UNIVERSITY OF CANBERRA

Celebrating success:
Numeracy in remote Indigenous contexts

FINAL REPORT
Remote Numeracy Project

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This document is the final report for the Australian Research Council (DP130103585) funded project: *Numeracy Success in Remote Indigenous Contexts*. It presents the summative findings from the project as it reaches its conclusion. The intent of the report is to provide an overview of the project, some of the key practices that were noted in the schools, and a brief summary of the final findings to those agencies, systems and schools who have participated in the study. A website has been established at the University of Canberra where the project outputs are freely available to schools, systems and the wider public.

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Executive Summary

This report is based on the final findings from the "Success in remote Indigenous communities" project. This project was funded through the Australian Research Council scheme (DP130103585)[1]. The project seeks to investigate, document and celebrate the numeracy successes of schools working in remote communities. The project focuses on the practices of those schools. The case study aspect of the project is not evaluative since a fundamental premise is to document what, and how, practices are contributing to the success of Indigenous learners in remote contexts.

The project adopted a strength-based approach, so underpinning it was a celebration of the great work being undertaken in a number of remote schools and that this work should be documented and shared with others. This report has been written at the conclusion of the project and extends the preliminary and mainly descriptive findings of the interim report. This report also supplements the very descriptive case studies of the schools that can be found on the project website.

Method

The project was funded to undertake 32 case studies but due to some significant cost savings, the final project involved 39 schools. Some of the case studies, however, were not published. The case studies are ethnographic in form and are developed through site visits to each school. Data were collected via interviews with members of the leadership team, teachers and local workers at the school; observations of classrooms; profiling of lessons, and collection of school artefacts. Collectively these are used to develop individual case studies for each site. A positive, strength-based report was generated in consultation with the school, and once approved, was uploaded to a website for sharing (and celebrating) the successes of the schools. The Remote Numeracy website is hosted at the University of Canberra[2].

The meta-analysis across the schools was undertaken for this report. Trends across the data were undertaken through the application of a software package – NVivo – into which all interviews were coded and analysed using grounded theory. This enabled the identification of key trends across the data set. Two further analyses were conducted using Leximancer and a separate NVivo of the published case studies, to confirm the trends reported here were valid. Across the three analyses there was a very strong confirmation of the themes/coding. A further statistical analysis was undertaken of the classroom observations. This analysis was undertaken by a statistical expert outside the project to ensure validity of the claims being made.

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[1] The views expressed in this report are those of the author and not the funding authority.
[2] http://www.canberra.edu.au/research/faculty-research-centres/stem-education-research-centre/research-projects/remote-numeracy

Schools

Permissions were gained from State Government and Catholic sectors in Queensland, Western Australia, New South Wales and South Australia. The Northern Territory Department of Education and Training (DET) denied access to government schools after three separate applications (2012, 2013 and 2014). There was only one Northern Territory Catholic school that met the criteria for inclusion but elected not to participate in the study. As such, NT schools are noticeably absent from this study. This is not to say that there is an absence of good practice in NT, as quite clearly there is some outstanding practice. Rather, it is a factor of the regulatory requirements to access schools through permission from the DET. One Independent NT school was included in the study. The schools' data have been collected from 2013-2016.

	Government	Catholic	Independent	Total
WA	11	3	7	21
QLD	4			4
SA	4			4
NSW	5			5
NT			1	1
Total	24	3	8	35

Table 1: Distribution of schools – published case studies

The schools include the range of schools that could be expected across Australia – including primary, secondary, schools to year 10, schools to Year 12, VET schools, and boarding schools. The schools also range in size from 'one-teacher' through to schools with 50 teaching staff. Some of the schools are located in the community, while others (such as boarding) are outside the immediate community. Some schools serve the community in which they are located, while others draw students from surrounding communities. Some schools are single campus, while others are multi-campus. Some schools are boarding schools including a senior vocational college, while most are day schools. One case study is based on a system-level approach so spans many schools within that system. The project's method has endeavoured to capture the diversity of schools operating across Australia.

Two schools were visited and data collected, but at the completion of the site visit there was no coherent story to be written, so no case study was developed. A further two schools were completed towards the end of the project but the principals relocated and hence the stories could not be confirmed/approved. In total, four sites were visited without case studies being published from those sites. Accordingly, of the 39 sites visited, 35 case studies were published.

Analysis

Two levels of analysis have been undertaken in this study. At the first level is the ethnographic case study approach. Each school has had a case study produced. These draw on the key themes of the school following the site visits. The case studies were negotiated with the school so that the stories presented in the case study were validated by the school and were seen to be a fair representation of the school. The case studies were published on the project website.

The second level of analysis was undertaken and will be ongoing given the enormity and breadth of the data. All interview data were entered into a qualitative database (NVivo) and coded using a grounded theory approach. This enabled trends across the data sets to be identified. The data presented in this report provides a summary of the key findings of the project. More analysis will be conducted on the large, comprehensive data set.

A quantitative analysis will be undertaken on the pedagogical profiling of the lessons and the complete dataset in NVivo.

Key Findings

Unsurprisingly, there is no unifying approach across the states, or schools. However, there are some features that appear in many cases that are noteworthy. While there are examples of practices that would appear to be diametrically opposed such as problem based/investigative group work with the highly structured worksheets of 'direct instruction', there is a unifying philosophy behind the teachers' intent with the adoption of these practices. First is that they sought to identify the entry level of the students (through assessment for learning practices) and then to develop targeted strategies to meet the needs of the individual students (differentiation). Rather than focusing on describing practices per se, the project has identified the norms that appear to underpin the practices.

To make sense of the multiple levels of practice observed across the study, three levels were developed – envisioned, enabled and enacted. Schools need to have a strong and well-articulated vision. They then put practices in place to enable the vision to be enacted by the staff at the school. Different schools had different emphases in their case studies. Each of these levels of analysis and examples are provided in this report. While this is represented in a nested manner, it is the case that each of the levels of practices interact with the other, thus suggesting a much more dynamic model.
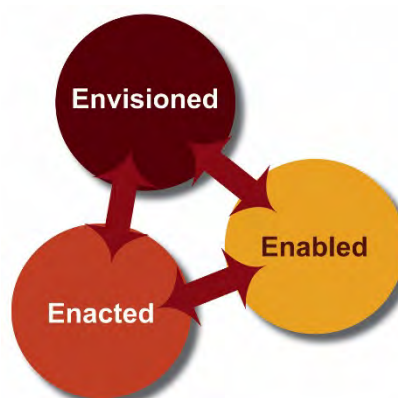
Figure 1: Model of the levels of practice

Envisioned Practices

Many of the schools in the study were very clear about the culture of the school that they sought to develop (or had developed and sought to maintain and sustain beyond the principal's time at the school). Features of these included:

- Articulating and leading the rollout of a school-wide approach to the desired culture and vision for the school.
- A supportive leadership team to work with staff to enable the effective management of the school culture – both in terms of the culture of the school, and the mathematics learning culture.
- Working relationships with community to share the visions of both the community and the school.
- Being prepared to evolve a positive culture over an extended period of time, and to ensure that the culture is embedded so that it endures changes in staff, is critical. Change needs to be slow if it is to be effective. Communities and families are often change-weary of leaders coming in to make their personal mark for personal gain, rather than for the gains of students and community.
- Sharing vision and working with staff and community is an important factor for success.
- Middle leadership was a strong theme emerging from the school data – this level of leadership mediates the vision of the school and supports teachers to enact the vision of the school.

Enabling Practices

To ensure staff and students can meet the goals of the school and thrive in the classrooms, schools have employed a wide range of practices to enable teachers to enact the vision of the schools. These practices sought to implement the vision of the school and to ensure that teachers were given quality opportunities to develop as teachers while aligning with the values and approaches of the school.

Some enabling practices observed included:

- Employment of quality local staff to work alongside teachers. Investment of time and resources were evident from local people who often took a strong role in the classroom and were an invaluable resource within the school.
- Quality professional learning for teachers – most of the schools were staffed by graduate teachers who were often in their first remote position. So considerable support was made available to induct these teachers into remote education, and to provide ongoing support in their development as teachers of numeracy/mathematics.
- Numeracy Coaches[3] were a feature at many of the schools. These individual roles varied depending on the context and needs of the teachers, but included sharing the vision of the school and supporting teachers to enact the vision and providing in-class support for teachers, from planning lessons to providing feedback (middle leadership).

[3] Many terms have been used to describe this role depending on the school. For this report, the term numeracy coach has been used for coherence across the document.

Enacted Practices

At the level of the classroom, there was an extensive range of quality practices that were articulated and observed. These included:

- Being explicit about the intent of learning, how lessons will be organised and what is expected of the students.
- Differentiating learning to enable identification of students' learning needs through assessment for learning practices and then to build quality learning experiences that meets and extends the needs of each learner.
- Recognising language as a key variable in learning, providing appropriate scaffolding in language (both home and SAE) to build bridges between the home and school, and provide entry into school mathematics.
- High expectations – of both students and staff – across social and mathematical norms. Students provided with age-appropriate learning outcomes (e.g. algebra for secondary students) and then quality teaching practices to scaffold learners to achieve those learning intents.
- Focus on mathematics – mathematics was a priority for learning. The mathematics that was being taught was age-appropriate so that students were being exposed to levels of mathematics that could be expected in regional settings. It became the task of the teachers to provide appropriate scaffolding for students to enable them to reach these levels of learning. High mathematical expectations were reinforced.
- Culturally responsive pedagogy was evident, where many strategies were developed to cater for culture of the students. Most obvious were strategies used to build language (of mathematics and the home language as well) and to have strategies that were cognisant of issues of "shame" within the classroom. There has only been one class to date that incorporated the more overt aspects of culture (e.g. art) but other teachers had sought to draw on the everyday activities that the students undertake (e.g. fishing, trips to town).
- Creating a sense of numeracy for life. Most communities had limited numeracy practices synonymous with urban living. Teachers have developed many strategies to create opportunities for students to see the purpose of mathematics/numeracy in their lives.
- Pacing of lessons, or parts of lessons, was often quick so as to engage learners, and prepare them emotionally as well as mathematically for the mathematics lessons. Using a quick pace engaged the learners. Humour was often part of the lesson as well, again to engage learners in a non-threatening manner.

Summary

While categorising practices into these three levels provided a way of clustering the practices, a further analysis of the data produced a theorisation of these practices around the notion of norms what were aligned with the three levels. These norms provide an overarching model that describes the principles that underpin each of the levels of practice. The model gives coherence to a collection of practices at each level. Having norms to underpin and guide practice provides principles for success.

Enacted mathematical norms	Enabled mathematical norms	Envisaged mathematical norms
• All students can learn mathematics – to high levels • Embedding mathematics is critical for understanding – embedding in the brain as well as embedding in contexts • Mathematics is as much about language as it is mathematical concepts • Transparency in learning and teaching mathematics enables students to access the "secret knowledge" of school mathematics • Mathematics lessons should engage learners at their levels of understanding, and then extend learning into new levels	• Teacher quality is essential for quality learning • Recruitment, development, retention of staff • Teacher support is integral to developing quality mathematical environments • A key person for mathematical support across the school enables quality teaching and environments - numeracy coach • Indigenous people are a key resource in teaching and the classroom	• Leadership is critical for developing a positive mathematics culture, supporting teachers and supporting community • Establishing a whole-school approach to teaching mathematics ensures consistency and transparency – for students, teachers, and community

Table 2: Summary of the norms identified from the project

Background

The achievement levels of students on wide-scale tests, such as NAPLAN, TIMSS or PISA, are seen to reflect the quality of the nation's education systems. It is recognised that some factors correlate with achievement on these tests – gender, social background, geographical location, cultural background, language background, and disabilities. The most "at risk' students – those most likely to perform poorly – on these tests are those who may have multiple of these markers. For Indigenous students, living in poverty and geographically isolated locations, and often having hearing difficulties, the potential for poor performance is compounded. This study focused on schools working with this cohort of students, and who have been able to demonstrate 'success' in the teaching of mathematics/numeracy.

Mathematical Success for Indigenous Australians

The data for success in mathematics (or numeracy) for Indigenous Australians are complicated and intersect with a range of variables. Students who live in urban areas, such as major cities or towns are likely to succeed at similar rates to their non-Indigenous counterparts. There are many examples of Indigenous students performing better than their non-Indigenous peers. However, there is quite a marked difference between the urban contexts and the further schools are from urban centres. The most profound differences are with students who live in remote and very remote areas. It is noteworthy that the Northern Territory "is a staggering fifty percentage points or more behind in reading, writing and numeracy across all year levels currently tested" (Ford, 2012, p.80), but there are many compounding variables impacting on Northern Territory education provision (Silburn, McKenzie, Guthridge, Li, & Li, 2014), least of which is that approximately 50% of remote Australian schools are found in the NT and they support 80% of Indigenous learners. Taking these variable into account, the figures are somewhat skewed. Other issues also compound these results. For example, the mobility and transience of students (Doyle & Prout, 2012) impacts on both capacity for learning and monitoring of students. This is a significant issue in remote areas and impacts considerably on the Northern Territory remote education provision. Similarly, the cultural and language diversity in the Northern Territory and the sheer geographical isolation of most of the state, impacts on performance.

High Stakes Testing: Identifying Gaps in Performance

There is broad recognition within the policy and research communities that there are significant differences in performance for Indigenous learners in remote and very remote contexts when compared with their peers in urban and regional settings. Geographical location impacts on mathematics learning across a range of variables (Panizzon, 2015) with students living away from major cities being the most affected in terms of performance. When this is considered in concert with issues of Indigeneity, language and culture, there are even more marked differences.

There are many measures of numeracy performance and the marked differences between Indigenous and non-Indigenous students, keeping in mind that the gap widens as the remoteness of location increases. The 2012 PISA results for 15 year old students shows that Indigenous Australians are 2.5 years behind their non-Indigenous peers in mathematical literacy. In 2008, the Australian Curriculum Assessment and Reporting Authority (ACARA, 2008) reported that for Year 3 students, 81.6% of Indigenous students met the minimum standard in numeracy while 96.6% of non-Indigenous students met the same numeracy standard. This dropped considerably by Year 9 where 65.7% of Indigenous students met the numeracy benchmark, while 92% of non-Indigenous students met the same benchmark. COAG (2013) reported that in the period from 2008-2012 the numeracy skills of Indigenous students in Years 3 and 7 had declined but that there were no significant changes in numeracy for Years 5 and 9.

There are many complex and intertwining reasons for these marked differences (Riddle & Fogarty, 2015), including language (Dixon & Angelo, 2014), health and attendance (Hancock, Shepherd, Lawrence, & Zubrick, 2013). Guether (2015) proposes a different standpoint to argue that the wide-scale failure of remote and very remote schools could be seen as a result of the difference in value systems between that of those who attend the schools and that of the system imposing the test items on the students.

The high stakes nature of NAPLAN testing has seen many schools and teachers moving into approaches that teach-to-the-test so as to improve test scores, thus taking away from the significant learning potential of other teaching (Thompson & Harbaugh, 2013). Klenowski (2014) and others have argued for a much fairer means of assessing Indigenous learners and learning, including the use of both formative and summative assessment.

Language and Culture

For many students and families living in remote and very remote areas, their language and cultures remain connected to their lives. Many remote communities still have many traditional practices, and the community members speak their home language/s, and/or a Creole from the region. A young child may enter the school context speaking more than one home language but not speaking English. The values of the community may be quite different from those of the school, and so the expectations of the school may not resonate with expectations of families. These differences are often manifested in the students voting with their feet and choosing not to attend school. Similarly, for many remote students, coming to school, and mathematics, means learning in a language (Standard Australian English) that is not the language of the home. To this end, there is growing recognition of the need for approaches that recognise the cultural and linguistic background of students and create ways of building learning environments and experiences that meet the needs of the learners while ensuring that they are able to access dominant forms of knowledge – such as literacy and numeracy. Some of the practices that have been developed are discussed in the following sections.

Culturally Responsive Teaching

There are numerous terms used to refer to ways in which pedagogy and curriculum (as well as assessment) can be created so that learners' backgrounds are incorporated into teaching practices. Two key ways that this can be achieved is through the recognition of the language and cultural norms of the learners and building scaffolds to support the transition into the school knowledge system. For example, recognising that the home language is quite different from that of the language of instruction, as well as the language of mathematics, requires the teacher to explicitly teach the metalanguage of mathematics. Simple strategies such as creating resources that show the many terms that can be used for the operations can reinforce to students that the same process can be signified by different words.

Another approach to culturally-responsive teaching is to build activities around the knowledge systems and home experiences of the learners. This can be cultural activities such as how maps of the land are represented – in the home culture and in school culture (Chambers & Watson, 1989). Another approach is to show how the (qualitative) calendar in the home culture would look as compared with the (quantified) calendar that is valued in the mathematics curriculum (Harris, 1990). The activities undertaken by the students in their out-of-school contexts (such as fishing, or sport) can also be a pathway into school mathematics. Culture and context can be the touchstone for activities that provide a strong context for mathematics learning.

Language and Mathematics Learning for Indigenous Students

A number of publications have arisen from this study to show the ways in which language impacts on mathematics learning, particularly for Indigenous learners for whom the language of instruction is different from their home language. This creates a multi-level process in terms of coming to learn mathematics. Not only must the students come to learn the language of instruction (Standard Australian English), they must also come to learn the nuances in the ways in which the socio-mathematical norms of the classroom shape the ways of interacting and engaging in the learning environment (Yackel & Cobb, 1996). As well as these aspects of language learning, the students must also come to learn the language of mathematics which is highly nuanced and very unique.

Programs for Indigenous Learners

The Federal and State Governments have allocated significant funds for programs for Indigenous learners in mathematics. Three of the more mathematically-focused programs funded from federal funding include *Quick Smart*, *Yumi Deadly Maths* and *RoleM*. The programs have different foci/emphases and had been implemented in a few of the schools in this study, and equally, had been dropped by other schools for failing to meet their needs. More generic programs have also been taken up by the State and Federal Governments. The Federal Government has provided $25million dollars to the Cape York Academy (QLD) for the implementation of *Direct Instruction* in their three campuses. The Stronger Smarter Institute has received more than $50 million in funding (Ferrari, 2013) and has worked with many of the schools in the area of leadership development with a strong mantra around high expectations of Indigenous learners. The intent of the high expectations approach is to the combat deficit ideologies and practice that permeate Indigenous education. Similarly, the states are implementing programs targeting Indigenous leaners – such as *Explicit Instruction* (Archer & Hughes, 2011) in the far North Queensland region. In Western Australia, the government developed two very comprehensive (research-based) programs – *Getting It Right* and *First Steps in Maths* (Department of Education WA, 2013). Other schools have purchased commercial programs or sought the services of consultants to work with the schools to develop school-based approaches suitable for their needs. It is not the purpose of this report to provide feedback on these programs, but to acknowledge that there are various programs being used in schools. Through this project, there has not been a consistent program used across a wide range of sites. In the writing of the case studies, there has been a very strong attempt not to name nor promote any program.

Policy Context

The Closing the Gap policy initiated under the Rudd Government in 2008 and continued under the Abbott government has shown no improvement in reading and numeracy since 2008 (Australian Government, 2015a) despite considerable investment of government money. In 2014, the Federal Government allocated a further $56.4 million to try to halve the gap in literacy and numeracy. Numerous funding arrangements have been made to target the gap in performance in literacy and numeracy. These have varied under the two successive governments and funding arrangements vary from state-to-state. Biddle (2014) undertook an analysis of school performance of Indigenous and non-Indigenous students and found, with all things being equal, that 20% of the performance gap can be explained through the poor attendance of Indigenous students. There is now a strong focus from both State and Federal Governments to encourage attendance. A recent report from Queensland Department of Education and Training, for example, highlights the regional distribution of attendance to show that schools in remote (and rural) areas have higher proportions of students whose attendance is below the desired rate of 85%. In Far North Queensland, there were more than 22.4% of students attending school less than 85% of time (Department for Education Training and Employment, 2013).

There are many policies and strategies across the states and territories that have been developed to support the attendance, and learning, of Indigenous students. The following summary is not meant to provide a comprehensive analysis of all policy documents, but rather to provide a context for what is happening in education in those states in which the study is based.

Connected School Communities - NSW

The Connected Communities strategy (Department of Education, 2014) is an initiative in NSW. Commencing in 2013, fifteen schools were selected to be part of the initiative. The schools work in partnership with leaders from the community in which the school is located to coordinate activities to improve the learning outcomes for the Indigenous students. The schools act as a community hub for the various services within the broader community and then develop and tailor education to meet the needs of those communities. There is an emphasis on community and school decision making which is a joint enterprise. The school has a number of staff appointed through the funding arrangements, including a key person to act as a conduit between the school and the community. The school reference group is responsible for setting the vision and direction of the school, defining local goals, identifying student needs, curriculum development, resources, community input, planning and inter-agency support. Schools also participate in language maintenance through Aboriginal Language and Culture nests and enhanced staff development through metropolitan teacher exchanges.

Good to Great Schools – QLD

Many of the schools in Queensland have noted their links to the Good-to-Great Schools initiative. The Good to Great Schools Australia (GGSA) is a not-for-profit organisation that "supports schools to transition from Poor to Fair, Fair to Good and Good to Great". The organisation promotes the use of "Effective Instruction" model of pedagogy. It promotes an education program and an effective teaching program. The GGSA 5C comprehensive education program incorporates four distinct, but related, learning domains of Childhood, Class, Club and Culture, which are integrated into the curriculum. These are complemented by the fifth Community domain, which focuses on engaging parents and families to support student attendance, school readiness and wellbeing. This program is showcased in the Cape York Academy schools of Aurukun, Coen and Hope Vale. The Effective Instruction program incorporates two strategies, Direct Instruction and Explicit Direct Instruction to assist teachers to respond to the unique demands of remote Australian Schools.

Empowering Local Schools – SA

The Empowering Local Schools Program (Association of Independent Schools South Australia, 2012) is an initiative of the Federal Government and provides funding for independent schools in South Australia to self-manage and respond to local needs. The focus of the ELS strategy is to deliver greater local decision making to schools; to further enhance local governance and management; to demonstrate that increased local decision making will contribute to improved student outcomes; and recognise diversity in current levels of autonomy. In particular, South Australia focuses on enhancing and improving current decision making across governing bodies and management at the school level within participating schools, building organisational capacity and establishing an innovative culture based on ongoing improvement at the school level. Participating schools nominate their focus areas based on a preliminary review/needs assessment. Each school application is addressed within the following five areas of the framework: 1. Governance; 2. Business Administration and restructuring; 3. Development of Local Partnerships and Community Engagement; 4. Workforce Planning; 5. Leadership and Management. There is also support for professional development of teachers.

Federal Policies

The Federal Government has allocated considerable resources through the policy context to stem the differences in academic achievement for Indigenous students, recognising that it is not solely education that needs to be addressed, issues of health and well-being (e.g. safe housing, mental health, etc) are also tied to educational outcomes. As the Federal Department of Education and Training has undergone a number of name changes through this project, a generic term has been used in writing this report. It has also directed funding specifically to targeted programs for Indigenous education, and specifically, mathematics for Indigenous learners.

Closing the Gap

Closing the Gap (Australian Government, 2015b) is a long-term framework that acknowledges that improving opportunities for Indigenous Australians requires intensive and sustained effort from all levels of government, as well as the private and not-for-profit sectors, communities and individuals. Established under the Rudd (Labor) government and continued under the Abbott (Liberal) government, the policy seeks to redress the substantive gaps between Indigenous and non-Indigenous Australians in the areas of education, health and housing. As part of this framework the Aboriginal and Torres Strait Islander Education Action Plan commits governments to a unified approach to closing the gap in education outcomes between Indigenous and non-Indigenous students. It brings together mainstream education reforms, under COAG's National Education Agreement, with a range of actions specific to improving outcomes for Indigenous students. The states and territories have identified 900 Focus Schools under the Action Plan (Council of Australian Governments (COAG), n.d.), where actions will make the greatest difference in progressing the Closing the Gap targets for education. A major initiative arising from this strategy was the National Partnerships agreement. This was in place at the commencement of the study but phased out during data collection (2014) thus making for significant changes in many of the schools.

Creating positive learning environments and engaging Indigenous parents have been identified as a significant opportunity for schools to contribute to closing the gap on educational disadvantage (Ockenden, 2014). Literature indicates that school-based factors play a significant role in developing an engaging learning environment for Indigenous students. In turn, this can have a significant effect on their attendance and educational outcomes. The literature and case studies point to a handful of crucial factors that schools can incorporate to create a school culture where Indigenous students feel welcome, safe and valued, fostering an environment where Indigenous students want to learn, and in turn, want to attend school. These factors include strong and effective school leadership, creating a positive school culture that encourages a positive sense of Indigenous student identity, and providing teachers with the skills and knowledge to effectively engage and develop relationships with Indigenous students and their families. The focus on some of the schools in the study have included a focus on student welfare; creating a happy school environment; strong partnerships within and outside the school; building on the cultures that students bring to the school; and whole school approaches to culture and/or mathematics reform.

Attendance in Schools: Remote Attendance Strategy

The Remote School Attendance Strategy (Department of Prime Minister and Cabinet, n.d.) arises from the Closing the Gap initiative, recognising that attendance is the precursor to achievement. The strategy focuses on supporting school attendance officers working with schools, families, parents, and community organisations to ensure all children go to school every day. The strategy started in Term 1, 2014, and is being implemented in partnership with communities and schools in locations in New South Wales, South Australia, Western Australia, Queensland and the Northern Territory. It is designed to be driven by the community to suit local needs. The Remote School Attendance Strategy works with local providers to employ school attendance supervisors and school attendance officers to help students get to school.

School attendance supervisors and officers may have different names in different places, but together they make up the school attendance teams in each community. These teams work with schools to help parents and families make sure students have what they need to go to school each day. Team members are local people from the community. They may be family or caregivers who want to help children in the community get to school. School attendance teams work closely with teachers, parents and the community to develop a community plan to identify ways to ensure all children in the community go to school every day.

The Federal Department of Education and Training has allocated considerable funding for targeted programs for Indigenous learners around mathematics, but also has implemented other more generic projects that focus on mathematics which must have a part of that project that will target Indigenous students. At the time of writing this report, the Federal Department of Education and Training has established a number of priority areas and significantly-funded projects. The *Excellence and Equity in Mathematics* Project that was headed by the University of South Australia and, in partnership with the Australian Association of Mathematics Teachers, aims to improve the achievement of Indigenous students in the area of mathematics (and numeracy) while they attend high school, with the specific intent of attracting them into University studies. STEM education has become a greater focus within the policy domain, rather than mathematics/numeracy per se in the more recent rounds of funding.

The recent funding to support play-based digital learning in pre-schools – *Early Learning in STEM* Australia and the *reSolve: Mathematics by Inquiry,* which is a program in partnership with the Science Academy – builds resources that focus on inquiry learning. Both projects have aspects of their projects that are earmarked for trialling the resources in Indigenous contexts with Indigenous learners.

Nationally, and with the support of state education systems, there is a strong focus on building policies and strategies to enhance the learning of Indigenous students, particularly in the areas of literacy and numeracy. While there have been many millions of dollars invested in Indigenous education with the intent to reduce the educational performance gap, the Senate Review, Helme (2013) raises a number of concerns about many of the programs that have been implemented. She argues that the projects do not have sufficient evidence (that is, rigorous evidence) of the programs' effectiveness; that much of the work is short-term and piecemeal and not evaluated in a robust manner; and that there is insufficient longitudinal data to track potential successes of the programs.

Unlike intervention projects and programs where there is a particular emphasis on a smaller aspect of mathematics – such as the ELSA project that is looking only at the early years and digital resources – or where external experts control the intervention, this current project has been founded on the recognition that staff situated in the context of the school and community, are better placed to understand the complexities of community life and education. This project has sought to document what 'experts in the field' are doing in terms of effecting learning outcomes. It reflects the points made through Hattie's seminal work where it is the teacher, and the collective wisdom of teachers, that are best able to make the changes that will impact positively (or in some cases negatively) on student learning. To this effect, this project has sought to document the practices of schools that are having success in the teaching of mathematics as a whole in a context where there is marginal success. It was the specific intent of the project to seek the data from those sites that were having a positive impact on student learning, and to share these practices with others working in the same context.

Staffing and Professional Development

Hattie's (2009) seminal work on large-scale meta-analysis of teaching and improvement has shown that the most important variable in effecting achievement is the teacher, once the background of the students is accounted for. In his work, he proposed that the two most significant effect sizes were for teacher estimates of achievement (1.62) and collective teacher efficacy (1.57) (Hattie, 2009) thus suggesting that it is vital to focus on the teacher if there are to be improvements in educational achievement. There are many challenges for attracting teachers to remote contexts, their on-going professional learning once in the context, and the need to retain teachers who will have had considerable investment in their professional learning. These issues will be discussed in the following sections.

A brief overview of the literature indicates a number of key issues – the teachers who work in remote settings are often new graduates, many of whom have not had experience living in remote areas nor working with Indigenous students or communities; there is a high turnover of teachers in remote areas; provision of professional learning is constrained by the tyranny of distance; issues of remote lifestyles can impact on teacher well-being. Sustainability of practices are impacted by these issues identified.

One of the biggest challenges in remote education provision is the attraction and retention of staff (Roberts, 2005). There are a multitude of factors that impact on the staffing in remote schools (Kelly & Fogarty, 2015). Some of these included the readiness of graduates to teach in schools, but equally their readiness for life in schools and community (White & Kline, 2012). While issues of community isolation featured strongly in teachers' evaluations of the challenges of working remotely, instructional and curricular matters were also issues for teachers, as were issues of organisational matters (Handal, Watson, Petocz, & Maher, 2013).

In some states, the transience of teachers is quite an issue (Helmer, Harper, Lea, Wolgemuth, & Chalkiti, 2013). In the Northern Territory, for example, there was a period where the average retention time of teachers in schools could be measured in months as opposed to years (Hall, 2012). Retention of teachers, particularly in remote settings, has been found to be problematic, for many complex reasons including access to professional development (Buchanan, 2012), and not providing teachers with support at both the school and system levels (Sullivan & Johnson, 2012).

With most of the teachers in remote schools being recent graduates – nationally and internationally (Gagnon & Mattingly, 2012), and often in their first appointment since graduation, there is concern about the capacity for preservice teacher education to adequately prepare graduates for the demands of remote teaching (Kline & Walker-Gibbs, 2015). To help support preservice teachers into rural and remote teacher employment, some universities offer placements in rural and remote settings during initial teacher training to induct urban preservice teachers into the nuances of remote/rural teaching (Adie & Barton, 2012; Beutel, Adie, & Hudson, 2011; Kline, White, & Lock, 2013). This allows preservice teachers to gain a practical understanding of working and living in remote contexts and enables them to make informed decisions as to their suitability for these contexts.

Teacher Quality

Teacher quality and retention of staff in remote schools is a notable issue in staffing (Brasche & Harrington, 2012). Teachers are often offered considerable incentives to teach in remote settings (Handal et al., 2013), and often with a short (2-3 year) contract after which they are able to apply for positions in urban or regional settings with priority over others seeking employment in these regions.

There are widely disparate views and expectations of teachers who elect to teach in remote schools. In one study of a cluster of remote schools (Jorgensen, Grootenboer, & Niesche, 2013), it was found that of the 32 teachers, their motivations for teaching in remote areas included seeking adventure, being able to live in a remote setting, or being unable to secure a position elsewhere. Only one teacher indicated an equity motivation for teaching in a remote context.

The tyranny of distance limits the possibilities for professional learning opportunities in remote schools. Distances to be travelled, time away from school, and the lack of substitute teachers to replace teachers undertaking professional learning curtail targeted professional learning. Some innovations in mathematics curriculum development have been sourced through on-line formats and the provision of professional learning through targeted programs (Warren, Quine, & DeVries, 2012) or through face-to-face professional learning (Jacob & McConney, 2013) where the project leaders offer programs to schools that are supplemented by funds from external agencies. As noted earlier, accessing professional learning and support as an early career teacher is critical in the retention of teachers in remote settings.

Summary

Collectively, this review has provided some insights into the current state of affairs in terms of issues that are part of the provision of education in remote Indigenous contexts. The issues for teaching in remote contexts are complex, and while Aboriginal activists, such as Noel Pearson, advocate for quality teachers in remote settings, there are many factors that need to be considered. These include curriculum, pedagogy, assessment, teacher preparation – both preservice and in-service, culturally-responsive pedagogy, leadership and others that have been noted in the review. Many of these issues have been found to be integral to the work of the schools in this study, except for preservice teacher education. Preservice teacher education was outside the parameters of this study, other than to be noted an issue that schools reported was not undertaken well in terms of the preparation of teachers for remote education.

Moving Forward

What is clear from the research literature is that there is minimal success for the most vulnerable students in the Australian educational landscape – remote Indigenous learners. There is an expansive amount of research that highlights the issues of this context, however, there is not a lot of documentation of what works to address the issues in these contexts. There are pockets of intervention but these can be inherently problematic for the reasons cited by Helme (2013) earlier in this review. The highly successful What Works Project (2017) sought to develop case studies across Australia in all regions (urban through to remote); across curriculum areas; across year levels and across contexts. The case studies are brief and designed for teachers. This project extended on the earlier project and only focused on deep, extensive case studies in the area of mathematics in the remote setting. Like the What Works Project, this project sought to identify the practices that were used by the 'experts in the field' who were familiar with their unique contexts. What is clear from the What Works Project, the work of Helme (2013), and this project is that there is no one method that will work across the diversity of Australia.

Aims

The stated aims for the project were:

1. Create thick descriptions of sites that account for the practices that shape numeracy education in and across remote communities
2. Explore the nexus between successful numeracy education practice and remote Indigenous communities
3. Identify principles for effective numeracy education as shaped by the sites
4. Develop limitations or caveats for general principles as shaped by the anomalies across the sites
5. Provide feedback and recommendations to statutory authorities with respect to quality numeracy education located in remote Indigenous communities
6. Document and celebrate successful numeracy education practices that account for the situated environments of remote Indigenous education.

To this end, thirty-nine case studies were conducted across those states and territories where there is remote education for Indigenous learners. Thirty-five of these cases were published on a project website hosted by the University of Canberra. The case studies can be accessed from the University of Canberra website. The remainder of this report documents the overall project and the summative findings.

Method

Prior to undertaking the study, ethics approval was sought from the employer universities – initially Griffith University and then the University of Canberra. Permissions were also sought from each State Department of Education and each Catholic Archdiocese in which selected schools were located. Independent schools were able to directly approve involvement in the study, depending on their individual management organisations. This process took 12 months to complete.

School Selection

The selection of schools was based on two approaches. In the first approach, a comprehensive search of the *My School* website was undertaken and was on-going over the duration of the project. Schools were identified as being remote/very remote, having a significant (usually above 80%) Indigenous student cohort, and to have scored better than similar schools (as represented by green or dark green on *My School*) over a number of years. Schools that scored green in one year did not qualify for inclusion. The NAPLAN provided an initial indication of 'success' as it is the only standardised national testing scheme through which schools can be compared. It is recognised that there are limitations to the process due to the limitations of the test itself. As Guenther (2013) has questioned, NAPLAN may not be the most ideal assessment tool for Indigenous students, but it is the only nationally recognised test and as such reduced any bias in the selection process. It is noted the selection of schools was based on comparisons with similar schools rather than comparison with the national scores. This ensured that there was some comparability based on the unique context of remote education provision. Schools were also included based on recommendation by other schools or regional directors and asked to provide evidence of their success based on school data.

Across the project, there was an attempt to ensure coverage of the diversity of schools – across states, sectors (Government, Catholic and Independent), types of schools (primary, secondary, boarding); size of schools (small, one teacher schools, through to comprehensive schools). It is recognised that there is a strong skewing to WA schools. This is, in part, due to the definition of "remote" but also due to the over-representation of success of many schools in the Kimberley region. The non-inclusion of NT schools has also limited the capacity to provide a spread of remote and very remote schools as this state has schools that would meet inclusion in this study. As a result, a larger number of schools in other states (namely WA) were able to be included. There has also been a conscious effort in the project to be prudent with costs so that collection of data has been focused in regions so as to minimise the travel costs while ensuring maximum coverage of schools. Regardless of the limitations of method in terms of school selection, the over-representation of schools in Western Australia is due to their successes.

There was an inclusion of some "provincial schools" from Queensland in the study. This is due to the definition of remote from the *My School* site which would have excluded many of the isolated schools in Queensland due to their definition. These schools are similar to those in WA but their geolocation (being close to a regional centre) has resulted in their classification as provincial rather than remote. For example, a school such as Halls Creek or Wyndham in WA may be very similar to a school such as Cherbourg or Murgon in Queensland yet the Queensland schools were described as provincial while the WA schools were described as remote. To this end, some provincial schools in Queensland were included.

At the completion of each site visit, a case study was written up, usually within two weeks of the site visits. Prior to leaving the site, a meeting with the leadership team was undertaken and a reflection of the visit was discussed. This provided the basis for the case study. Through this process, the school was aware of some of what would be the basis of the case study. The case study was then passed back to a nominated person in the school – usually a member of the leadership team – who would review the case study and adjust. When the case study was finalised, the school would approve the story and the case study would be uploaded to the project website.

As part of the ethics negotiations process – discussed later in this section – a negotiation occurred which is an anomaly for the usual ethics processes. In the early stages of the research, principals requested that schools be named, as the case studies were a positive reflection of the school and as such it was kudos for the school to be recognised as a successful site. After considerable negotiation with the University (and education systems), approvals were given for the schools to be named should this be requested (and approved in writing) by the principal or approved person within the school. Where such approvals were given, the schools were only named on the case studies. All other reports and publications arising from the project comply with the usual ethics procedures to protect the identity of the participants and schools.

	State	Sector	Title of Case Study
1	WA	G[4]	Creating groups for targeted learning
2	WA	I	Structure and support for teachers
3	WA	G	Culturally responsive pedagogy
4	WA	G	Adopting a whole school approach
5	SA	G	Adopting a multi-faceted approach
6	WA	I	Learning in the early years
7	WA	G	The importance of language
8	WA	C	Focus on the early years
9	SA	G	Transitioning to mainstream schooling
10	NT	I	The influence on boarding on learning
11	QLD	G	Teaching students, not mathematics
12	QLD	G	Quality lessons= Great outcomes
13	WA	I	A supportive on-line tool for assessing and planning
14	WA	G	Building a learning culture
15	QLD	G	*Multi-age classrooms and early career teachers*
16	QLD	G	An integrated approach to teaching mathematics
17	WA	G	Leadership in mathematics
18	WA	C	Creating a supportive culture for teachers and students
19	WA	I	The value of Aboriginal Education Workers
20	WA	C	One teacher school: Teaching mathematics from Prep to Year 6
21	WA	G	Focusing on Number
22	WA	I	Teachers and AEWs as partners in the teaching process
23	WA	I	Catering for the Whole Child in the Learning of Mathematics
24	QLD	G	Better together
25	NSW	G	The School with No Gates: Communication
26	NSW	G	Creating a Positive, Quality Learning Environment
27	NSW	G	The Value of Agricultural Studies to Cater for Inclusion: Agriculture Is Numeracy
28	NSW	G	Mathematics Pedagogy
29	SA	G	Empowering Learners and Learning
30	NSW	G	Culture, Curriculum and Community
31	WA	G	High Expectations for Mathematics Learning
32	WA	G	Embracing Change in Numeracy: Adopting Current Best Practice
33	SA	G	When it's My Idea: Student Centred and Independent Learning
34	WA	I	Catering for the Whole Child in the Learning of Mathematics
35	WA	I	VET: Training for Life

Table 3: Summary of case studies undertaken

It is noted that a further four sites were visited. After the visit, no case study was written for two sites as there were inconsistencies that would not permit a coherent case to be written. In the other two cases, case studies were written but the principals had relocated and the reports could not be approved prior to the cessation of the study.

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[4] The code for the schools is G=Government, C=Catholic and I=Independent

Consistency within Site Visits

In order to be able to build a coherent case study account, there needed to be some consistency within a site. In some sites, there was remarkable coherence in the accounts shared across the school while in others there was some variation in the accounts shared, but there remained a sense of commonality across the school in terms of practices.

There were two sites visited where no case study or story was written for the schools. This was due to a less-than-consistent story from that school. In one case, the story being told by the administration team was very different from the story being told by the teaching staff and community members. At the other site, the principal had decided to implement a new approach at the school so it was difficult to write a story about the current practice that was being rolled out when the successes in mathematics were most likely due to the previous work being undertaken. There would be no evidence that the current approach was resulting in success. As such, in consultation with staff at the schools, no story was produced. This was seen to be important in terms of the internal validity of the overall project.

Field Visits

Each site visit was shaped by the school. The size of the school influenced who and how many participants were involved in the case study. At some schools there was an attempt for as many people to be included in the study as possible; while at others, the school sought a particular focus, so targeted personnel were included. Each site visit included:

- Interviews with the principal and/or members of the leadership team. This was to establish the 'big picture' of the school, history of the school and rationale for the approaches taken at the school;
- Interviews with teachers and other staff/personnel at the school. These interviews provided details about how and why particular actions were taken in classrooms, explanations of teacher practice, and more detail of the day-to-day actions of those at the chalkface;
- Observations of lessons to enable a confirmation as to whether the rhetoric of the staff/participants matched the practice. Lessons were profiled using the productive pedagogies schedule. Lessons were noted for their language use, questioning etc so that a comprehensive and detailed account of teacher interactions were developed.
- Document collection – usually of planning documents, policies etc. associated with teaching mathematics;
- Field notes were taken during interviews and lesson observations so that they could be used to inform the generation of the case study reports;
- Photographs for the desktop version of the published case studies.

All interviews were of an open-ended design so that participants could talk about the practices that were adopted at the school, what was working in the teaching of numeracy and why. All interviews were tape-recorded, transcribed and then the tape discarded.

Analysis

Two forms of analysis are undertaken in the project. The initial case studies were developed soon after the visit. The overall project had many case studies completed and using the grounded theory model, there was an emerging familiarity across many of the case studies. The overall analysis for the project was ongoing and iterative as the project progressed, in line with the grounded theory method.

Case Studies

Case studies were generated for each site. Each case study was generated within a short period of time after the visit. The text for the case studies were provided to the principal (or nominated person) who worked with the team to ensure accuracy within the report. Photographs were included in a desktop version. Principals were required to approve both the text and desktop versions. Initially, under the usual ethics processes, schools were not to be named. But in the very early stages of the research, schools wanted to be named as the stories were positive accounts of the practices used within the school so they sought to be recognised. University Ethics approved the option for principals to have their school named. All schools have elected to be named.

Full Study

A number of analyses were undertaken of the data. All interviews were transcribed and then uploaded into two software packages – NVivo and Leximancer. Other data (productive pedagogies) was analysed in full via a statistical package once all data was collected.

1. The first, NVivo, is a grounded theory analysis so that trends across the full data set can be forthcoming. Interviews are coded and new codes were established as the project progressed so that at the completion of the study, a detailed analysis could be undertaken.
2. The second, Leximancer, uses a textual analysis of the words and builds a key concept model. This model removes coder errors but is limited by the statistical analysis that can be undertaken.
3. The third, statistical analysis, was undertaken with the productive pedagogies data, after being entered into NVivo. NVivo has the capacity to be imported into statistical packages.

The analysis has been ongoing and evolving throughout the project. The data presented in this report is part of the final analysis and is designed for distribution to the participating schools, systems and other interested parties. It is anticipated that further analysis will be ongoing past the completion date. Academic publications arising from the project are listed on the project website.

Data Collection and Analysis

All completed and approved case studies have been uploaded to the Remote Numeracy website hosted at the University of Canberra. The case studies were written to highlight the strength-based approach of this project. They were designed to celebrate the practices of the schools and to provide advice, suggestions, and/or information to others who may be seeking ideas on how to improve their practices. The case studies were written based on the information provided at the sites and were based on the triangulation of data between (1) interview with leaders, (2) Interview with practitioners, and (3) the practices observed in classrooms. All reports were negotiated for accuracy with the schools and, once approved, were uploaded to the project website.

All data have been uploaded and coded in NVivo so that tabulations and counts can be made from the data, and theory generated from that coding. NVivo is a software package where transcript data are manually coded using key words identified by the researchers from the data. This is then used to generate theories and outputs.

The interview data have also been entered into Leximancer. This program enables the analysis of natural spoken text. Using a statistical algorithmic method, it extracts both the sematic and relational information within the text. Through the use of Leximancer, it was possible to confirm if the analysis/coding being undertaken in NVivo was a reflection of the data per se. It was confirmatory so that there were strong synergies between the outputs of Leximancer with the codes being used in NVivo.

This report represents the synthesis of the complete data set from the Remote Numeracy project.

Ethics

This project has been approved by the University of Canberra Ethics Committee. The study complies with the approvals given to conduct research of this nature. In accordance with the ethics guidelines, schools cannot be named in this report.

Approval has been gained from all regulatory bodies associated with the selected schools – Education Queensland, Department of Education and Children's Services (SA); Department of Education (WA), Department of Education (NSW) and the relevant Catholic Archdioceses. Independent Schools have the autonomy to opt in or out of the study. All schools, when approached, had the option to opt in or out of the study, regardless of the authority given by the statutory bodies.

What Builds Success in Remote Numeracy?

The project website contains all the case studies that have been completed and approved. These case studies are documents that share the 'good news' stories of the schools. The website – http://www.canberra.edu.au/research/faculty-research-centres/stem-education-research-centre/research-projects/remote-numeracy - is open access. The sharing of the case studies is intended to celebrate the success of those involved in the study, as well as to share exemplary practices with others who may find the information useful for their own contexts.

In this section of the report, the general trends in the data are drawn together.   What has emerged from the data is that there is quite a complex mega-story to be told. It is not the case that 'one size fits all' and indeed, schools are working successfully as they incorporate strategies to suit their contexts.

Figure 2: View of the Remote Numeracy website

Trends from the Data Analysis

From the data coding, there were some observable trends in the data, some which were unsurprising, while others were unexpected. From these trends across the data set, some thoughts about what is good practice in remote settings for Indigenous learners in the area of mathematics/numeracy become salient. While the initial intent of the project had been to explore the pedagogical practices of teachers, much more has come out as being important. Pedagogical practice at the level of the classroom is important, but there were other variables equally at play at the schools. This has resulted in the three levels of practice that have emerged from the data. What has occurred since the original coding of the data has been a need to create a more nested set of analysis that reflect the model that has emerged from the data and, as such, the complete data set has been recoded in light of the learnings from the project.

Enacted Practices

As enacted practices were the starting point for the project, there were some trends in the data that could be observed across the data set. Initially, the pedagogies used in the classroom were the driver of the original basis for the project. But these became much more nuanced as the data were collected.

Pedagogical Practices

From the data analysis in NVivo, a number of pedagogies occurred frequently across the sites. While there was a very extensive list of pedagogies used across the schools, Table 4 provides examples of the twelve most frequently occurring responses.

	No of participants[5]	Total number of references
Using data to inform teaching	91	134
Hands on Learning	89	114
Differentiating learning	87	150
Consistency, routine, structure	85	116
Real life mathematics	66	101
Group work	65	102
Language of maths	64	89
Being explicit in teaching	64	108
Repetition, retention	63	81
High expectations	59	101
Games	56	84
Digital tools to support learning	53	66

Table 4: Most frequently occurring pedagogical practices adopted in the schools

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[5] It is noted that in the tables, there are two scores. The first refers to the number of people who made the comment, and the second refers to the number of references to a comment. It is important to include both scores as there is a possible skewing if only the total references are included as one person may make a plethora of comments on the one topic. By including the number of participants, it can be seen that there are many people referring to a particular topic.

From this table, it can be seen that there are quite a few practices that appeared across the study and were frequently used. What was very clear from the study was that teachers saw value in making lessons consistent so that routine and structure were evident in their lessons. This was seen to enable students to engage with lessons readily, usually upon entering the room. This meant that there was not a lot of lost teaching time. Being explicit about the intent of the lesson also helped students to have a clear idea of what they were to learn and how they were to engage with the lesson, again maximizing learning time. With the diversity in all of the schools/classrooms across the study, teachers were very strong on the use of group work to cater for students' needs. Most often these were heterogeneous groups where students could engage in peer tutoring but with a caveat that teachers need to spend considerable time establishing group work norms in their classrooms. In one case, the teacher indicated that it took a term to establish the norms but once established, the students engaged with the activities and learning. Having group work also supported differentiated learning.

One of the key points made by many teachers was a need for repetition due to the differences in the numeracy practices expected at school, and the numeracy practices out of school. Students needed to have repetition undertaken in engaging ways that would be productive for learning, but importantly, helped prime students for learning. For example, through speed activities, timed activities, digital games, etc.

Overarching the pedagogies teachers used was that there was a high expectation of the students in terms of their capacity to learn mathematics. No school in the study tolerated a deficit approach to learning mathematics. Many of the pedagogical practices supported the high expectations. At the same time, there were high expectations for teachers to develop practices that would foster the high expectations of mathematics learning.

Language

A separate node was created for language as this permeated many schools' practice. There were more than 300 comments directly related to language and mathematics learning. Participants made a range of comments related to language and how it impacted on the practices in the classroom. Most notable was the recognition that students needed to be scaffolded into the language of mathematics as much as Standard Australian English as the medium of instruction.

	No of participants	Total number of references
Mathematics Vocabulary	78	98
Code Switching	50	63
Role of AEWs	41	53
Diversity of languages	41	48
Transition from home language	32	40
Language programs	27	31

Table 5: Language pedagogies

It is perhaps unsurprising that good learning outcomes in mathematics are supported by the recognition that language factors are implicated in learning. As a study conducted in remote areas of Australia, most of the students spoke an Indigenous language or a Creole as their first language. Coming to school meant that they encountered instruction in a language other than the one from the home. As well as coming to learn Standard Australian English (SAE), they had to negotiate the norms of conversation/instructional practices, and the language of mathematics. The local Indigenous people employed at the school had a critical role to play in this aspect of the teaching process. Most of the teachers are transient and do not learn the home languages of the students. The schools deployed the skills and knowledges of the local people to support the transition between the home language and SAE/mathematics.

In a number of the schools, there were programs and strategies that focused on the development of the language of mathematics, recognising that home languages were different from SAE and the classroom interaction norms. In some schools, there were active and highly successful programs that saw the translation of mathematical texts into both SAE and the home language/s (Jorgensen, 2016).

Data and Assessment

In current education policy, there is a strong emphasis on accountability. National teacher standards (AITSL, 2017) have a strong emphasis on teachers being able to differentiate learning to meet the needs of their students. To do this well, teachers need to be able to identify students' needs and this is through good assessments and then using that data to inform their teaching. Teachers need to be aware of their students' learning so that they are best able to report on their students' performance in ways that are accurate and true. To do this, teachers need to have good assessment practices. As such, it was unsurprising to observe a lot of emphasis on assessment, assessment to inform teaching and then sharing assessments with the students, other staff and families.

	No of participants	Total number of references
Using data to inform teaching	91	134
Assessment tools	67	83
Assessment for learning	65	81

Table 6: Assessment practices

Assessment, as a tool and as a process to inform teaching, featured strongly in the discussions with teachers, and in the observations of lessons/classrooms. Most classrooms that were observed had some display or otherwise of students' assessments. Teachers shared how they used their assessments to differentiate student learning, to group students, to target learning activities, and so on. There was very little evidence in the study of whole class teaching other than at the commencement of a lesson in which the teacher/s orientated the students to learning, and/or the concept that was to be the focus of the lesson. In some cases, the orientation may have been more instructional in terms of lesson organisations such as group activities.

Enabled Practices

Hattie's (2008) claim that the teacher is the most important factor in achievement suggests that investment in staffing – teaching and AEWs – is critical for success in remote teaching. Within this context, the teachers are often new graduates who not only need support as they transition into their profession and/or as they undertake their first teaching position in a context that is likely to be very unfamiliar to their home context. As such, schools have developed a range of strategies to help build the repertoire of skills and knowledges needed to work in remote education. Also, many of the schools recognised the value of the local Indigenous people who work in education, and often at the backbone to the school. Many of the local people have been working in the schools for many decades and can be a valuable resource to teachers, leaders and community.

	No of participants	Total number of references
Teacher professional learning	108	178
AEWs	105	171
Numeracy Coaches	57	92

Table 7: Enabled practices

The enabled practices identified in this study relate to the production of quality staff within the parameters of the vision/strategic direction that has been envisaged for the school. Having staff and practices that will enable the vision to be realised is critical but with the issues around staffing that have been identified (transience, early career, etc), coupled with the tyranny of distance that limits the potential for professional learning that is available in urban settings, schools have devised ways to facilitate the development of the staff.

Envisioned Practices

One of the surprising and unanticipated outcomes of this study was the importance of leadership within the school. Leadership was often greater than the principal but about the leadership style and the enactment of vision across the school. Having a way forward and the support to be able to enact that vision was a very frequent comment offered by participants. Whether this was leadership at a generic level or leadership in mathematics, almost 75% of the participants made some reference to the value of leadership.

	No of participants	Total number of references
Leadership – mathematics	92	137
Leadership – management	84	149
Culture of the school	88	105
Whole school approaches	83	138

Table 8: Envisioned practices

The responses here indicate that leadership is an important aspect of remote education, particularly in terms of building (and sustaining) a positive culture at the school, whether or not that directly relates to mathematics *per se*. What was also well cited across the schools was for a whole-school approach to mathematics and that this was a vision for the schools.   The whole-school approach was supported by the leadership team/s through various practices – at the enabled level as well as the enacted level.

Levels of Analysis

Across the cases, it is quite clear that schools have focused on very different levels within their schools[6]. Some schools have focused on school-wide reforms that have included the building of a focused culture, vision and approach at the school. The motivation of the schools was often quite different but bound by the wider context within which the school operated. Schools often had unique circumstances (and issues) that they needed to address that resulted in very different strategies[7].

At the other end of the spectrum of practices, teachers adopted very particular teaching strategies within their classrooms. These again, were shaped by many different motivators. Some of the practices were informed by the school-wide approaches that were consistent with the vision being enacted at the school level. In other cases, teachers had considerable flexibility to support the learners in their classrooms. This was most evident in the smaller schools, but not contained to small schools.

There was a mediating level – between the envisioned practices of the school level, and the enacted levels across the school and within the classroom. Enabling practices were evident that supported both leaders and teachers to achieve their goals. Many of the schools are staffed by early career teachers who are struggling with their development as a teacher, which is not isolated to remote schools but a general phenomenon for new teachers.

Envisioned
Vision for the school – high expectations of all participants; common and consistent approach; Leadership (distributed), supportive culture at the school, supportive learning culture; professional learning for staff; sharing vision, embedding practice, sustainability

Enabled
Recruiting and training of staff – teachers and support staff; databases to inform teaching and action; professional development; targeted staff to work with teachers and support staff, resources

Enacted
Assessment for learning; lesson structures; differentiation; scaffolding; targeted learning; language; culturally responsive pedagogy; consistency in approaches; explicit teaching of concepts and strategies; making goals explicit; pacing; small groups; whole class teaching; early years focus
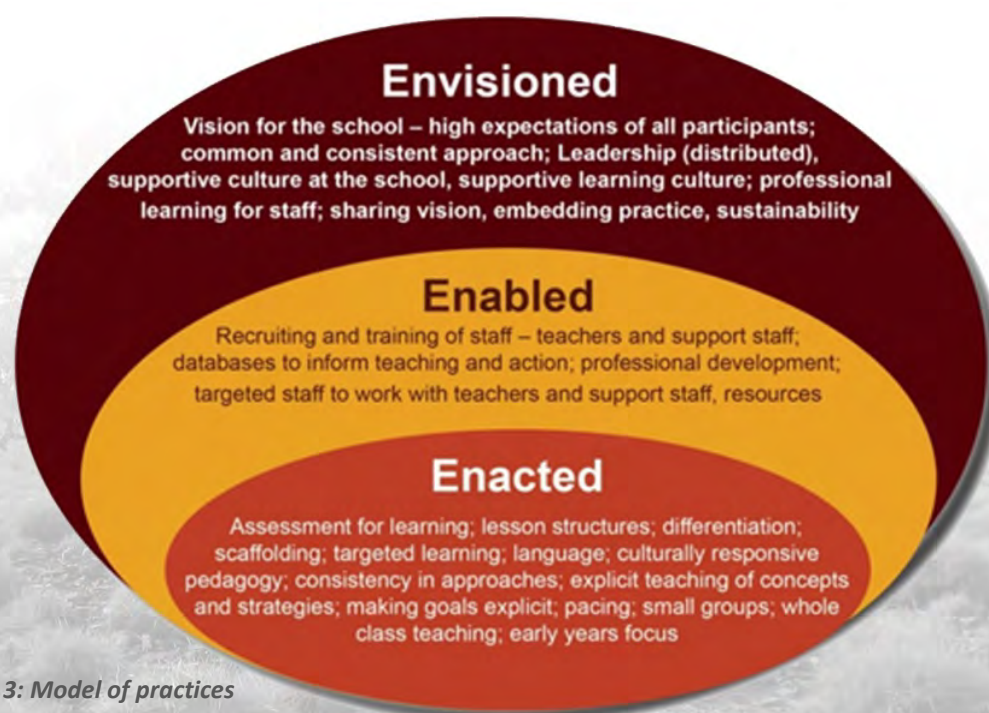
Figure 3: Model of practices

[6] A more detailed discussion of the levels of analysis has been published at the International Conference of Mathematics Education and Society group, Portland, USA, June, 2015
[7] A comparison of two schools was undertaken and presented (and published) at the international conference of the Psychology of Mathematics Education, Hobart, July 2015

The Three Levels of Practice

In this section, specific examples are provided of the three levels of practice. The text in the boxes is that which was provided by participants and highlights the various levels of practice.

Envisioned Practices

"The leadership team commenced at the school and found many students were truant. It was also found that there was not a good perception among the community of the school. The leaders brought in an outside expert to undertake an analysis of needs and provide a strategy for the future. The outcome has been for building a culture at the school that creates a sense of happiness and safety so that the students want to come to school."

Initially it was not thought that the leadership of the school would be a significant variable in the study, given the intent was to document practice. However, over the evolution of the project, leadership has emerged as a significant and important (macro-level) practice at the schools.

Most of the schools have adopted some sense of school-wide reform so that there is a consistency in the approaches taken at the school. Depending on the context of the school, and the philosophy of the leadership teams, different approaches have been taken at the school level. In some cases, the focus has been on developing a particular school culture (such as a supportive, welcoming school environment), while at other schools, the focus has been on a school-wide approach to curriculum, pedagogy and or assessment. To date, there have been two schools that have not focused on mathematics but rather, directed their work at building a school culture where students (and families) want to be, and in so doing, have created a very strong culture within the school, that indirectly supports the learning of the students. One school has the motto of being the 'happiest school in the world', and from this has flowed a sense that students (and families) seek to be at school.

Many of the schools in the study were very clear about the culture of the school that they sought to develop (or had developed and sought to maintain and sustain beyond their time at the school). Most schools were seeking to develop ways of sustaining the work that had been developed throughout the current time in the school. There is an awareness of the vulnerability and viability of practices with changes in school leadership and staffing.

The schools have also developed leadership teams to support the enactment/rollout of initiatives across the schools. The emergence of middle-leaders (such as numeracy coaches, or numeracy Heads of Curriculum) was observable in most of the case studies. The role of these people was important in terms of managing and maintaining the implementation of the vision of the school, but also to be able to support the teachers (most of whom were new to teaching and working in remote schools) in their mathematics teaching, learning and assessment. Provision of professional learning opportunities (that align with the vision of the school) was a dominant feature in the success of the schools.

Most of the schools had very good working relationships with the wider community. This was often as a result of considered effort from the school leadership team (and teachers). In some schools, the relationship was in an advisory capacity with council-type bodies to provide input into the school, while in other cases, the schools had very strong practical support via the employment of teacher-aide/workers within the school. A considerable number of the schools had invested in their local people and saw them as an integral part of the teaching community. These relationships were very context-dependent and were shaped by both the local people and the teaching community. Being able to share the vision of the school with the local people enabled a stronger partnership between the families and the school, along with a sense of ownership of the school, the curriculum and outcomes.

Building relationships with communities is seen as an integral part of a successful partnership in education. Considerable work, trust and effort has been built, over a period of years, to establish strong, positive relationships with the community. Many community people are employed at the school, as a strategic operational plan. Within the school, positive and genuine relationships among staff, and between staff and students is a priority."

One of the more salient findings of the study to date, is that in most of the schools in the study, the leadership team has remained in the community for a significant amount of time – often more than 5 years. In some geographical areas, principals move around the region and become familiar with families, communities and the culture of the region. This has allowed the leadership team to establish relationships with the families and community, to build programs that meet the needs of the communities and high standards of learning, and to see such programs enacted and embedded.

Summary

In summary, the key features of the envisioned level of the practices across the sites were:

- Articulate and lead the rollout of a school-wide approach to the desired culture and vision for the school.
- A supportive leadership team to work with staff to enable the effective management of the school culture – both in terms of the culture of the school, and the mathematics learning culture. The models of leadership encompass both devolved and distributed leadership. Such a model also helps to bring new leaders into leadership roles.
- Working relationships with community to share the visions of both the community and the school.
- Change is slow if it is to be effective. Being prepared to evolve a positive culture over an extended period of time and ensuring that the culture is embedded so that it endures changes in staff, is critical. Communities and families are often change-weary and hence wary of leaders coming in to make their personal mark on the school in return for personal gain, rather than for the gains of students and community.
- Sharing vision and working with staff and community is an important factor for success.

Philosophy of the Leaders and Schools

A number of the participating schools were part of formal programs, such as *The Stronger Smarter Institute*, that provided professional learning for leaders and staff. Within this program, there is a very strong emphasis on having high expectations of the students. Many of the schools had bought into other programs to support the work of the schools. This included very commercial programs, through to some that were available through the relevant system (such as *Explicit Instruction* in the Queensland context or *Getting it Right* in WA). Other schools had sought the input from free-lance consultants who had marketable products. These consultants were commercial in their orientation and undertook tasks and provided advice to the school leaders.

Building strong links with the community – both the families and businesses – has enabled the school to cater for the welfare needs of the students (and families). Students may not come to school if they don't have food or shoes or have illnesses or not slept. The school works with families and providers to counter these problems and enable the students to come. Part of building this open culture has been to create a transparency at the school so teachers, students and families feel empowered to talk with staff. The school has an open-door policy for all stakeholders."

The espoused values of the school leaders were evident in how they managed their schools and the approaches taken. For example, at one school there was a "relational leadership" approach at the school where the emphasis was not only on relationships with the community but also about relationships within the school. This humanistic approach to leadership meant that the community links were well developed and an integral part of the school's operations but also that the school was focused on the relationships among the staff within the school as well. Similarly developing an ethos of being the "happiest school in the world" was the focus of a school so that students felt like they wanted to come to school. Practices were put in place to ensure that students were happy at school and it was a happy place for them. A final example was where the emphasis at the school was on student welfare – ensuring that student and families' needs were met, as this had acted as a barrier to schooling. To undertake this approach, a considerable amount of trust had to be built between the school and families so that families could feel comfortable in acknowledging their needs and the impact this had on accessing education.

"The case study draws on the success of students who have learning difficulties. Their success is not measured in the NAPLAN outcomes but in their engagement with school, and the possible transition to work. This school has invested considerable resources in establishing an Agricultural Centre where the students can learn many valuable life skills with farming. The experience is very comprehensive and is now being extended to bring in the elders and seniors to share the experiences of the students, but also to draw on their wisdom of farming in the region. This has been an enriching experience for both students and community."

Needs of the School and Community

In some schools, the needs or culture of the community shaped the reforms at the school. Attendance can be a reflection of the marginalisation students and families feel towards the school. Two schools worked proactively to focus on building a school culture that encouraged families and students to want to come to school. For example, in one community, the students were not attending school. They would walk around community clearly flaunting their non-attendance. The school sought to find ways to re-engage students with school and make school a place where the students wanted to attend. Through providing a happy and safe environment, students began attending regularly and engaging with learning. In contrast, another school had sought to engage in strong, open and honest communication with families, students and the broader community. The school sought to have no barriers for families to come to school, so student welfare was a priority.

Culture and Shame

Schools had adopted approaches that could be seen to be culturally responsive. For example, shame was a big factor in classroom management. If a student feels shame or seeks to avoid creating shame for another member of their classroom, they will act in particular ways that may not be conducive to learning. Teachers had developed very effective strategies to engage students without creating situations for shame to emerge. For example, rather than have public displays of knowledge, teachers frequently used small white boards that the students used to write their responses and show the teacher who could then assess learning, but without students being shamed if they had the wrong answer. The interaction was between the teacher and student without any public displays of knowledge (or lack of) and so reducing the potential for shame (and disengagement).

Curriculum Leadership: Leading from the Middle

Being able to implement a model of mathematics leadership requires staff with a strong background in mathematics and/or mathematics education. Given the unique circumstances of remote education, particularly the employment of new graduates, the high turnover of staff and the difficulties accessing external professional development, many schools have adopted some form of internal curriculum leadership. A key role of the curriculum leader in many of the schools was to build a coherent program that operated across the school. This included the enactment of the vision of the school, but also to ensure quality practices at the level of the classrooms. Schools varied in their models from those that had a standard lesson model across the school through to those that were more open in how teachers operated within their classrooms. It is the case that there were more schools who were focusing on common models, so that there was consistency across the school, as this was seen to be more enabling for the students who would enter classrooms knowing what to expect and thus engage in learning more quickly and easily.

Enabling Practices

To mediate between the vision held at the school level and the enactment at the classroom level, schools had a number of practices that supported the flow down (and flow up) of vision and practice. These varied from site to site but largely included four key practices.

Employment and Development of Community Members

The role of community people across the schools varied considerably – in some sites there were few, if any, local people employed, while at other sites there were more local people than teachers. In some schools each classroom had a local person (or two) to work alongside the teacher, along with local people employed in other support roles (behaviour management teams, garden staff, bus driver, etc).

"Employing, training and building the capacity of the local community helps to build sustainability in the approaches taken. Local people work alongside the teacher, as a teaching partner to build their skills and knowledge, move into taking small groups and over time, taking the whole class. Code switching and being the expert in home language provides strength to the teaching team. The local people also undertake training to build their skills and certifications."

There were two schools (from which specific case studies have been developed) where there has been an extraordinary relationship developed with the local people. In these two cases, the local people are an integral and seamless part of the teaching process at the schools. Building the capacity of the local people in the education process has been a strong feature of many of the schools, but it is noteworthy that a particular group of schools and their professional team have built a range of support mechanisms to empower the local people in the education process and to build their skill levels (and qualification base). The case study "Culturally responsive pedagogy" illustrates the role that the AEWs have played in the school to develop pedagogies that meet the needs of the students. Also, the "Teaching students, not mathematics" case study site takes responsibility for an annual regional professional development conference for the local people employed in schools in the region. The conference not only helps to build the skills of the AEWs but also helps to build networks across the region for the local people involved in education.

Professional Support for Teachers

As with most remote contexts, frequently the teachers at the schools are early career, new to remote teaching, and often only remain in community for the duration of their contract. The effect is for a regular turnover of early career teachers. There were sites that had long-standing members of their teaching communities but these were limited. The types of teachers in remote communities means that schools need to have well-developed induction processes for teachers coming into the schools. There were frequent comments to the effect that if a new teacher does not like the approach being taken at the school, then they should not come to this school. Principals and leadership teams acknowledged that it was important for them to be able to have this scope so that they were able to develop the culture at the school without the stress of staff not wanting to buy into their programs. Living and working remotely is fraught with many challenges, so having staff at the school who were willing to engage with the approaches valued by the school was integral to the success at the school. Schools had carefully managed inductions, and in some cases, the school provided teachers with the first four weeks of lessons so that they were able to get on with the task of teaching in their early days, and in that time come to understand the approaches of the school. This was found to be invaluable for the incoming teacher as he/she was able to teach the model of the school and the numeracy coach could then work with the teacher around the planning and teaching expected of the incoming teacher. For beginning teachers this was a very good induction into the school (and education as a career) as it took considerable pressure off the person as they came to understand the school, the students, the culture and the community.

Teachers are provided with the first four weeks teaching plans so that they can begin teaching in the model of the school and get to know their students without having to assess and plan for the first few weeks. The model aligns with the teaching plans of the school."

Many teachers are new graduates and do not have a strong content or pedagogical content knowledge. Building an integrated resource that allows teachers to asses for learning, then target teaching to the needs of the students, and then to access good teaching activities enables teachers to provide quality learning for their students. An online resource has been constructed for the teachers to enable an integrated approach for teaching maths. It also allows teachers to enter student data and for other teachers to access these assessments. This is invaluable as students move between schools and teachers are able to identify the students' achievements when they enrol in another school (that is on the

Middle Models of Leadership

In a significant number of the schools, a person had been appointed to lead numeracy reforms. The title of the person varied but the roles were similar across contexts. The role included working with staff – many of whom were new to teaching – to build their repertoire of teaching skills in numeracy/mathematics; supporting the teachers through lesson observations and feedback; to providing model lessons to demonstrate quality teaching; supporting planning; and where schools were undertaking comprehensive data collection to inform teaching, the role was often to support the collection, interpretation and then action arising from the data collected.

In some schools, funding had been allocated by the State to support this role, but in other cases, the schools saw the role as pivotal to the quality of the programs and had worked their school budgets to enable the appointment of these roles. Depending on the expertise of the numeracy coach, teachers were very supportive of the quality work undertaken by most of those in this role. This was particularly valuable for those early career teachers, usually new graduates in their first teaching role, and also new to remote living.

A numeracy support person helps teachers with planning, pedagogy and assessment for learning which has built teachers' repertoire of quality teaching in mathematics. The numeracy coach supported individual teachers to plan quality mathematics lessons, provided modelling of quality teaching, provided feedback to teachers on their teaching, helped teachers to interpret student data and then to build quality interventions based on student need."

Many primary school teachers enter their profession with mathematics being their least favourite and most daunting area to teach. A significant number of the schools have appointed middle leaders who assume the responsibility of translating the vision of the school into classroom practices. The role is variously called a Numeracy Coach, Head of Curriculum etc, but generally the role is to provide professional support to teachers to help them develop quality mathematics lessons and programs, along with the interpretation of student progress to inform subsequent practice. The Numeracy Coach can undertake various roles in the school and these have included modelling lessons, helping with planning, observing lessons and providing feedback. Teachers have valued this support. In some schools there has been strategic planning in the senior executive to enable the funding to be redirected to enable the employment of a Numeracy Coach. For example, at one school, the leadership team, in concert with the staff, decided that the student:staff ratio model could be adjusted so that teachers had more students in their classes so as to free up one teacher who would take on the role of Numeracy Coach. The teachers recognised that there is considerable flexibility in student numbers *vis a vis* attendance so that the figures could be manipulated to enable the employment of a dedicated person to help with numeracy. Teachers valued this support and were prepared to have larger classes in exchange for the access to support.

Transitioning

Across the study, there have been a number of examples of schools supporting students in transitions. These transitions vary from context to context. In some cases, the transitioning has involved taking students from the communities and supporting them to transition into mainstream schools and urban life, so as to broaden their experiences while providing a stronger education that would not have been possible in a remote community. In other instances, the transitioning has been from the home to school, where the school (based in the community) builds the children's (and families') skills and knowledges about schools and mathematics so that when the child moves into formal schooling they are ready. This readiness means that the students are then able to engage with substantive learning rather than just learning general skills associated with school behaviours.

Summary

In summary, the key points to be made with regard to the enabling practices observed in schools are:

- Employment of quality local staff to work alongside teachers. Investment of time and resources were evident of local people who often took a strong role in the classroom and were an invaluable resource within the school;
- Quality professional learning for teachers – most of the schools were staffed by new-to-teaching teachers, and often in their first remote position, so considerable support was made available to induct them into remote education, and to provide ongoing support;
- Middle Leaders – often referred to as Numeracy Coaches, Head of Curriculum or Instructional Leaders - were a feature at many of the schools. These people's role varied depending on the context and needs of the teachers but included sharing the vision of the school and supporting teachers to enact that vision, providing in-class support for teachers from planning lessons to providing feedback.

Enacted Practices

The enacted practices are those practices that can be observed at the level of the classroom. Over 150 lessons have been observed as part of the study. There has been considerable diversity in practice at the level of the classroom. It is not possible to fully capture this diversity in this report. Over the project, a productive pedagogies (Lingard et al., 2001) profiling has been undertaken of the lessons observed.

Productive Pedagogies

Across all schools, profiling of lesson observations has been undertaken. Using the productive pedagogies framework, the lessons have been scored as per the model. Here, a score of one is used to denote absence of the pedagogy and a five is used to indicate that the pedagogy was an integral and featured part of the teaching. Over 150 lessons were observed and scored using this framework.

What appears to be the case is that most of the schools have a strong focus on intellectual quality, with scores often quite high. As has been found in other studies (Education Queensland, 2001) teachers were also very supportive of learners, with the social support pedagogy scoring 3.10.

Intellectual Quality	Supportive School Environment	Recognition of Difference	Connectedness
2.17	2.40	1.37	1.73

Table 9: Mean scores for quadrants of pedagogy

What these data suggest is that teachers are focusing on the intellectual quality of the lessons and with a high degree of social support. In contrast, there is only a small attempt at pedagogies that focus on inclusive educational practices and connections that draw on the culture and backgrounds of the students and families.

Differentiation and Class Size

As would be expected, there is considerable diversity in remote Indigenous classrooms. There are many factors that impact on the constitution of any classroom and this impacts on diversity within those classrooms – issues of attendance, health, transience, family life, community life, well-being and so on all impact on the learner. Without exemption, all schools and teachers commented on the diversity within their classrooms and schools. Schools varied in how they dealt with this diversity. Often the strategies were contingent on the size of the schools – larger schools had more capacity to be flexible in their structural arrangements, while smaller schools had less scope for movement in their capacity to offer different arrangements within their school's structures.

The size of the schools varied considerably across the study, and with that, the sizes of the classrooms. Some schools had worked to create small classes to enable more teacher time for students, while others sought to have class sizes commensurate with non-remote settings so that students would have more interaction with peers. What was apparent, regardless of class size, was that in each classroom there was considerable diversity. What was consistent across the schools was that teachers used data to plan teaching. In most cases, students were on individual learning plans and data were used to construct these plans and practices within the classroom. Grouping students according to achievement was commonplace, but there was also considered variety in grouping techniques. In some cases, heterogeneous grouping was implemented so that students could learn from each other, in other cases attendance and behaviour were the basis for grouping students.

"Students were grouped by attendance – those who attended regularly and behaved well were placed in one classroom, often working at benchmark levels. Students whose attendance was recorded as somewhat sporadic and needed more intervention were allocated to another group so that focused work could be undertaken. Those who attended infrequently and were poorly behaved were placed in a small class with a teacher who could work on behaviour management and intervention. This process allowed the regular attenders to achieve at level without the disruption of poor peer behaviour. "

Grouping Students by Attendance (and Behaviour)

Some schools had worked with models of class differentiation through allocating students to classes based on attendance and behaviour. Students who attended regularly and behaved well were often performing well, and often at standard for their ages, so were grouped together so that their classes could run as a mainstream class. Students who attended less regularly often needed more support so were placed in classrooms that were smaller and more flexible, to cater for the greater diversity in learning needs. For some schools, small classes were made available for those with poor attendance and poor behaviour. This enabled the teachers to work closely with the students, while also ensuring that they did not distract the learning of the peers who were attending regularly. This enabled the schools to support the needs of the learners thus enabling all students to achieve.

In-Class Grouping

Grouping within classes was commonplace across the study. Diversity in classrooms was commonplace, so teachers needed to find effective strategies to cater for the diversity. Many teachers had spent considerable time building group work skills. In one case study, the teacher had spent one term building the group work skills of the early year students. Depending on the lesson, or the school, teachers frequently used heterogeneous groupings so that students could support each other and this would enable teachers to undertake focussed teaching with smaller groups, or to undertake assessments and interventions within the classroom.

The grouping allowed teachers to target activities to meet the needs of the learners so that within any group, students could be of any age and undertake a particular activity. Most classes across the study were diverse in terms of ages of students (multi-age classrooms), and in some cases, were a one or two-teacher school. This meant that it was possible to teach only in the small group context given that there was so much diversity within any one class.

Individualised Learning

For most of the teachers, the diversity within a class meant that learning needed to be tailored for individual students. Teachers catered for this in many ways – through Individual Learning Plans, tailored learning activities (such as worksheets or modified activities within a group for each learner). In many classrooms, teachers tailored activities so that they appeared to be the same activity but were differentiated for each student. For example, in many schools in one geographic location there was a strong emphasis each day on number activities – such as counting on, back, skip counting, etc. Teachers had the same activity sheet for each student, but the 'magic number' written on each student's sheet was targeted for the student. So, one student may have a number of 8 from which they did their counting activities, while another may have been 65, or 122 or 2.5. This targeted learning was commonplace across many schools. The activities were not only tailored to meet each student's needs, but also appeared as if each class member were undertaking the 'same' activity thus reducing any external appearances of difference and potential for shame.

Data-Driven Pedagogy

Assessment-for-Learning featured in most of the schools to date, and where data were used to inform teaching. The schools varied in their assessment tools but all used some form of recognised testing/assessment scheme. Students were assessed against the scheme or model and the results were used to both inform subsequent teaching but also to monitor student progress.

Data Walls

In many classrooms and schools, student data (usually for literacy and numeracy) were on display. In one school, a whole wall in the staff room had been designed to show all students, their levels of achievement and also their growth over a semester. The school created an event as they moved students forward and collectively celebrated students' successes. Teachers often had student data displayed in their classrooms. Students (and families) could see results on given tests, but also how data were improving. Similarly, in some schools, there was a wall with whole school data. What was salient in these displays was the public display of results, along with growth over time.

A wall in a shared space, but away from the public eye, was created. All student data were displayed. Each semester, the staff would hold a special meeting to share the growth of their students' learning over that time. The wall was a permanent fixture so that teachers and students were able to see (and enjoy) the learning growth of their students."

Many schools used the data to share with families to show growth over time, as well as to illustrate to families the mathematics that their children were able to do, what was expected of them for their age (national benchmarks) and how they were performing in comparison with these national expectations. For example, a school had made the data the basis of teacher/family interviews. The interviews were conducted in school and in out-of-school contexts (such as the home or public area). Another school conducted their final parent interviews at an event at the local pool which was strongly orientated for family involvement. The data were presented in a family-friendly manner so that families could understand the growth of the students. This could be in showing how the students were working with larger numbers (or part numbers) and operations. Pre-data (as in the activities that students would do for that data) were shown, and then activities were shared as to what the student was now undertaking. This helped families understand what was happening at school and how their children were progressing against the teaching and curriculum expectations.

Student progression was shared with families – either in their home, at the local pool or at the school. The data of the students' success, and progress, were shared in a way that families could understand the progress that had been made, but also where the student was in terms of national benchmarks. Teachers provided examples of the students work to show the successes, but also shared examples of what is expected for that age level and how the student was tracking against the national expectations."

Explicit and Consistent Lesson Structures

There was diversity across the schools in terms of expectations of how teachers would organise their classrooms – ranging from each teacher being able to decide their own approach, through to highly-prescribed teaching methods. However, while there was diversity across the schools, it was commonplace for the teachers to be expected to be consistent in their approach to the teaching of mathematics.

A number of case studies focused on lesson structures and how they support learning in a very dynamic way. One detailed case study provides details on how lesson structures varied to cater for, and ensure, quality mathematics lessons that were over a two-hour period. By having a set structure of all mathematics lessons across the school has meant the students know what to expect as they enter any mathematics lesson and how the lesson will change over the two-hour period. This reduces students' (potential) confusion about what they are to do, what is expected of them, etc. as they enter a lesson. In turn, this results in the students engaging with the mathematics rather than trying to guess teacher expectations and their roles in that lesson. Also, with every lesson across the school being conducted in the same way, students know what to expect on any day in any year. Families also know how the lessons operate, so over time a strong culture has developed so that there is no confusion or misconceptions about the ways in which the school operates. This has been made very transparent to the community and students.

"Mathematics lessons were an uninterrupted two hours, usually the second session of the day. The lessons followed a format where the students usually undertook the following activities each day:

- *Consolidated learning by revising concepts at a fast pace to develop fluency*
- *Practice mental maths*
- *Explicit teaching of new mathematics concepts*
- *Exploration/use of digital media for mathematics learning*

Using this format each day and across the school, students entered a mathematics lesson aware of how the lesson would go, and hence, could engage in mathematics."

Building Proficiency in Number

A key focus for many schools was to build proficiency with number. Somewhat related to the culturally-responsive pedagogy, teachers were aware that for many remote and very remote students, number is not as evident in their daily lives as it is for urban students. Taking this into consideration, the teachers used the extended lesson format to build number skills so that a deep knowledge of number could be developed and automaticity with numbers could develop. The lessons revised many number concepts each day, often in new ways, but always to help students remember their previous learning and to build skills, as well as confidence, in number and its application. One case study emphasised the importance of number in mathematics and spent a considerable amount of lesson time on building number skills, application and automaticity.

An emphasis on the big ideas of number – counting, number (whole and part), place value and operations – was central to the mathematics curriculum at the school. Most of the lesson was spent building competency, confidence and fluency in number as it was seen to be the key to numeracy outside school. The application of number was undertaken through very hands-on activities such as cooking, measuring and building so that students could see the application of number in real contexts."

Pacing of Lessons

There were few, if any, schools that did not adopt an approach that was fast paced. Teachers reported that to keep students engaged, the fast pace helped as it gave limited opportunities for the students to opt out of the lesson. To keep the pace right, various strategies were used, including:

- Revising concepts that had been covered so the activity was designed to build automaticity with number (or other strands), rather than deep understandings;
- Use concepts with which students are familiar so that the pace can be kept up;
- Using a range of presentation styles: PowerPoint; activities provided with Interactive Whiteboards (SmartBoards); flash cards; and small white boards;
- Using personal bests rather than competing with peers;
- Using timed exercises so that students know that they have x mins to complete the tasks or do as many questions as they can in the nominated time;
- Use a clock that counts down the time so that students can see how much time they have left to do the activities; and
- Use of humour to keep students engaged.
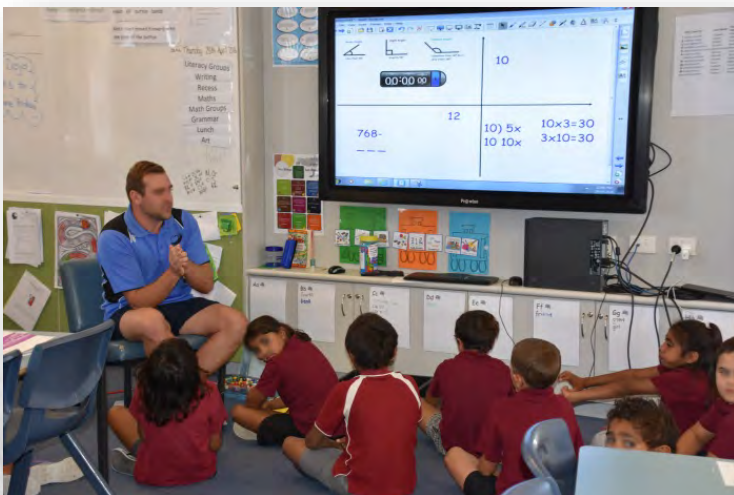
"Quick paced questions, often recalling basic skills and knowledge, helped to engage the learners. The questions could be posed verbally by the teacher, put on the whiteboard and a timer displayed so the students could see how long they had; or a rapidly fired screen that revolved through the displays at a nominated time. The teacher interspersed his questioning with humour as this was seen to keep the students engaged and motivated."

Language-Based Mathematics

In all of the remote and very remote schools in this study, the use of SAE was, at best, the second language for the students, or in some of the more remote locations, it was a third or even foreign language. Coming to learn mathematics was as much about the mathematics as it was the language. Mathematics has many nuanced terms, processes and concepts. Coming to learn these in a medium (Standard Australian English) can be a challenge, so finding ways to scaffold learners is important for success. In some schools, there was either an explicit strategy whereby the early years allowed the students to use their home language as they navigated their way through mathematics (and school in general) and that by the time they were approaching the middle years of primary school, they had gained a proficiency in SAE. There were a wide range of practical strategies teachers used to support the transition into SAE, but most frequently the local Indigenous people were critical to the success of the approaches adopted. For most of the teachers in this study, they did not learn the home languages of the students, so the local people were central to brokering between the home language and SAE.

The Aboriginal Education Workers in the school played a significant role in supporting teachers to create scaffolds between the home language and Standard Australian English. The Aboriginal Education Workers built resources that represented activities from the lives of the students, and created bilingual resources for the students – books, big books, songs, and prompts/posters – to use in the classroom to reinforce the links between the home language and the language of mathematics."

Working with the local people, as a teaching partner, provided students with role models on how to speak SAE but also to validate the home language and to navigate code switching. The teacher and AEW worked as a teaching partnership. The teacher would read the text, the AEW would then translate into home language. The teacher would model, the AEW would then model as the teacher had done, but also add things that might also help the students. The teaching partnership grows so that the AEW can become an educator in his/her own right."
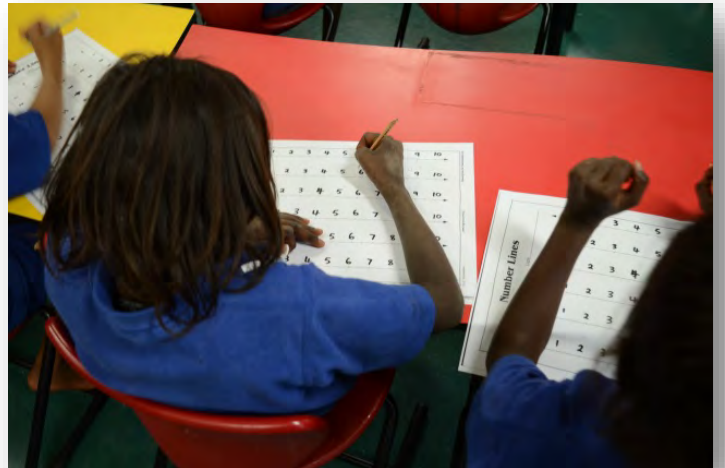
High Expectations

A query run through NVivo showed that all schools, to date, have made explicit reference to 'high expectations' of students and/or staff. In total, 459 references have been made to high expectations and it is the most cited comment in the study to date. While some schools have been part of the "Stronger Smarter" training, this is not the case for all schools. There is a clear trend for the schools to articulate (and enact in most cases) having high expectations of learners.

"*Some schools have adopted an approach where students are provided with age-appropriate mathematics. That is, if the student is in a particular year level, e.g. Year 9, then he/she will be given mathematics from the Year 9 content of the National Curriculum: Mathematics. If the student is unable to undertake this level of work, then it is the teachers' responsibility to provide appropriate scaffolding to build learning to enable the students to attain this level of achievement. As many participants in the study were very clear to articulate, it is insufficient for teachers to hold students back and only offer an impoverished curriculum.*"

Mathematics, Mathematics, Mathematics

It has been recognised that good teachers of mathematics usually have strong content knowledge. This emerging literature poses a challenge for many primary school teachers whose mathematical content knowledge (MCK) is often quite weak. A number of the schools had developed professional learning around mathematics. The teachers were asked to build their own mathematical understandings and the Numeracy Coach was an integral part of this professional learning.

An approach adopted in a number of the schools was to give the number strand a high priority. The approach was founded on the knowledge that number sense and proficiency was a key life skill, and many of the resources for number were absent in the community. As such, building strength in number knowledge was a priority for mathematics learning.

Culturally-Responsive Pedagogy

Working with Indigenous learners requires some consideration of the cultural background of the learners. There was considerable evidence, to a greater or lesser degree depending on the schools, as to how culturally-responsive pedagogy has been implemented at the school. In some cases, the school had taken a line whereby the leadership team (often in consultation with the community) had decided that school was responsible for 'school business' and community was responsible for 'cultural business'. The approach at these schools has been for literacy and numeracy to be priority learning areas for the students. In contrast, there were a few schools that incorporated 'cultural business' in the schools. There were some tensions between schools and communities with regard to the incorporation of cultural business into the school. A few community representatives from some of the communities expected that school incorporate more cultural activities (such as dance, art, festivals, etc) into the school curriculum in a very substantive manner. So, across the study, there was an identifiable tension as to the importance of 'cultural business' being part of 'school business'.

"The teachers made explicit references to the resources in the classroom so that students could use these as prompts but also to support independence of learning (by not asking for teacher support). For example, if a teacher had constructed a resource that exemplified the various words that could be used for the four operations, the teacher would model a problem – such as not understanding a word in a word problem (e.g. distribute) they could look at the word board and find out what the term meant in their own language and to which operation it was associated. This encouraged the students to use prompts in the room rather than develop a dependency on the teacher."

What is clear across many of the sites, is a strong cultural awareness and the need for pedagogies to be adjusted to incorporate cultural aspects of the students into the learning. A number of important strategies were observed. Shame is a big factor impacting on participation and learning. A few schools have taken up a strategy of making students write on small whiteboards (or other tools to show their understandings) and then display these to the teacher. The teacher is able to do a quick scan of the students' responses and assess for learning. Depending on the results displayed by the students, the teacher is then able to adjust teaching according to the students' responses. This process allows students to show their understandings without being shamed and allows the teacher access to those understandings. Similarly, as a white board, there is no permanent record of the work, so for Indigenous learners who may be wary of writing a numeral or diagram incorrectly, the erasable surface means they do not have to focus on the accuracy of the representation, but rather on the concept. Again, this allowed the teachers better access to students' mathematical understandings than through recording work (permanently) in a book

As discussed earlier, language was also an important consideration in many classrooms, particularly noted in those where the students were still strong in-home languages (and creoles), and to a lesser degree to where they spoke Aboriginal English. There was recognition that language is an important factor in learning mathematics – both in the relay of concepts as well as the language of mathematics itself. Many classrooms had rich displays of resources that were targeted for the learners in their classroom and for the concepts being taught.

Group Work

The diversity within each classroom was a constant across the project. In some cases (at the larger schools) the diversity was within the age group, in other cases (at the smaller schools) the diversity was due to multi-age classes and the diversity within the learners. Teachers dealt with this diversity by differentiating the curriculum, through targeted learning activities. To manage the diversity at a very practical level, and depending on class size (and attendance), most teachers used a group work structure in the classroom. The structure of the group work varied depending on need and context – sometimes the groups were homogenous groups where the teacher would use a targeted group to teach new concepts to that small group. At other times the groups would be heterogeneous so that students could work independently and support each other. Teachers used the groups to suit their needs for a particular lesson. Often, in the larger schools/classrooms, there were three groups in a class – one with which the teacher would work; another with which the AEW would work, and another which would work independently. This practical organisation of the groups did require considerable effort from the teachers, particularly if the students had not been skilled in group work, and/or had been used to dependent learning. In one case, the teacher indicated that it took one term to build the group work skills, but it was very successful once the students had become proficient in working in the groups.

Early Years

A number of the cases have focused on the early years of schooling. In some cases, the school had created new spaces for the prior-to-school experience so that the teachers could provide learning experiences that built the children's school readiness – socially, behaviourally and cognitively. Providing the experiences for the children to learn many of the pre-number concepts prior to coming to school, such as counting, recognising/writing numbers, familiarity with the materials used in mathematics (counters, blocks, etc) helped in the successful transition into school.

One of the side benefits of providing prior-to-school experiences also meant that families felt more familiar with, and in, the school and were more likely to send their children to school once they commenced formal school. It also helped with the transition into school – it was no longer an unfamiliar place and children fitted into school more easily.

The early years' experience was also a feature of a number of schools. Here the teachers worked on building the students basic mathematical concepts, skills and processes, often with quite a diverse range in the starting levels of knowledge of the students. In some cases, as noted in the language section of this report, building experiences that linked the home language (and culture) of the students with the SAE of the school was undertaken in the early years. Building strong number sense, counting skills, operations sense, and both whole and part number knowledge were key to building mathematical understandings that would support students' mathematical understandings. Providing contexts that were rich in language and practical activities were central to many of the early years' settings.
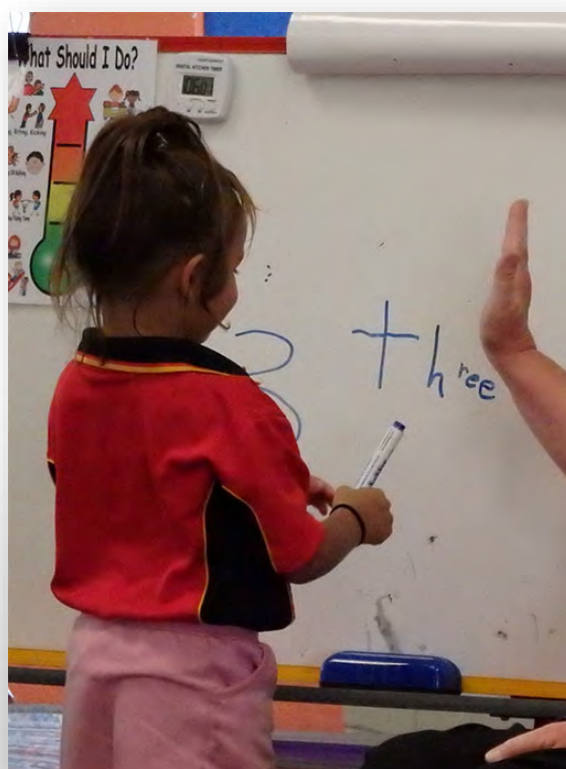
Attendance

As in most Indigenous communities, attendance is an issue. But there is also considerable diversity among the students and families in relation to attendance. In some schools, there are cohorts of students who attend regularly while at the other end of the spectrum there were students whose attendance was very sporadic and very transient. Schools have developed a range of strategies to build attendance in a positive (rather than punitive) manner, and to cater for the diversity in attendance. In one case, the school has been very proactive in creating Fridays as a fun day so that students want to come to school, but the activities are rich in terms of mathematics.

Catering for the diversity within a cluster of students, such as year level, a number of schools have created groups or classes (in the larger schools) that are built around attendance. Schools reported a correspondence between behaviour and attendance so have created spaces to cater for the regular attendees and the irregular attendees. The students who attend regularly are placed in one classroom and are able to achieve at benchmark, while those with poor attendance and often poor school behaviour and low achievement, are placed in smaller, focused classes where their needs are met and without their behaviours distracting from the learning of other students.

"With Fridays being a very poorly attended day, the school has opted to increase the attendance hours during the week and Friday is a half day. Fridays is a 'fun day' with many activities for the students so that there is an incentive to attend school. The activities have strong literacy and numeracy basis but all have a high level of activity, engagement and fun. This has helped build attendance over the week."

Pedagogical Practices

In summary, the key points that emerged in relation to the enacted practices at the level of the classroom were:

- Being explicit about the intent of learning, how lessons will be organised and what is expected of the students;
- Differentiating learning to enable identification of students' learning needs through assessment for learning practices and then to build quality learning experiences that meet and extend the needs of each learner;
- Recognising language as a key variable in learning, providing appropriate scaffolding in language (home and SAE) to build bridges between the home and school, and provide entry into school mathematics;
- High expectations – of both students and staff – across social and mathematical norms. Students should be provided with age-appropriate learning outcomes (e.g. algebra for secondary students) and then quality teaching practices to scaffold learners to achieve those learning intents;
- Focus on mathematics – mathematics was a priority for learning;
- Culturally responsive pedagogy was evident where many strategies were developed to cater for culture of the students. Most obvious were strategies used to build language (of mathematics and the home language as well) and to have strategies that were cognisant of issues of "shame" within the classroom. There was only one individual class that incorporated the more overt aspects of culture (e.g. art) but other teachers have sought to draw on the everyday activities that the students undertake (e.g. fishing, trips to town);
- Creating a sense of numeracy for life. Most communities had limited numeracy resources that were synonymous with urban living. Teachers have developed many strategies to create opportunities for students to see the purpose of mathematics/ numeracy in their lives;
- Pacing of lessons, where the teachers kept a good quick pace in their questions appeared to engage the students and keep them on task. The pacing was often in the earlier parts of the lessons to engage the learners and provide them with the necessary knowledge and skills that would be needed for later work. The pacing also primes the learners for the lesson; and
- The early years were seen to be a launching pad into school, and numeracy. Building skills in mathematics (and the language of mathematics) in the early years was a crucial and integral part of the building blocks for mathematics learning. Many schools have invested significantly to build a positive and rich learning experience in the early years.

Summary

In this section, the actual practices have been discussed. It is here, that the levels of practice begin to take form. From this study, it is clear that there are three quite distinct levels of practice that need to be considered – envisioned, enabled and enacted. While the three are quite different, they are also dialectically informed. What is clear from the study, that for practice to be effective, these three levels of practice need to be evident.
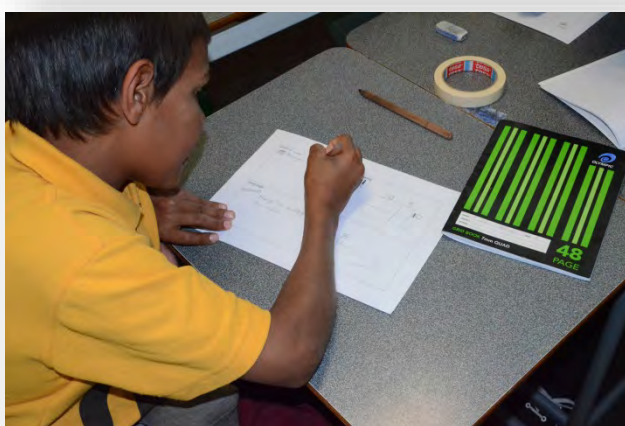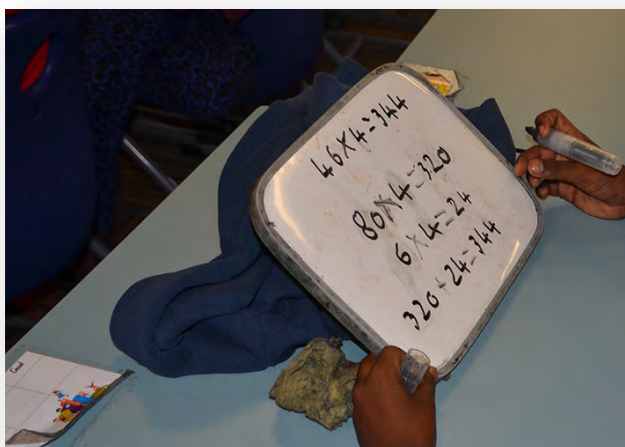
Establishing Norms: Moving Forward

The implications of this study suggest that there is significant diversity in practices across the successful schools in terms of how to organise for learning mathematics/numeracy. However, underpinning these practices are some norms that transcend the practices that were observed and described. What emerges from this study is the need for norms to be identified and articulated, and then established when thinking about successful practices in numeracy/mathematics for Remote Indigenous learners. From the practices shared in this study, there are some very clear messages that have emerged. The successful schools undertake a very wide range of practices thus suggesting that there is no single method that will bring about success but there are some consistent principles that underpin these practices.

There is considerable literature in mathematics education on the notion of norms as they pertain to the mathematics classroom. Most notably the work of Yackel and colleagues (2000) draws on the notion of socio-mathematical norms that relate to the normative understandings of the mathematical realities in classrooms. While these norms relate to the mathematical activities that are undertaken in a classroom, they are different from the mathematical content. The sociomathematical norms in a classroom provide the framework for the interactions through which mathematical meanings can be negotiated by the learners and teachers. Norms act as a means for mediating learning. Many terms are used to describe the practices that come to constitute norms in the classroom, including discourses, discursive practices, practices, and/or culture. For this project, the term 'norms' has been chosen as it is well established in the mainstream mathematics education literature and dates back to the very early work of Cobb and colleagues (Yackel & Cobb, 1996).

Norms can be seen as principles that underpin the practices. They provide the implicit and explicit guidelines through which the practices will evolve, and reflect what is valued within the classroom, school and/or community. They shift thinking from deficit models to strength-based models of practice. Under each of the norms, there are many sub principles and practices that need to be developed in order to embed and enact that particular norm. For example, if a school were to opt for a program that spanned across the whole school, as it was recognised that this would not only help students and community to see a common approach across the school, but there was also a need for a commitment from the staff to develop strategies that would enable this to happen. This would include staff development so that they would be familiar with the program. There may need to be consideration as to how best enable staff to undertake that staff development given that the schools are often unable to release teachers during teaching time due to the issues around isolation and inability to access to teacher relief. Considerations would also need to be made of how to ensure that the program is sustainable in the immediate context, but also how it may continue after the current staff leave the school. As such, each norm reflects various strategies (or practices) that have been shared through this research project.

Many of the strategies or practices that have been shared in this project cut across a number of the norms, which is why the notion of norms can be powerful in this type of research in bringing a coherence to the diversity of practices that have been observed. For example, one of the most cited conversations was around the need to have high expectations of the students in terms of learning *and* behaviours. To go beyond the rhetoric of having high expectations for learning mathematics, teachers also had to have a skill set that would enable them to create positive learning experiences that would facilitate learning mathematics. Some of these included identifying students' current levels of mathematical knowledge and thinking; then being able to develop appropriate strategies that met the students' current needs and extended them into new realms of mathematics; and being able to cater for the diversity within a classroom as students were on many levels of mathematics understandings, but in a context where the potential for the negative impact of shame would be minimalised.

Enacted Mathematical Norms

- All students can learn mathematics – to high levels
- Embedding mathematics is critical for understanding – embedding in the brain as well as embedding in contexts
- Mathematics is as much about language as it is mathematical concepts
- Transparency in learning and teaching mathematics enables students to access the 'secret knowledge' of school mathematics
- Mathematics lessons should engage learners at their levels of understanding, and then extend learning into new levels

Many of the classroom practices in the previous Enacted Practices section are evidence of the Enacted Mathematical Norms. For example, it was observed in many classrooms that teachers sought to be very explicit and transparent in their teaching. The teachers would make the intent of the lesson clear to the students and the teachers would also ensure that the students knew what they needed to produce at the completion of the lesson, so there was no second guessing about what the teacher wanted. This meant that students were clear about what was expected of them. Lessons across the school would be of the same structure so that both teachers and students knew what to expect as the lesson progressed. Having this consistency was useful within the context of a classroom, but also where students may be required to move to other classrooms. The structure was the same for every classroom so that students understood what was happening in any lesson if they walked into another classroom. These processes ensured time was not lost with having to provide constant directions (and confusion) as to what was to occur at a given moment.

Enabled Mathematical Norms

The intermediary level of Mathematical Norms refers to those norms that aligned with the vision or direction of the school but would filter through to classroom practices. Typically, the enabled Mathematical Norms were associated with ensuring that the practices were high in quality and supported teachers to achieve this goal.

- Teacher quality is essential for quality learning
- Recruitment, development, retention of teachers
- Teacher support is integral to developing quality mathematical environments
- A key resource for mathematical support across the school enables quality teaching and environments - numeracy coach
- Aboriginal people are a key, and valuable, resource in teaching and the classroom

All schools in the study faced similar issues with the attraction, training and retention of staff. Most staff were new to teaching and/or remote teaching and, as a consequence, needed considerable support. Having programs in the school that supported teachers to develop the knowledge and skills to be able to engage with the Enacted Mathematical Norms (and practices), was essential to developing a coherent and quality program within the school. This support was often achieved through human resources such a Numeracy/Mathematics Coach who would work intensively with teachers to build their repertoire of skills or to mediate the vision of the school and to ensure that teachers were engaged with and implementing the vision of the school. In some cases, there was support available through systemic processes – such as an on-line tool specifically developed for a cluster of remote schools and also supported by a numeracy consultant who would visit the schools each term and was also available remotely (usually by telephone or email). These schools were typically very small school and could not create a nominated coach position. Local people were an integral part of the mediation between school and the community, particularly in relation to issues of community and culture. As with the teachers, the local staff also needed support to be able to be the best that the school could offer their students and communities.

Envisioned Mathematical Norms

One of the more significant, and surprising, outcomes of the study was the impact of vision, leadership and coherence across the school. It was found that in a number of the schools that a specific numeracy (or mathematics) focus had not been addressed or implemented and yet there were improvements in students' mathematics achievements. This was a side effect of other actions that the schools had undertaken. Often these initiatives were around student welfare and engagement rather than mathematics per se. As a result of these initiatives, there was improvement in learning mathematics. These practices were at a very macro level of practice and where there were some overarching principles in place, the improvements were notable. Leadership was a critical factor where the leadership was of a devolved and distributed model so that all parties across the school and wider community felt that they were a part of the initiatives being implemented.

- Leadership is critical for developing a positive mathematics culture, supporting teachers and supporting community
- Establishing a whole-school approach to teaching mathematics ensures consistency and transparency – for students, teachers, and community
- Mathematics is a significant part of the preparation for the world beyond schools

The envisioned mathematical norms are those where there is a vision and strategy for the school. Often this involves programs across the school with a whole school approach. Having a coherent approach across the school was seen to be a salient feature of many of the schools. In some cases, this was a whole of school mathematics-based program, whereas in other schools, the program had little or nothing to do with mathematics. However, the policy and practices that were being implemented in the latter approaches indirectly created an environment for mathematical success. Leaders who incorporated their team – as shaped by the context of the school – were able to roll out initiatives into which the collective staff (and community) felt they were a part.

Summary

From the overall study, there are some significant findings. Some are not surprising, but what is of value is that this is the first study of its kind to be undertaken and hence it provides an overarching analysis of remote schools across Australia that are working well, despite the challenges that face many, if not all, remote and very remote schools.

Three levels of success emerged from the study and collectively these provide a framework for building success. Each level informs and impacts on the other. This was particularly evident in the highly successful schools.

There are a comprehensive range of practices that schools have used to create success for their learners – some of these are at the level of classroom practices while other are more systemic and at the level of the whole school. In some cases, the practices of the schools did not specifically address mathematics education per se, but the flow on effects impacted indirectly on mathematics learning.

In summary, some of the key findings in the study include:

- Leadership is a key factor in building a successful culture in the schools. The culture is one that fosters learning and encourages students and families to attend school. Respect for the community, the culture and the language of the families was a common theme throughout the visions of the schools, but with the simultaneous emphasis on a rich, rigorous curriculum that had high expectations of all parties – students, teachers, school and community.

- Middle leadership – where mathematics curriculum in both content and pedagogy were the focus of the practice. Providing support for teachers to develop the skills, knowledge, practice and dispositions towards quality teaching of mathematics in remote contexts is complex. Providing informed support that builds these within the teachers, who are often early career teachers with limited teaching experience, builds the quality of the teacher, but also helps to maintain the vision of the school so that there is a consistent philosophy embraced by the school and projected to the students and community.

- Providing a consistent and transparent framework enabled teachers to know what and how to deliver quality learning for students. That same consistency enabled students (and families) to know what was expected of them in mathematics lessons and so engage with mathematics rather than trying to second-guess the teachers' or schools' intention. In so doing, students were able to better engage in learning.

- Data-informed practice provided opportunities to target learning to meet the needs of the learners. Time was used strategically to enable teachers to focus mathematics learning for each individual student. Given the diversity in achievement (and attendance) at schools, the mathematical understandings of students varied within each classroom. Targeting learning for the individual and organising classes in groups, as a whole class and for individual targeted learning enabled teachers and students to focus mathematics learning and enable growth in understandings.

- Culturally-responsive pedagogy was often used but in terms of recognition of the culturally nuanced behaviours (such as shame) and language that the students bring to school. Recognising and validating the social, cultural and linguistic norms of the students, and then scaffolding learning to build bridges between the culture and language of the students and school mathematics provided pathways into the learning of school mathematics. Much of school mathematics is about the representation of the dominant Anglo-Western culture and language so students need ways of accessing these norms and building strong understandings of this knowledge system.

To focus solely on the specific practices identified on an individual school basis would fail to account for the across-schools successes. For a better understanding and theorization of these across school practices, it is useful to frame the practices within various norms that appear across the schools, states, sectors, school type and so on. Through the use of norms, it becomes possible to see the principles that inform and shape the practices observed and described in this study. The norms relate to the three levels found in the study – the enacted practices at the level of the classrooms; the enabled practices that work as an intermediary between the classroom and management; and the envisioned practices that serve to create a vision for the school. These norms provide an overarching framework for unifying what, at one level, seem to be diverse practices. Through the use of the norms, it became possible to conceptualise the practices into a coherent way of teaching.

Enacted Mathematical Norms
These refer to the norms that guide classroom practice and how teachers organise for learning.

Enabled Mathematical Norms
These norms refer to the ways in which the vision of the school is mediated and enabled into the repertoire of practices that teachers will enact in the classroom.

Envisioned Mathematical Norms
For success to occur there needs to be a strategy and vision for school that will provide a framework and culture for the school, and for mathematics. Often this Norm relates directly to mathematics – such as a whole school approach but there were cases where there were other issues that were beyond the mathematics classroom that needed to be addressed – such as student wellbeing, or attendance – that impacted on learning. When there was a vision and strategy for implementation, whether directly or indirectly related to mathematics, there was a greater possibility for success

The research conducted through this study has shown that classrooms and schools are complex and that there is not a single strategy or program that can be the panacea for often entrenched issues. What has been shown from this study is that schools need to respond to the needs of their respective community with respect and an informed approach. In many of the schools, external 'experts' or 'consultants' were employed to assist in the development of initiatives. It was very common across most regions that schools are staffed by teachers and principals who value informed input and support in order to effect positive change that has a positive learning outcome for remote learners.

Recommendations

This study, funded through the Australian Research Council Discovery Grants scheme, aimed to document successful numeracy practices in remote Indigenous education that appear to be having success for students. It was founded on the premise that despite considerable odds, there were pockets of success and that much could be learned from those working in the field. These people were experts in the field who had a sense of the issues, the community in which they were working, and what might work in these contexts. What emerged from the research are some significant findings, particularly that there are many practices that appear to have had success but these practices are multi-layered. Arising from the outcomes and analyses shared in this report, there are some recommendations that can be made. These include the following, based on the evidence provided and shared within this report.

1. **There is no one single approach that will bring numeracy success for Indigenous learners.** The practices that bring about success are shaped by the context in which the school is located and this is a prime consideration.
2. **Any program that is implemented in a school has three levels, each informing the other.** What has been very evident from this research is that success is a three-level model – where there is coherent vision, with support to mediate between the vision and the chalkface. Piecemeal interventions do not bring sustained success
3. **Schools would benefit from having a whole school and consistent approach to teaching mathematics**. Having a common approach assists with teacher learning as well as student learning.
4. **Appropriate models of professional learning need to be developed for teachers and local people working in remote areas.** The models involve in situ learning that takes account of the nuances of the community within which the schools or cluster of schools is located.
5. **Teachers need to develop a coherent repertoire of practices that enable them to enact the vision of the school.** This is possible through the support mechanisms operationalised by the leaders at the school and/or the system more generally.
6. **Consistency and transparency are critical for ongoing success.** Consistency within lessons, across classrooms and across time, appear to be an integral part of the ongoing success in schools. Coupled with consistency is transparency – students, teachers and communities need to be made aware of the intent of teaching, education and schooling.
7. **Good teaching is good teaching wherever it is located.** The results of this study, in the most vulnerable of our nation's educational communities, can be extrapolated to other contexts – such as low SES communities or communities working with ESL-refugee families.

Limitations

As this was a strength-based approach to researching successful numeracy practices, the stories that were published represent a positive account of the schools and their practices. There was every intention to represent the positive accounts from the schools. What has emerged as a result of this approach has been that through the process of data collection, participants have been called to recount those positive aspects of their work. In this process, they have been able to reflect on the successes they have experienced rather than focus on the challenges they confront on a day-to-day basis.

The report has (intentionally) not focussed the issues that the schools have faced. These were sought and represent the general literature, however, this research focused on the solutions. The omission of issues is deliberate and reflects the approaches taken in schools. There already exists a very large literature on issues. Suffice to note here, these schools are not unique. They do have the same issues as other schools. What is different is that these schools have taken proactive steps to address the issues rather than to use the issues as an excuse for poor outcomes.

There are potentially schools that have not been included in this study that did meet the criteria. The project team has spent immeasurable hours trying to ensure that any school that could qualify for inclusion was included. However, for any school that may have been missed, we apologise.

The study was not undertaken in the Northern Territory government schools where there are issues that are unique to that jurisdiction.

Terms and Definitions

Throughout this report, some terms are used that may be interpreted differently by readers or need clarification as to how they have been used in the report.

Remote and Very Remote

Remote is both an objective and subjective condition. Geographical isolation can be measured by the physical distance from a major regional centre. The schools in this project have been identified from the *My School* website where the terms for geolocation have been adopted. Using this process, it was seen that there was an external objectivity to the definition of geolocation.

In some states, the definition of a physical distance from a regional centre is used but this is not always a viable definition of remoteness. For example, in Western Australia, the physical distance certainly impacts on the sense of remoteness. However, and in comparison, Queensland has few schools listed as remote or very remote, but the same sense of isolation can be applied to schools that are listed as provincial. To this end, we have also included a number of Queensland schools that have the same or similar living conditions as those who are geographically 'remote' but are listed as being provincial.

Success

For this project, success was initially defined by (but not contained to) success in numeracy results in NAPLAN testing. It is recognised that this is not always a reliable indicator of success due to the nature of the testing. It is, however, the only 'objective' criteria that allows for comparison on a national scale. Scans were conducted on the NAPLAN data from 2011 onwards, and schools were initially approached who had scores that were better or significantly better than like schools over a period of at least two or three years. This at least gave us some indication that the scores were not an abhorrent set of results.

Schools were also included on recommendation. Recognising the limitations of NAPLAN testing, systems or other schools could suggest schools to be included. For example, in one case, a boarding school was recommended by the Independent Schools Association. The school had been established in a very remote area away from the communities, and at the request of the communities. The communities were quite dysfunctional and elders recognised the impact that this had on learning, so taking the students out of the mayhem and providing a strong learning community was seen as a viable way to help them. The students entered the school with significantly low numeracy levels for secondary students. Many were functioning at the equivalent of a Grade 2 level. The school was able to add 3 years achievement levels when the students came to school for the year. So, while the data supported strong growth, these data would not be reflected in NAPLAN achievement due to the very low entry level. But it is also undeniable that the value-adding by the school was an indicator of their success.

Schools were asked to provide supporting data about their achievements so that, where possible, this could also be used to justify their achievements.

Aboriginal Education Workers

Throughout this document we have opted to use the term Aboriginal Education Workers (AEWs) in order to remain consistent. It is recognised that there are many terms used across the states and communities to refer to the local Aboriginal and Torres Strait Islander people who play an important role in the schools. There has been quite a diverse range of roles played by the local people within the schools ranging from qualified teachers, assistants to the teachers, office workers, grounds people and maintenance. In this report, the focus is on those whose role is contained to the classroom. With respect to the various sites that used terms other than AEW, it is acknowledged that the terms should be included here. These titles have included Aboriginal Indigenous Education Officers (AIEOs); Teaching Assistants (TAs); Teacher Aides (TAs). Where participants have used the local term, this has been included in the case study to retain authenticity of the interview, but for the purposes of writing this report, the term AEW has been used across the project.

Abbreviations

- **ACARA** Australian Curriculum Assessment and Reporting Authority
- **AEW** Aboriginal Education Workers
- **AITSL** Australian Institute for Teaching and School Leadership
- **COAG** Council of Australian Governments
- **DET** Department of Education and Training
- **ELS** Empowering Local Schools program
- **ELSA** Emotional Literacy Support Assistant
- **ESL** English as a Second Language
- **GGSA** Good to Great Schools Australia
- **NAPLAN** National Assessment Program - Literacy and Numeracy
- **PISA** Program for International Student Assessment
- **SAE** Standard Australian English
- **SES** Socio-economic status
- **TIMSS** Third International Mathematics and Science Study
- **VET** Vocational Education and Training

Publications Arising from the Project

In this section we share the publications that have arisen from the project to date.

Jorgensen (Zevenbergen), R. (accepted). Culturally responsive pedagogy: Addressing "shame" for Aboriginal learners In C. Nicol. *Culturally Responsive Pedagogies*. Rotterdam: Sense.

Jorgensen (Zevenbergen), R. (accepted) Language Resources to Scaffold Mathematical Learning for Remote Indigenous Learners. In M. Civil and R. Hunter, *Mathematical discourse that breaks barriers and creates space for marginalized learners*, Rotterdam: Sense.

Jorgensen (Zevenbergen), R. (2017) Developing 'quality' teachers in remote Indigenous contexts: Numeracy leaders. A. Chronaki, (Ed) *Proceedings of the 9th International Mathematics Education and Society Conference*. April 7-12, Volos Greece.

Jorgensen (Zevenbergen) (2016). Middle leadership: A key role of numeracy reform. *Australian Primary Mathematics Teacher*, 21 (3)32-36.

Jorgensen (Zevenbergen) R. (2016) Playing the Game of School Mathematics: Being Explicit for Indigenous Learners and Access to Learning. *Intercultural Education*.27, (4). 321-366. 10.1080/14675986.2016.1203586

Jorgensen, R. (2016). Curriculum Leadership: Reforming and Reshaping Successful Practice in Remote and Regional Indigenous Education. In G. Johnson & N. Dempster, (Eds) *Leadership in Diverse Learning Contexts*. (pp 275-288). Dordrecht, The Netherlands: Springer.

Jorgensen, R. (2015). Language, culture and access to mathematics: A case of one remote Aboriginal community. *Journal of Intercultural Education*. 26 (4) 313-325.

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