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## Aboriginal Independent Community Schools Numeracy Strategy

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## Summary

The Aboriginal Independent Community Schools (AICS) Numeracy Strategy is a comprehensive approach to improving remote Aboriginal students' learning in mathematics through the development of substantial online resources and the support of systemic Numeracy Consultants. The specifically designed and developed online portal provides support, structure and resources for teachers to work diagnostically to assess students' prior learning, and to then develop appropriate learning experiences. Also, the online portal includes a tracking tool to record and help analyse student progress. Alongside the online resources, Numeracy Consultants provide professional development and ongoing support for teachers, principals and the Aboriginal Education Workers.

The Numeracy Strategy is designed to meet specific issues identified by the principals and governing bodies of the Aboriginal Independent Community Schools (AIC schools). The overall objective is to improve the numeracy levels of low-achieving students in a cluster of AIC schools in Western Australia. More particularly, the school communities want their students to better understand money and time, and be able to participate fully in community and work-related life when they leave school.

The Numeracy Strategy was built on a firm premise that in order to improve student outcomes, it is imperative to focus on improving teachers' knowledge of mathematics content and pedagogy.



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Locations of Aboriginal Independent Community Schools in Western Australia © AISWA



### Detailed description of map

School name	Location
CAPS – Coolgardie	Coolgardie, 580 km from Perth and 40 km from Kalgoorlie
CAPS – Kurrawang	Between Coolgardie and Kalgoorlie
CAPS – Wongutha	Gibson, about 20 km north of Esperance
Karalundi Aboriginal Education Community	East of Carnarvon, 60 km north of Meekatharra, on the Great Northern Highway
Kulkarriya Community School	East of Broome, on Noonkanbah Station, 170 km south-west of Fitzroy Crossing
Nyikina Mangala Community School	West Kimberley, about 120 km south-east of Derby off the Great Northern Highway
Parngurr Community School	370 km east of Newman, on the edge of the Great Sandy Desert
Purnululu Independent Aboriginal Community School	East Kimberley, at Frog Hollow
Rawa Community School – Punmu	600 km east-south-east of Port Hedland, Great Sandy Desert
Strelley Community School	At Strelley 60 km east of Port Hedland; and at Warralong 160 km south-east of Port Hedland
Wulungarra Community School	West Kimberley, south-east of Fitzroy Crossing on the edge of the Great Sandy Desert
Yakanarra Community School	West Kimberley, 80 km south of Fitzroy Crossing
Yiyili Aboriginal Community School	East Kimberley, 170 km south-east of Fitzroy Crossing



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## Target student group

This strategy focuses on 12 AIC schools in regional, remote, and very remote parts of Western Australia. In total, there were 12 principals, 56 teachers, 30 Aboriginal Education Workers, and 741 students from kindergarten through to year 12.

All the students were Aboriginal and, almost without exception, below national standards for numeracy.

## Method

An understanding of numbers is the basis for learning in most areas of mathematics, and is also needed to function in adult society. With this in mind, the Numeracy Strategy focuses on the critical aspects of number that students need to learn at each year level from kindergarten to year 6. This involves improving students':

- understanding of the way the number system works
- ability to do mental and written calculations
- capacity to use a calculator effectively
- judgement of the reasonableness of their results.

The AICS Numeracy Strategy is a targeted program designed to help teachers work out what mathematics students know and what they need to learn. Teachers are supported to use data to plan efficient and effective lessons to accommodate the needs of their students. The Numeracy Strategy included an online portal; professional learning for teachers, principals and Aboriginal Education Workers (AEWs); and, in-school and remote support.

The online portal is the hub for the resources and data, and schools only had access to their own student data. Foundational to the strategy are two scope and sequences – one for Numeration and another for Calculations – that outline the critical aspects of mathematics that students need to learn at each year level from kindergarten through to year 6, and are directly linked to the Australian Curriculum. The scope and sequences are the access point for the assessment tasks, and for the mathematics content and activities. In this way, the assessment tasks, mathematics content and the activities are directly linked to the mathematics needed to move students through each year level.



AICS online portal showing the Numeration scope and sequence © AISWA

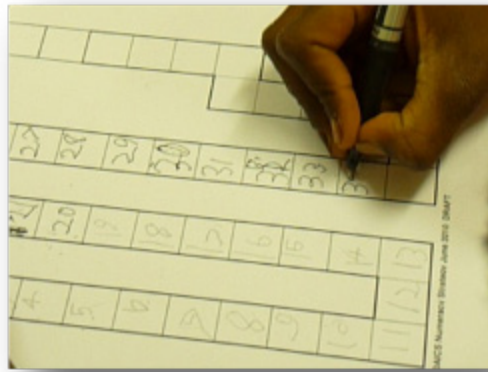
A range of resources were accessible through the online portal, including the following:

- **Diagnostic Assessment Tasks** that were developed to identify what students know and what they need to learn. The assessment tasks included instructions, a recording proforma, examples to help teachers identify student's current level of knowledge, and common misconceptions.
- **The Mathematics** where the mathematics content that the students needed to learn was explained, and pedagogical approaches are outlined. It also contains summaries of relevant recent research in the areas of Indigenous mathematics and learning mathematics in a second-language environment.
- **The Activities** that are well-planned and targeted, and written specifically for the Aboriginal students in the AIC Schools. The English language words that students need to understand in order to undertake each activity are specifically listed.
- **The Planning Tool** that could be used to create and systematically file a range of planning documents. The planning documents could be downloaded into a Word document so that teachers could personalise them.
- **The AICS Numeracy Tracking Tool (ANTT)** that allowed teachers to track student progress; teachers could also create a range of reports to show student progress.



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To assess student performance, classroom-based diagnostic assessment tasks were specifically developed for students in the AIC schools. The tasks assessed each of the identified critical aspects of the number curriculum at each year level from kindergarten to year 6. The tasks included a set of instructions and a description of what constitutes evidence. Many of the assessment tasks were interview style, while others were small-group or whole-class tasks. AEWs translated from home language to English when needed. The students were given a task the teacher felt appropriate, and asked to complete it until they could not go any further. If necessary, a lower level task was administered. In this way, a students' highest level of understanding was noted, and the data recorded on the ANTT.



A student completing a number-sequence assessment task © Kaye Treacy

At the school level, individual student's data can be used to monitor their improvement across various time periods. Principals can use this facility to report student progress to the schools' governing bodies and to parents. Also, the data from across all of the schools was aggregated in order to monitor the effectiveness of the strategy. Some baseline data was gathered at the start of the project, and the assessment tasks were reviewed based on the data, and on feedback from principals, teachers, AEWs and students.

Initially the Numeracy Consultants administered the tasks, with the teachers and AEWs observing. Over time, teachers were encouraged and supported to administer the tasks themselves. This was an integral part of the teacher professional development that was built into the project.



The AICS Numeracy portal allows student data to be easily moved from one school to another, which reduces the impact of the transient nature of the school communities. This means that when a new student arrives in a school, teachers can go onto the portal, search for the student and transfer all the accumulated data from that student's previous school, simply by clicking a tab. The teacher knows straight away what that student needs to learn next. Accessing student data in this way allows teachers to start working immediately on targeted activities that meet the needs of each student. This is particularly helpful for the residential schools in the south of Western Australia, where many of the students go for high school.

## Results

This strategy contributed to a major extent to improved numeracy outcomes for the students in the schools. Although NAPLAN data for schools with very small student numbers is problematic, the results from the two larger schools are showing measureable improvement:

- Yiyili's 2011 data showed progress at the year 5 level. Students were 'substantially above' similar schools, whereas in 2009 they were 'below'. There were not enough students to register results for years 3 and 7.
- Kulkarriya's 2011 data showed that all year levels are 'close to' similar schools, instead of 'substantially below' as in 2009.

Classroom-based diagnostic assessment tasks were used to gather baseline data in February 2010, and this was compared to data from November 2011. Students from kindergarten to year 12 were assessed using teacher-selected tasks to suit the particular needs of the students, so all students were not assessed on every task. The data, as recorded in the ANTT, showed considerable progress, despite the fact that some of the tasks became harder; for example, decimals were added after the initial trial.

The aggregated data showed that students had an improved understanding in each of the included aspects of Numeration. For example, the amalgamated data for Reading Numbers showed an improvement across all year levels. In 2010, 24 per cent of the students from K–12 were working at or above year 3 level – that is, they could read and interpret whole numbers up to 9,999 and decimals involving money – whereas in 2011, 42 per cent were working at or above year 3 level, and this is even more noteworthy because the assessment tasks had become more difficult with the inclusion of decimals.





Also, after two years of the project, 18 per cent of year 8, 22 per cent of year 9, 31 per cent of year 10, 15 per cent of year 11 and 21 per cent of year 12 students could interpret decimal numbers to three decimal places (which is year 6 standard in the Australian Curriculum). This shows a marked improvement, because at the start of the project in February 2010 there were no students at this level.

Individual year groups also showed substantial improvement, as shown by the data for the students at the pre-primary level.

**Table 1: Improvement of students at pre-primary level 2010–2011**

Beginning of 2010	End of 2011
81% of pre-primary students were <b>not</b> able to recognise numbers in their environment.	78% of pre-primary students <b>could</b> recognise numbers in their environment.
19% of students <b>could</b> recognise numbers in their environment.	47% of students <b>could</b> read number symbols up to 10.
4% of students <b>could</b> read number symbols up to 10.	16% of students <b>could</b> read numbers up to 50.
	9% of students <b>could</b> read numbers up to 109 (Australian Curriculum standard for year 1).

Similar data was gathered in the other areas of Numeration, and showed similar results across the two years.

Name damian Year/Grade 2 Date 7/3/12

Count by ones and write the numbers to the end of the boxes

106	107	108	109	110	111	112	113	114
115	116	117	118	119	120	121	122	123

124

In March, Damian, a year 2 student, was unable to say or write the number sequence beyond 119.



Name Damian Year/Grade 2 Date 4/9/12

Count by ones and write the numbers to the end of the boxes

106	107	108	109	110	111	112	113	114
115	116	117	118	119	120	121	122	

394	395	396	397	398	399	400	401	402
403	404	405	406	407	408	409	410	411

895	896	897	898	899	900	901	902	903
904	905	906	907	908	909	910	911	912

996	997	998	999	1000	1001	1002	1003	1004
1005	1006	1007	1008	1009	1010	1011	1012	

In September, Damian had learnt how to say and write the number sequence up to 1,012.

## Lessons learned

The centrepiece of this initiative was the online portal that was specifically designed for the schools involved. The development of the portal, and the associated professional development support, required a substantial investment. Without this financial support, the strategy would not have happened.



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Apart from the financial support, the success of the AICS Numeracy Strategy was grounded in some key factors. These included:

- developing resources specifically to meet the learning needs of the students in the participating schools (in this case, remote and very remote Aboriginal schools)
- having assessment tasks that related directly to the mathematical concepts involved
- ensuring communities, schools and teachers were intimately involved
- including the AEWs as key people in the process
- providing in-school and remote support from consultants
- focused professional learning for teachers, AEWs and school leaders.



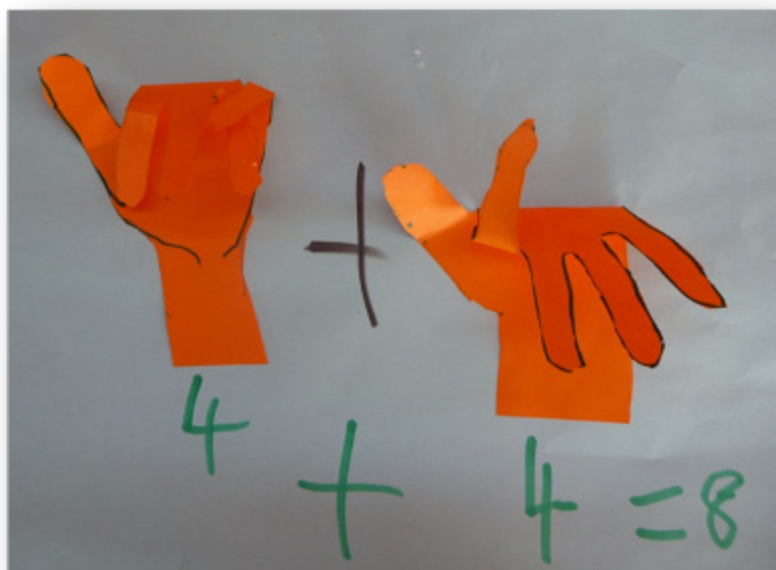
Activities were designed to meet students' learning needs © Kaye Treacy

The development of high-quality resources was the most critical aspect of the strategy. The learning and assessment tasks were developed specifically to meet the needs of the students, teachers and AEWs in the AIC schools. To this end, the resources were grounded in current educational research with Aboriginal learners and connecting home languages with mathematical language. As well as providing students with rich learning tasks, it was also important that the resources supported teachers to develop their understanding of how students learn the critical areas of the number curriculum. In particular, it helped teachers make explicit to their students the connections between the oral and written versions of numbers and the quantities they represent.



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The ongoing data collection process, and tracking student progress with the ANTT, allowed teachers to easily identify what mathematics their students knew and what they needed to learn. This data-driven approach helped teachers to engage in deeper learning about the mathematics, and provide more targeted teaching.



Student work sample showing a partitioning activity completed after reading *Ten Little Fingers, Ten Little Toes* by Mem Fox © Kaye Treacy

Right from the start, the AICS Numeracy Strategy was designed to address the learning needs identified by the community leaders. Furthermore, the strategy was comprehensive, as it involved school and community leaders, teachers and AEWs having input at appropriate stages. Without this input, involvement and buy-in, it is unlikely that the project would have been as successful.

Through this project, the critical role that AEWs can play in the mathematical learning of Aboriginal students has been a focus. AEWs are important role models for students in AIC schools, and often provide continuity and stability in the schools. Furthermore, the AEWs are more than mere teacher aides; they bring particular understandings of the students and their language, cultural and community backgrounds.



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Through the AICS Numeracy Strategy, many of the AEWs used the Mathematics section of the resource to help get a better understanding of the mathematics for themselves and to understand how students learn mathematics. Several AEWs stated that after looking at the Numeracy portal activities they not only understood what the teacher was trying to do but they understood the mathematics better as well. This was a consequence of the mathematics and activities being written in a style and language that was easily understood, and the scope and sequence being focused on only the critical aspects of the mathematics curriculum.

This session has really helped me as a novice teacher to understand the maths needs of my students. Also to consider in depth what students know and what they need to know. (Teacher, after professional learning seminar)

The professional learning, and the in-school and remote support from the consultants, helped the teachers to use the resources to become more efficient and focused in their teaching. The professional learning was designed to enhance teachers' knowledge of content and pedagogy. While it was imperative to provide all the resources through the online portal, effective use of the material in the classroom was only possible if the teachers were able to develop the knowledge, strategies and confidence to actually adopt them. In the first two years of the project, the consultants provided the professional development on a regular basis. This included sessions with clusters of schools together at centralised locations, and after-hours sessions at the school sites.



Teachers using the AICS online portal during a workshop © Kaye Treacy



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Also, the consultants provide professional development for others involved, and in particular the AEWs. Not all schools have the support of AEWs to work in mathematics classrooms on a regular basis. However, where possible, AEWs were provided with training to support them to develop a better understanding of the mathematics and how to use the online portal activities to work with individuals and groups of students.

## Next steps

The initiative will be sustainable as the Association of Independent Schools of Western Australia is committed to supporting the program and maintaining the portal. As the strategy is based on activities that support progression through the Australian Curriculum, it will remain current and relevant for the foreseeable future. All key stakeholders have already committed substantial financial resources for the development of the Numeracy Strategy, and in particular the construction of the online portal. Now that the portal has been established, the financial commitment to sustain it will be relatively small.

The principals and governing bodies continue to support the strategy in their schools and communities. From 2013, each school is going to include a Numeracy Curriculum Leader to support the strategy. This new role will mean that the schools are taking on more of the responsibility for the continuation of the strategy. The Numeracy Curriculum Leaders will be supported by frequent, tailored professional learning that will provide them with opportunities to develop the knowledge and skills they need to provide ongoing in-class assistance to their own staff. Given the high turnover of teaching staff, they will be able to support new staff to continue with the established teaching and learning programs. In addition, Numeracy Curriculum Leaders will provide ongoing support for other staff – including the AEWs – to use the portal resources to monitor students' learning and to prepare learning activities. This will also allow new staff to make effective use of the portal as soon as they begin their teaching contract.



The long road to one of the AIC schools © Kaye Treacy



## Research base

The AICS Numeracy Strategy was informed by a number of other successful mathematics strategies, such as Getting it Right Numeracy Strategy. These strategies had a strong focus on enhancing teachers' professional judgements about mathematics, students and pedagogy (Ingvarson, 2005).

The Numeracy Strategy also considered research that focused on Aboriginal education. The 2008 National Numeracy Review Report highlighted the importance of teachers' pedagogical content knowledge, and so building teacher's knowledge of content and pedagogy is a prime focus of the strategy. The AICS Numeracy Strategy also incorporated the National Numeracy Review suggestions (p. 55) for improvements in outcomes for Indigenous students, including:

- having high expectations of students
- building strong relationships with students
- using relevant and meaningful contexts to 'situate' the learning
- paying particular attention to socio-cultural differences in learning styles in the delivery of the mathematics curriculum.

Furthermore, research in the area of Indigenous education and Indigenous mathematics education has been incorporated into the development of the resources and the professional development programs. In particular, the work of Warren & de Vries (2009) in the area of oral language in Indigenous contexts; Hughes, More & Williams (2004) in the area of Aboriginal students' ways of learning; and Jorgenson, Sullivan, Grootenboer et al. (2011) into reform in mathematics education in remote Indigenous communities.

It is also important to note that within the Numeracy Strategy, further research has been conducted in two main areas: students' understanding of language in the mathematics classroom; and pedagogy that best suits students in the AIC schools. Both of these research projects are ongoing; information from them is incorporated into the online portal and the professional development. Further details are available from the Project Coordinator.



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## Further reading and links

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