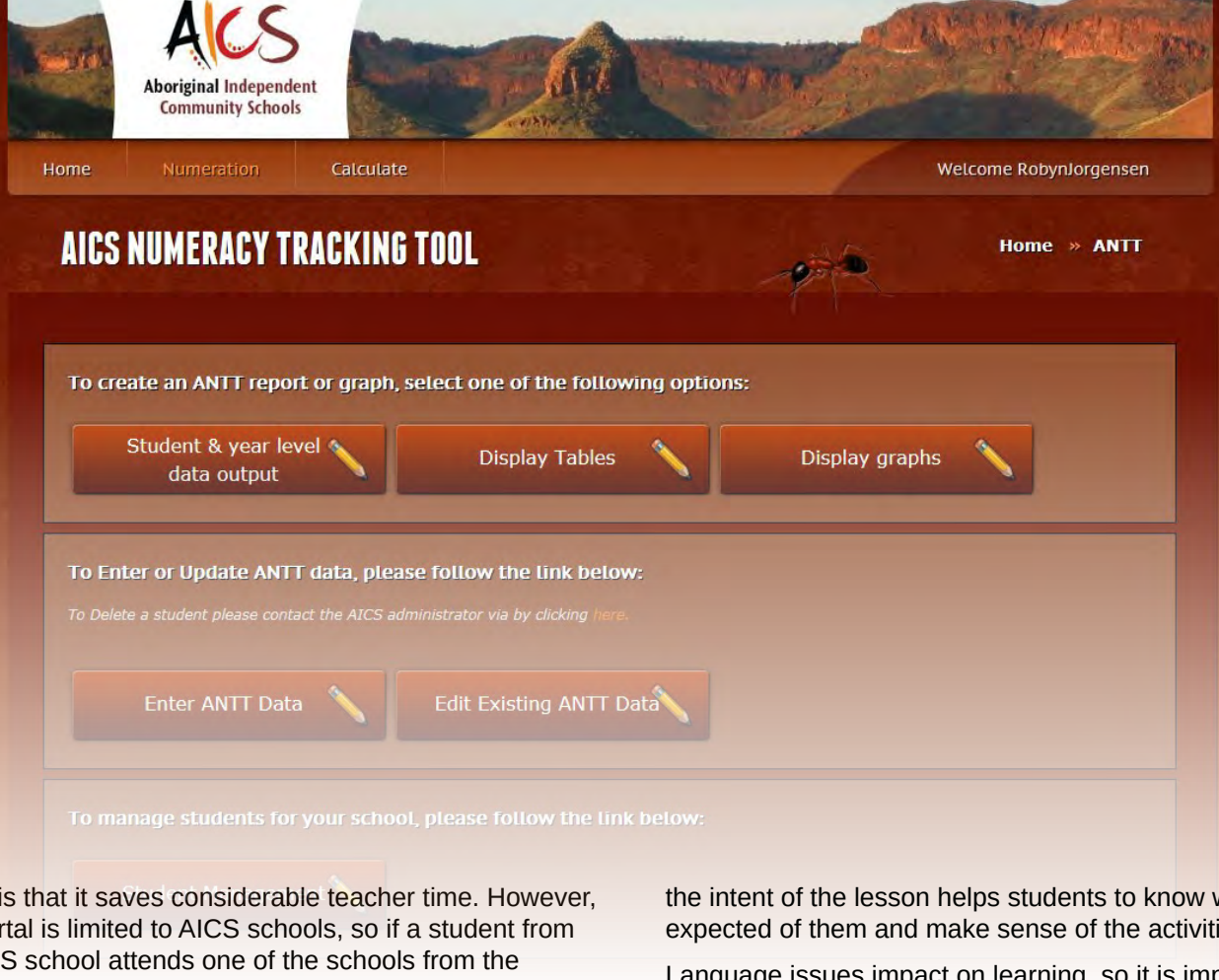
It became evident during school visits that teachers were not embracing the three modes of representation in mathematics and this was then built into the resources and overall program. This is a very common model used in most mathematics education courses where it is anticipated that teachers provide students with the three modes of representation and that it is important to make links between these modes of representation. A common (mis)conception is that Aboriginal learners are oral learners. Consequently, teachers often modelled and promoted the use of oral language at the expense of the written representation. For this reason, one focus of both the professional learning and the portal is to encourage teachers to build mathematical writing into their teaching.

Another focus of the professional learning experiences is scaffolding student learning. One of the dilemmas of the writing for the Portal was how much scaffolding is needed for teachers. Providing prescriptive lesson has the potential to limit the choices that teachers can make in terms of the learnings for their students. To this end, teachers were supported through a tool that enabled them to create a planning document based on analysis of their student data and their understandings of the mathematics they needed to teach. This was populated directly from the Maths Book (for the focus of the lesson) and Activities section.



Managing Transience

Many indigenous students in remote communities travel between schools, and the Portal assists teachers to cater to these transient students. Specifically, because students' achievements are recorded in the Portal, teachers at AICS schools are able to download the performance records of students who have newly arrived from other AICS schools. This valuable attribute of the Portal helps teachers to quickly plan for the needs of their learners. The strength of the portability of assessment among the users of the



Portal is that it saves considerable teacher time. However, the Portal is limited to AICS schools, so if a student from an AICS school attends one of the schools from the Catholic or State sectors, their learning is not recorded or transferred.

Good Lesson Structure

The Numeracy Strategy encourages teachers to develop lessons that are focused on the needs of learners. There is considerable variance within a classroom, so activities need to be tailored for all learners within a class. The pedagogies that a teacher uses may vary, but being focused on what the students need to learn means that teaching is targeted for a particular concept or process.

Lessons within the Numeracy Strategy should begin with some activity that will orientate the students to the fact that the lesson is a maths lesson, and to the specific purpose of the lesson. This orientation may be as simple as reminding students what was done on the previous day. Specifying the intent of the lesson helps students to know what is expected of them and make sense of the activities.

Language issues impact on learning, so it is important to consider what language will be used in a lesson. As most of the students' home language is different from school language, both the language of mathematics and English as the medium of instruction can create challenges for learning. During the planning process, consideration of language challenges enables teachers to be aware of areas that may need to be explicitly addressed. For example, in a lesson on money, children were asked how many silver coins could be used to make a particular amount. The students then used dollar coins in their responses. It is commonplace in some Aboriginal languages for 'silver' to refer to any coin, rather than the silver coins in the money system. Thus, confusion results from difficulties with language, rather than the mathematics per se.

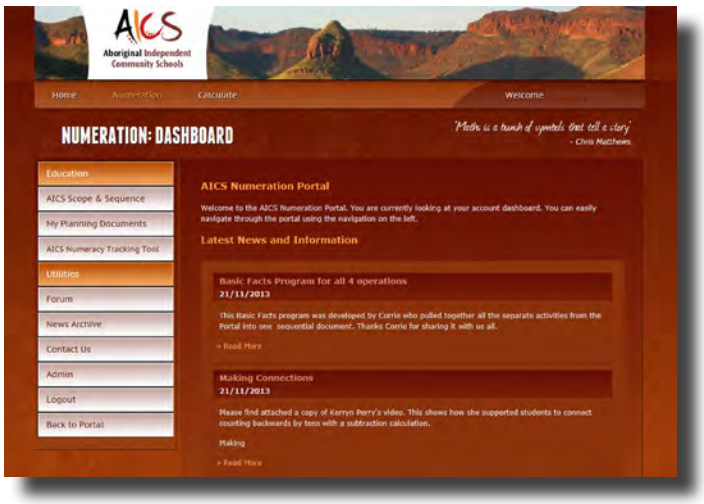
The Portal

The AICS Numeracy Portal provides two main functions for AICS teachers. First, it provides a tool for managing planning and enables teachers to identify good ways to plan for learning. Second, it acts as a monitoring tool (ANTT), as teachers are able to enter and retrieve student data.

Teachers have found the Scope and Sequence is perhaps the most useful aspect of the Portal. They find that it gives them the big picture of where the students have come from and where they should be heading. Some teachers only use this and do not use the other aspects of the portal, choosing to use other resources in order to teach the next concepts in the sequence.

The Portal as a Planning Tool

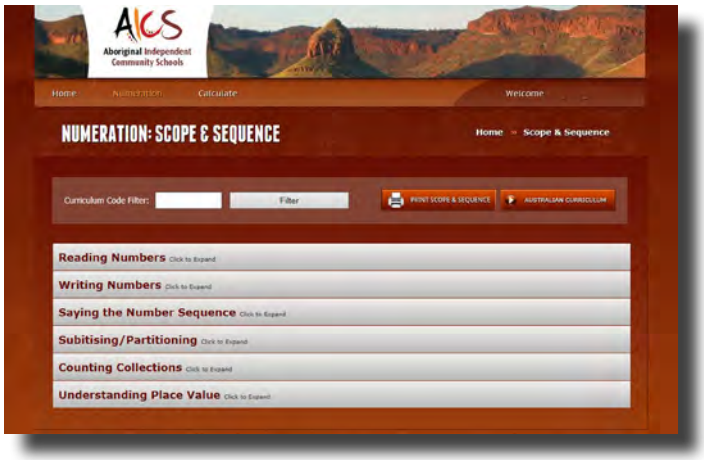
Teachers are able to access assessment tools, background (theory: mathematics content knowledge, and how students typically learn), and activities to support their planning.



Within the portal, there are different areas to be addressed. Within the Numeration Scope and Sequence, there are 6 key areas:

- Reading numbers
- Writing numbers
- Saying the number sequence
- Subitising/partitioning
- Counting collections
- Understanding place value

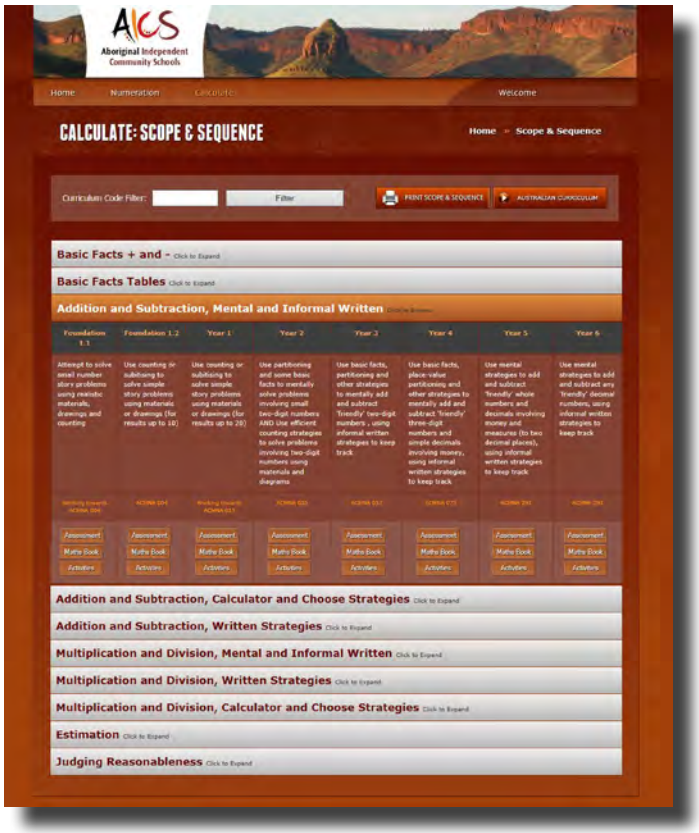
For each key area, important learnings for each year are described.



For the Calculate substrand, the key areas are:

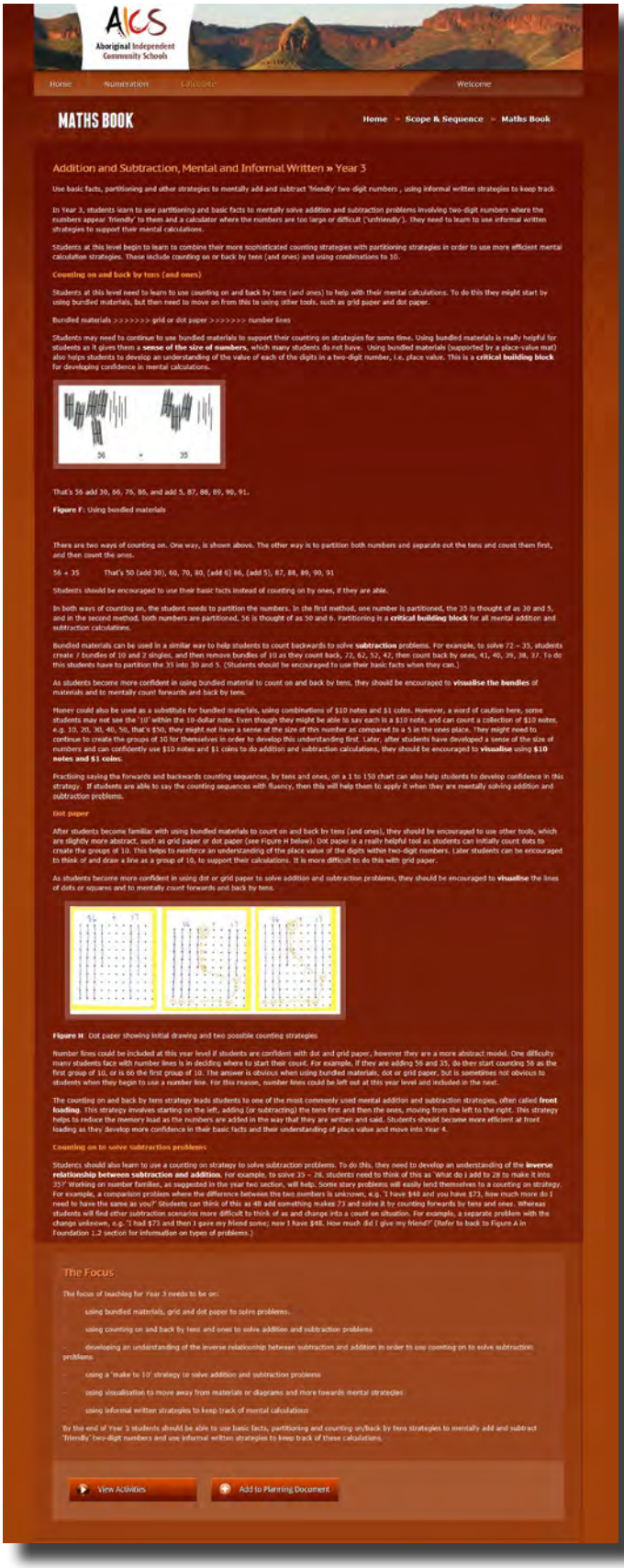
- Basic addition and subtraction
- Basic facts tables
- Addition and subtraction: Mental and informal written
- Addition and subtraction: Calculator and choose strategies
- Addition and subtraction: Written strategies
- Multiplication and division: Mental and informal written
- Multiplication and division: Written strategies
- Multiplication and division: Calculator and choose strategies
- Estimation
- Judging reasonableness.

Concepts within each of the topic areas are targeted for specific year levels, and this is indicated on the portal. For example, selecting the “basic facts tables” concept shows that this concept is likely to be introduced around Year 3.

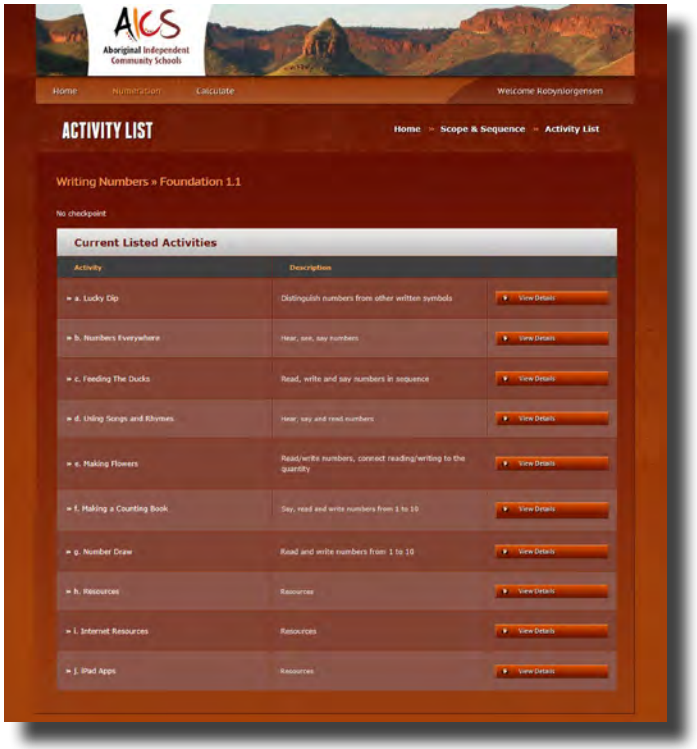


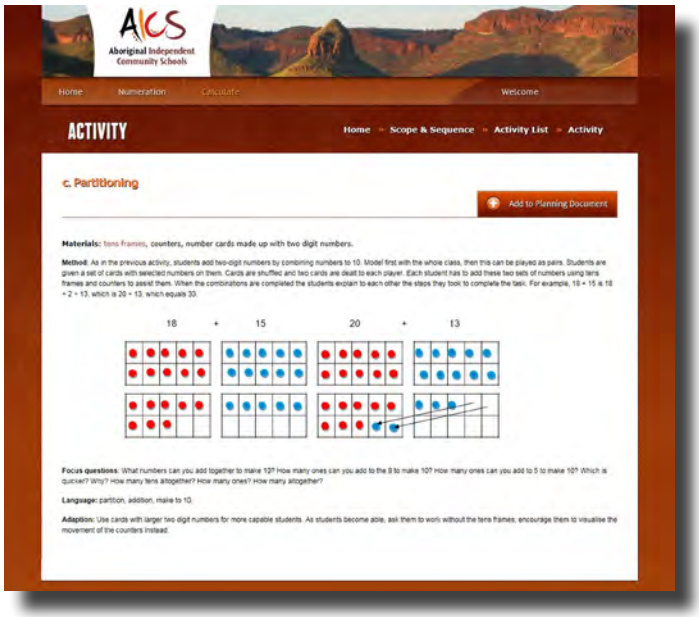
From here the teacher can then click on the options for the nominated year level to view assessments for that year level.

The teacher is then able to select the ‘maths book’ option, which provides background information about that concept and how to teach it. Essentially, the maths book is a type of manual that provides teachers with the theory behind many aspects of teaching mathematics. This helps teachers to be better informed about the practices that are introduced through the Portal.



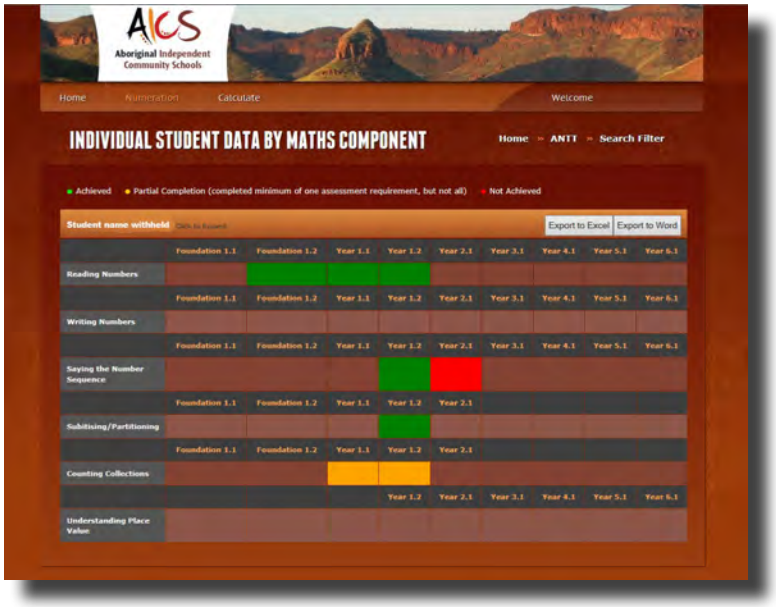
From this section, the teacher can then move to the 'activities' section that provides a wide range of activities that can be used as targeted teaching. The activities are explained with sufficient detail to enable the teacher to carry out the lesson. The lessons are aligned strongly with the assessment. This support of focused teaching is an important element of the Portal, because it is widely recognised that high-quality teaching is clear in terms of the mathematical intent of the lesson – a characteristic that is often missing in teaching. The Portal ensures that the teaching activities correspond with the learning intent of the Scope and Sequence areas.

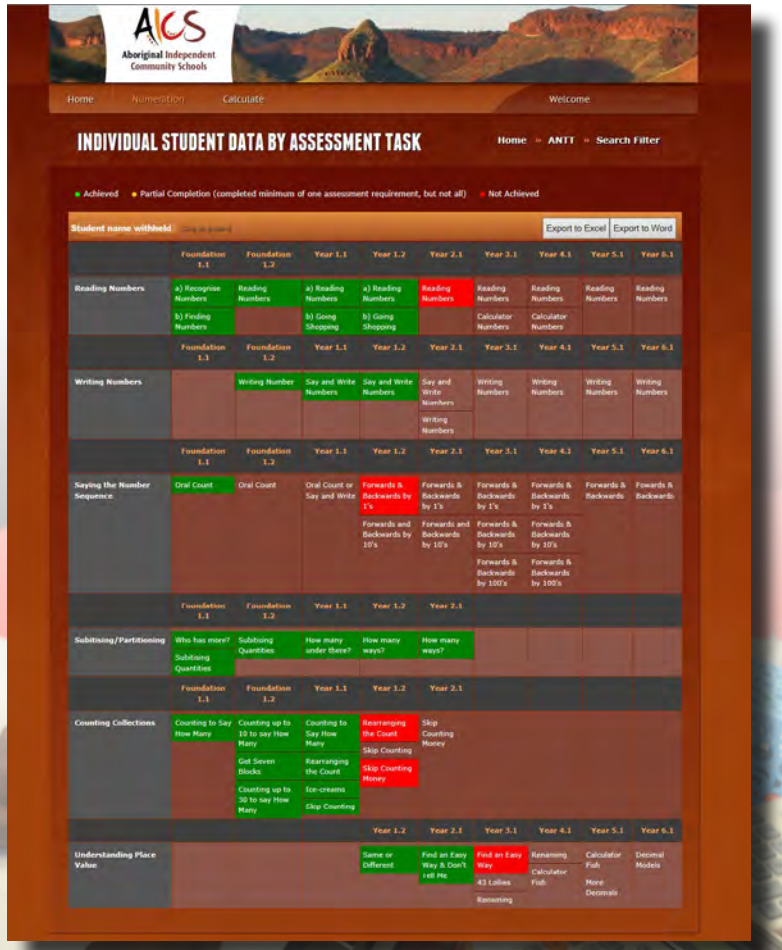




The Portal for Monitoring Student Learning

The other key benefit of the Portal is that student learning is recorded and uploaded. This helps teachers to readily observe what students know, what they need support with, and their learning trajectories. Entry of student performance on an assessment item has been made easy for the teachers: They select the mathematical component, then the year level, and then the assessment item, and then they enter the result. The portal uses a colour-coding system for each component: Green indicates full understanding, that is, the student has successfully completed all assessment tasks for that component; yellow indicates partial understanding, usually achieved when the student has passed one or some of the assessment items for that component; red indicates that the student failed the assessment tasks for that component; and gaps indicate that no assessment has been done in that area. This display, shown below, can be a ready reckoner, as it is easy to see what has been assessed and passed, and what needs more teaching.





There are several different ways of looking at the data are possible. First, teachers can generate reports of students. To do this, they enter the year level of the student, click on names, and then they can easily see what the student has achieved. In the report below, the grey column lists the mathematical concepts, while the horizontal axis lists the year level. To achieve a green in a year level, the student must successfully complete all assessments for that year level.

For a more detailed analysis, teachers are also able to run a report that shows the tests that were completed. This is shown in the figure below.

Teachers are able to generate reports about individual students, groups of students, and whole classes. For example, reports can be generated by the highest level of achievement for students in a particular year level.

Benefits for Learning and Learners

As the underpinning approach to the Numeracy Strategy was to have data-driven practice, the Portal provides support for teachers to identify the learning needs of individual students and then to plan for targeted and scaffolded teaching. Targeted teaching means that teachers are able to support students in productive ways, even if attendance is irregular. In most communities, when students are in community, they attend school. Irregular attendance is most often due to the students being away from the community. The targeted teaching means that the teaching during the time that students are attending schools is very specific to the needs of the learners.

Many teachers in remote schools may have been trained in secondary education, and may be specialists in non-maths areas such as arts or music. For these teachers, learning to teach mathematics to learners who are predominantly working in the primary years requires significant learning – both of mathematical content knowledge and pedagogical content knowledge. Through the highly scaffolded environment of the portal, assessments align with Scope and Sequence continua, so teachers are able to see the progression of mathematical concepts and processes. The focused activities help teachers to undertake teaching that is targeted for the particular concepts and processes that have been identified through the testing. These connections have been carefully developed through the Portal and help both teachers and students to learn mathematics.

Advice to Teachers

It is important to start teaching at the level of where the students are currently working. Being able to identify what students know and then scaffolding learning from this point is crucial to teaching, particularly when students' attendance is sporadic. There is limited time to create learning opportunities, so such opportunities need to be targeted at the needs of the learner. Data needs to drive teaching. Knowing what students already know, then mapping on scope and sequence continua, enables teachers to undertake teaching that is focused at the needs of the students.

Focused teaching activities that align with the goal of the teaching episode are essential. Teaching must be targeted to the particular mathematics concepts/ processes that needs to be taught.

Teachers must recognise that language factors impact on learning. The difference between the home language and the language of the school mathematics can create barriers, so explicit teaching of language is important. Classrooms should be language rich with good scaffolds around the room to act as support for learners.

Key messages — summary

This initiative is different from others that have been detailed in the Remote Numeracy Project. It is a systematic approach to what are well recognised and documented challenges for remote education provision – early-career teachers, transience among students, short stays of teachers, professional learning and mentoring of teachers (particularly early-career teachers), sometimes low levels of mathematical understandings of teachers, and the need to provide support to teachers as they plan for learning.

The Numeracy Portal has been informed by research in its design and then refined through the provision of feedback from the end users.

The Numeracy Strategy is based on evidence – teachers need to start with assessment to identify students' learning needs. From this evidence, practices are developed for targeted and scaffolded learning. In addition, the evidence documents the success of teaching.

The strategy advocates a particular lesson structure for teachers. This model of lessons helps to focus mathematics learning and to scaffold the learning of the students.

The Scope and Sequence of mathematics has provided teachers with a model to show how mathematical concepts are developed so that they are better able to design appropriate learning experiences that are targeted for students' levels of understanding and to then extend that learning to new levels of mathematics.

Teaching that is targeted to the needs of the student is key – remote students frequently have poor attendance, so teaching must make the most of the time that students attend school. Providing tools to support teachers to undertake this work, and to keep records of student achievement, helps to build teachers' confidence and knowledge of mathematics education, while supporting students' learning of mathematics. Knowing the learning needs of the students enables teachers to target teaching and learning so that there is best use of time in school.

School demographics

Year range	x	FTE teaching staff	0
Total enrolments	0	Non-teaching staff	0
Location	Very remote	FTE non-teaching staff	0
ICSEA (school)	0	Indigenous students %	0%
ICSEA (distribution of students) (bottom quarter to top quarter)	100% in lowest quarter	Enrolments: Girls/Boys	0/0
		Language background other than English	—
Teaching staff	0	Student attendance rate %	0%

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