What makes for successful numeracy education in remote Indigenous contexts: An ethnographic case study approach

The Northern Peninsula Area is a unique location in Far North Queensland, famous for its proximity to the most northern tip of Australia, known locally as Pajinka. The area is very isolated and accessible by ferry (from Thursday Island in the Torres Strait), by road in the dry season, or by small plane. The Bamaga airstrip was operated by the US Airforce during World War 2 and its runway is the third longest in Australia.

The area is made up of five communities: Bamaga, Seisia, New Mapoon, Injinoo, and Umagico. Three of the communities (Bamaga, Umagico and Seisia) were established by Torres Strait Islanders. Injinoo is a community whose inhabitants are descendants from local Aboriginal people of the area. New Mapoon was a forced relocation of Aboriginal people from Mapoon near Weipa some 50 years ago. Some Sabai Islanders sought to live in the deserted World War 2 American base of Mutee Heads but this settlement failed when the water pumps were removed and no water was available to the community.

Culture is very strong in the region with people retaining many of the ancestral traditions in daily living. Being close to the coast, fishing is a major recreational activity as is hunting. Goods generally arrive by ferry. The largest community, Bamaga, has a supermarket, bakery, hospital, police station, hotel, and many service providers. The five communities are connected by bitumen roads, but once out of the region, the roads are dirt, and often accessible by 4WD only. The area experiences 80% of its tourism in the months either side of the mid-year school holidays.

Northern Peninsula Area State College consists of three main campuses: two primary schools at Bamaga and Injinoo, and a secondary school based in Bamaga. Students are bussed from communities to either one of the two primary schools. The current strategy is that the most highly achieving students may be offered scholarships in boarding schools in main urban areas. However with the successes of the primary school
now being transferred into the secondary school, there is a vision that the secondary school will offer a full comprehensive program in the future so that all students can receive education in-country.

Some seven years ago, the school decided to build a culture of learning through a focus on literacy and numeracy. Through the use of explicit teaching methods, students have come to understand the goals of teaching and the approaches being taken. This understanding is believed to support a re-engagement of students in learning, allowing them to experience success. The approach also aims for students to develop understanding of the purposes of schooling leading to consequent improvement in attendance. Since introducing this focus, the school has progressively built on developing teacher skills in explicit teaching as a pedagogical framework, refining and expanding methods to improve the mathematics teaching practices across the school. Various programs have been incorporated into teaching practices across the different sectors of the school. The impact of this approach is now filtering into the high school as the students advance, identifying themselves as successful learners and entering the high school ready for learning. The College is trialling many strategies to bring about consistency across the three campuses and to build sustainability of the successful practices that have been developed by the College. There is a strong cohort of regular attenders, particularly at the Bamaga Campus, with many of the students achieving 80% or more attendance.

The College operates as an urban school and prides itself in this. There are high expectations of learners, teachers, leaders and community. Several working bees at The College have attracted more than 70 family members to support work in the school grounds. Parents attend the weekly school assemblies. The College operates as would be expected of a mainstream urban school – being remote is not seen as a valid excuse for lower standards. Students wear uniforms funded by Bamaga Enterprise, a local initiative, and every student has a uniform for school. Teachers are expected to provide a quality education for the students, and the school actively seeks to build a strong learning culture. Building this culture has taken time and has been sustained over the past two successive principals, although many of the teachers and leadership team remain in the school for extended periods of time. A number of teachers have been at the College for more than 10 years, and there have been two principals in seven years. This has built a very stable staff, particularly for a very remote site.

### Defining success

The College has achieved consistent success in NAPLAN for many years. Since implementing the changed practices at the school, The College has increased success in NAPLAN from the lower band to Bands 3 and 4. Now that there is fluency across many aspects of mathematics, the College is focusing on taking student achievement into the higher bands.

The College also uses a range of assessment tools to monitor student achievement and growth. Teachers enter student data regularly with specific test data entered in Week 5 and Week 10 of each term. These data are used to inform teaching and also to track success at the school level. Teachers meet with their Head of Curriculum to discuss data against the agreed goals for the class, to discuss plans for literacy and numeracy for the whole class based on the data, and to develop individual plans for particular students who require differentiation.

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The College operates as would be expected of a mainstream urban school – being remote is not seen as a valid excuse for lower standards. Students wear uniforms funded by Bamaga Enterprise, a local initiative, and every student has a uniform for school. Teachers are expected to provide a quality education for the students, and the school actively seeks to build a strong learning culture. Building this culture has taken time and has been sustained over the past two successive principals, although many of the teachers and leadership team remain in the school for extended periods of time. A number of teachers have been at the College for more than 10 years, and there have been two principals in seven years. This has built a very stable staff, particularly for a very remote site.
NPASC has adopted a school-wide structure to mathematics lessons. Teachers follow an explicit teaching model where, through careful and explicit scaffolding, students are able to complete tasks independently and build a strong sense of success and pride in their accomplishments. The Explicit Teaching model adopted at the school is the “I do, we do, you do” model. This model has been implemented at the school for many years and underpins the approaches in all curriculum areas, including mathematics.

The explicit model of learning is enacted through a structure in mathematics blocks. Each day is divided into three key blocks – a 2 hour literacy block, a 2 hr numeracy block and a block at the end of the day for other key learning areas.

**Numeracy Block**

The Numeracy Block is conducted in the second block of the day – from 11.40-1.40 – and is divided into four main activities. The activities can vary in structure, form and length depending on the teacher, the student needs, and the topics. So while the block appears to be long, it is divided into smaller, distinct phases so as to maintain student engagement.

Units of work, or investigations, are planned for approximately 5 weeks so that students experience two consolidated units of work per term. The units have been devised by the Heads of Curriculum so as to ensure that essential content is covered and teachers are provided with guidelines as to what to teach for each term. A new teacher will be presented with their first unit of work at the induction so that they are able to focus on pedagogy and direct attention and energy to quality teaching practices. A dominant feature of the lessons is the constant revision of concepts so that concepts are committed to long term memory. Through the explicit teaching approach, teachers justify their teaching to the students so that students, for example, are aware of why the constant revision (or consolidation) is undertaken so that they commit knowledge to long-term memory.
**Numeracy Block Structure**

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<th>Phase of Lesson</th>
<th>Description of Practice</th>
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<td><strong>Consolidation</strong></td>
<td>In this section, the teacher revises many of the concepts that are foundational to mathematics. These are concepts that are usually assumed to be known by students but it is recognised that this may not be the case. Topics such as time, calendars, conversions, fractions etc. are revised in this session. The rationale for this session is that the foundational mathematical concepts need to be built into long term memory so that students then understand basic mathematics concepts and can build automaticity with these both. The Consolidation phase of the lessons adopt a 'recite, recall, apply' approach where students will often engage with group chanting of mathematics facts (or readings), then the teacher will ask various questions to elicit students’ knowledge and understandings; and then the concepts are applied to problems. The pacing of this aspect of the lesson is brisk. All students are expected to respond to questions, so strategies are used for students to display their work (e.g. individual recording on white boards that are displayed; ladders are used for counting work) which allows teachers to assess students’ understanding immediately and to give feedback or address problems as they appear.</td>
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<td><strong>Mental Maths</strong></td>
<td>As a requirement of the FNQ region authority, Mental Maths is a strong feature of the maths block. Teachers scaffold students (in the first four days of the week) so that students are able to complete the exercises around various concepts. This builds success and confidence, and prepares them for the Friday test. The practice activities prior to the Friday tests help teachers identify areas where students may need further support in order to comprehend the item and be able to respond correctly. Students are expected to achieve at least 80% in the mental maths quizzes.</td>
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<tr>
<td><strong>Mathletics</strong></td>
<td>Students access Mathletics to support a range of their mathematics skills. The digital environment appeals to the students and they actively engage with this medium. Prior to the Mathletics activity (usually 2-3 times a week), students are scaffolded in the concepts in which they will be engaged online.</td>
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<tr>
<td><strong>Explicit Teaching</strong></td>
<td>Depending on the year level, various (commercial) programs have been implemented at The College. There has been an explicit alignment of programs used at the school with the Australian National Curriculum (and state documents) so that teachers are confident that they are delivering learning experiences that align with National Guidelines. In the earlier years, the school has recently adopted a commercial program as a model and aligned this with the National Curriculum and C2C learning outcomes. In the middle-to-upper years, the College has adopted the Queensland curriculum (C2C) as the basis for this component of teaching. The College has sought to ensure that the students are exposed to curriculum that aligns with national expectations for all Australian students.</td>
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Hands-On Activities

The College has adopted practices that focus on the use of hands-on activities in mathematics lessons. There is a strong belief that students learn best through hands-on activities so there is an emphasis on providing a range of activities to engage the learners. This is particularly the case in the early years.

Language

As the students come from an English-as-Second language background, there is a strong emphasis on linking mathematical language with Standard Australian English language and the mathematical concepts so that the students can make sense of the concepts and interactions in the classroom. Teachers focus on many aspects of language and have many and rich resources displayed around the classroom. The environmental prints in the rooms also support students with various mathematical terms and concepts, and are displayed to deliberately prompt the students.

Environmental Resources

A school-wide policy mandates the use of rich displays for numeracy/mathematics (as well as literacy) to offer support for students. Teachers make explicit connections to the displays in the room to reinforce to the students that they can refer to these resources to help them with their work.
Recite, Recall, Apply

A key strategy used by the teachers is the ‘recite, recall, apply’ strategy. A key objective for using this strategy on a daily basis as part of the consolidation phase of the lessons is to build long term memory. Teachers reinforce the need for students to learn many concepts in mathematics so that these are lodged in long term memory providing the base for success in later years. The focus of the fast pacing of this aspect of the lesson is also to cue students into concepts that could be covered in later segments of the numeracy block. This helps to refresh students learning as they build confidence through experiencing success.

**Recite**: This part of the strategy can include a number of processes used by the teachers. Students may use group reading of information that is provided on the Interactive Whiteboard (IWB), or they may sing songs. This aspect of the lesson is undertaken as a group.

**Recall**: The recall component of the strategy is a fast paced questioning by the teacher where simple recall questions are presented so that the general facts are reinforced.

**Apply**: Apply questions are posed so that students either demonstrate that they can apply the knowledge or successfully address questions that are different in structure but require the use of the same knowledge or concept.

**Recite**: Students read (as a group) a series of calendar/time facts prepared by the teacher and displayed using Powerpoint.

**Recall**: Questions are posed by the teacher as to facts around the calendar: What day is it today? What day comes before… What day comes after… What year are we in? What is next month?

**Apply**: Questions that move beyond the recall of knowledge to applying it: How many Mondays have finished in this month? How many more Mondays are left? How many more Sundays are left?

**Feedback**: Students use resources to provide feedback to teachers. Whiteboards were used on which students wrote their responses and teachers could scan the responses to assess for learning.

**Praise**: When praise was offered, it was named.
Formative assessment of student understanding is a feature of all lessons. All classrooms have adopted a range of processes where students are able to provide individual responses to teacher questions. These are typically displayed in some form.

- Individual whiteboards where the student writes his/her answer and then shows these to the teachers.
- Ladders that are laminated and so can be written on where students can display number (or other) sequences.
- Other resources appropriate for the year level of the students.

The teacher is able to scan the classroom and assess students’ level of understanding. Individual students may display mis/understandings and teachers are then able to work with individual students. The whole class may also show that they have mis/understood a key concept and then the teacher can make an informed decision as to where/how to move the lesson based on the feedback the students have provided to them.

When teachers provide feedback to students, they are detailed in their responses – whether for mathematical understandings or processes, or for behaviours. The feedback is very specific so students are aware of why they are being praised. – “I love how Daniel didn’t go ‘I don’t know’ – he thought about it and then worked out how many sides were in the pentagon.”

Seeking and Providing Feedback
Grouping Students

The organisation of the College is aligned with the learning needs of the students and attendance is acknowledged as a key factor in achievement. Year level classes are based on attendance, behaviour and achievement. Many of the students who attend regularly are working at minimum benchmark or above so these students are clustered into a class set where the teachers are able to pitch learning to meet their needs. Students whose attendance is less regular, and often have gaps in their mathematics learning are placed in classes where there is a stronger emphasis on differentiation, while those whose attendance is quite poor are in a class where there is an emphasis on Individual Learning Plans (IEPs) that meet the needs of the individual learners.
Environmental Footprints

Classrooms are rich with resources on the walls. Teachers provide a stimulating and rich learning environment with resources (literacy and numeracy) to support students in their learning. The intent of the resources is to support students to become independent learners and rely on the resources (rather than the teacher). To transition students to the use of the resources, explicit teaching is undertaken to alert students to how they might use the resources in the classroom. These can include the resources on the walls, and other resources that teachers may have made available to the students. These include ‘placemats’ that contain a range of mathematical information (calendars, multiplication facts, units and conversions of various measures, basic geometric shapes and solids, etc). In the various components of lessons, teachers make explicit reference to where students might seek support.

Data Walls

Included in the environmental footprint is the display of student data. Students and families are able to see not only achievement but are also able to track growth over the year. Students can readily see their progress and achievements – again reflecting the explicitness and transparency of practices valued at the College.
Professional Learning for Teachers

There is a strong focus on building a common culture across the school where all teachers adopt the same teaching practices in their classrooms. Many of the teachers coming into the school are often recent graduates and are offered very strong professional development from their induction into the school (and remote education), and throughout their time at the College.

Initial induction into The College model for mathematics teaching comes through the induction offered by Department of Education, Training (DET) through their RACE conference where teachers new to remote education receive a week long induction program into remote teaching (and living). This is followed by inductions into the departmental regions (Far North for The College) for policies that are operationalised in the region and impact on the teaching at The College; and then a final induction offered by the school in the pupil-free days prior to the commencement of the school year. Furthermore, NPASC has a comprehensive program offered each Tuesday in after-school meetings/forums. These focus on various practices that the College is adopting to improve the teaching and culture of the school. The College is developing a series of Standards of Practice (SoPs) that outline various practices that the College adopts across the three campuses.

At the Tuesday meetings, only two meetings per term focus on the operations of the school. Other meetings focus on professional learning of the staff. Teachers are expected to attend the meetings. In these sessions, the professional learning may be based on a particular SoP, a focus that the College leadership has nominated, a visiting professional, or a program that the College may have bought into. Collectively the diversity of professional learning not only builds the skills of individual teachers, but builds a strong culture of learning at the school. It also creates consistency of practice across the three campuses.

Individual teachers are supported by the Heads of Curriculum and the Executive Leadership team. College practice is for its leaders to conduct regular walk throughs of classrooms so that teachers are inducted into a culture of open classrooms where leaders can and do drop in and observe teachers at work, providing constructive feedback back in both structured and ad hoc formats. This helps teachers to build confidence in their teaching and allows the College leadership to ensure that the model of teaching advocated by the College is enacted.

The College prides itself on its comprehensive induction and on-going professional learning program provided to teachers. Many of the staff who transfer out of the College at the end of their contracts are proactively sought by other schools aware of the quality of the training they have received at the College.
Heads of Curriculum

The College has four Heads of Curriculum (HoC), each targeting different sectors of the school. These are the early years (P-3), the middle years of primary (3-5), upper primary (5-6), and secondary school (7-10). The role of the HoC is strategic as well as practical. The HoC supports teachers in the development of curriculum plans; provides feedback to teachers (after lesson observations); provides modelling of lessons; supports the rollout of curriculum initiatives; assists in development of SoPs; mentors new teachers; supports teachers in the interpretation of classroom data and strategies to improve data outcomes; and provides overall leadership in the nominated years for the HoC role.

Standards of Practice

The College is building a repertoire of practices for implementation by all teachers across the schools. Referred to as “Standards of Practice” (SoPs), these outline principles and practices that are expected to be adopted by all teachers across all campuses and year levels. The SoPs detail the practice that is being promoted and in so doing, create a document to create a corporate memory for the school. This is important in a context where there is a relatively high turnover of staff as it helps to maintain consistency in practice. The documents also provide scaffolds for incoming teachers as they detail the practices expected for working in the school. The SoP is (generally) a two page document structured so as to provide a rationale for the practice; the expectations to be realised through the implementation of that practice; and, a sample or example of the practice, that individual teachers can then operationalise in the classroom. Some examples of the SoPs developed at the school are:

- Achievement ladders – Outlines the structure to map student achievement.
- Consolidation Lesson Design – Outlines the design and purpose of the consolidation phases of lessons.
- Data Collection and Analysis – Outlines how data are to be collected in classrooms, how to be analysed, to inform teaching and monitor progress towards student, teacher and College goals. The data collected is from the various schemes used across the College and stored in a school database. Teachers are expected to enter data in Week 5 and Week 10 of each term so that student and school progress can be monitored and adjustments made to ensure goals are met.
- Environmental Print – Outlines how teachers must create visually and educationally rich classroom displays and how they are to be used effectively in teaching.
- Explicit Teaching Lesson Design – Outlines the explicit teaching practices to be adopted in lesson formats.

The SoPs provide scaffolding for teachers as to why they need to adopt the practices, the goals that are expected to be achieved, and how they will be realised and reported. They are practical documents to help support teachers in the implementation of the practices valued by the College.
Leadership

There is a strong leadership team at NPASC who provide a well-articulated vision of the College and the support structures in place to enable the vision to be realised. An important factor enabling the NPASC to achieve its current level of success has been the successive leadership of two principals who have built and developed the whole of school vision and practices. The leadership team explicitly articulate that there is a vision and detail the practices with which staff need to comply. This is not negotiable and compliance with the vision and associated practices are made transparent to the staff. All staff work on the common approach across the school, initially commenced at the primary campuses, it is now becoming embedded in the secondary campus.

The leadership team is structured to both support teachers to build their skills and knowledges around the approaches adopted at the school as well as to maintain a high standard of professional practice across the school.

Each campus has a Head of Campus (locally referred to as a HoC who works with the Principal as part of the Executive Leadership team. Four curriculum leaders (Head of Curriculum) are also employed across the school. The HoCs Curriculum Heads assume responsibility for the leadership at the grassroots level of the classroom and work closely with the daily practice of teachers – supporting teachers with the development of their teaching skills, classroom management, lesson planning and data collection/analysis.
Benefits for Learning and Learners

Students experience success in mathematics when teachers are able to scaffold effectively. This has helped turn the school around from one of the poorest performing schools in Queensland to its current state of success.

The Consolidation Phase of the lessons explicitly seeks to constantly revise concepts so that these can be committed to long term memory. Similarly, the success students experience in the Consolidation Phase of the lesson and the concepts that have been revised creates experiences whereby the students continue to experience success in subsequent phases of the lesson. The Consolidation Phase of the lesson can be approximately 30 mins so there is ample opportunity for students to engage with many mathematical concepts and processes and enjoy a positive experience around success.

The emphasis on the professional learning of staff not only helps to build a coherent approach across the College, but it also builds the professional skills of the teachers. The approach adopted at the College draws on a significant research base so teachers are inducted into research-driven pedagogies that have shown to bring about success.
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<tr>
<th>Principle</th>
<th>Implications for mathematics</th>
<th>Focused strategies</th>
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<tbody>
<tr>
<td>Structured mathematics lessons</td>
<td>• Building concepts into long term memory.</td>
<td>• Consolidation component of lessons consists of repetition of many mathematics concepts on a regular and on-going basis so that they are committed to long term memory.</td>
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<td>• Mental Mathematics to build fluency and automaticity with mathematical concepts.</td>
<td>• Mental maths often builds on the work in the consolidation phase of the lesson. Concepts can be covered here as well as in the first phase, to build knowledge and confidence in the skills that will be needed for the explicit teaching of particular concepts found in the Australian Curriculum (and QLD curriculum –C2C).</td>
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<td>• Be explicit about the mathematics to be learned, the processes through which students will demonstrate their understandings, and why it is important to students.</td>
<td>• At the start of a lesson, teachers define the concepts to be learned (intended learning outcomes); the criteria by which students will be assessed (explicit assessment criteria); and the rationale for why the content is important (application to the world). This helps students understand the purpose for the lesson and what they were about to learn.</td>
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<td>• Effective modelling of mathematics to build independence of learners.</td>
<td>• Teacher commences activities by modelling work or concepts to the students (I do), the teacher and students then work in unison as they work through tasks (we do) and then the students work independently. The class is then called back to a whole group to work through tasks and assess learning.</td>
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<td>• Employing digital tools to supplement other activities used in the teaching of mathematics.</td>
<td>• Students have time to engage with the digital mathematics games, Mathletics, where they practice skills learned in earlier parts of the lesson. Teachers often scaffold students with various mathematical concepts and processes in the first phases of the lesson so that students enter the Mathletics games with confidence and success with the concepts. The digital media is engaging for students, and allows an environment for independent work.</td>
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<td>• Focus on language</td>
<td>• Using a commercial package – JEMS and EMS – teachers employ the package to undertake direct instruction methods to assist in the development of mathematical language. In the recent past, the College has also adopted the RoleM package to assist with the development of mathematical language in the early years.</td>
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<td>Embedding a Culture of Learning</td>
<td>• There needs to be a culture around mathematics lessons, learning and scaffolding.</td>
<td>• A culture of mathematics lessons is created and embedded across all levels of schooling. Students know what to expect and how to engage with learning. • Focused professional development to ensure all teachers are working to the same structure in lessons • Leadership team build the culture through expectations of teachers and students; provide on-going support for teachers; and conduct walk-throughs to both support teachers and to ensure the culture is being enacted.</td>
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<tr>
<td>Providing Support for teachers</td>
<td>• Induction and support for teachers to build lessons and units to support mathematics learning in the NPASC model.</td>
<td>• Heads of Curriculum support teachers in year level sectors to create mathematics lessons that support the NPASC model. • Regular sessions are conducted to reinforce the models of teaching at the College. • SoPs are developed as formal documents to support teachers and to ensure sustainability of the practices (particularly given the transience of teachers in remote areas). • Units of work are created for teachers that align all school documents with the expected outcomes in the national curriculum.</td>
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**Advice to Teachers**

It is important for all staff to be working on the same approach across all year levels. The approach needs to be embedded across the school and systems need to be established to ensure the adoption of the practices. Having a consistent and transparent approach to teaching mathematics ensures that students encounter paced lessons that provide consolidation of learned skills and knowledge, helping students retain (and refresh) knowledge. In so doing, students are able to move into other aspects of lessons confident in their capacity to complete tasks – success breeds success in mathematics.
Key Messages – Summary

There is strong merit in having a whole-school approach to mathematics teaching and learning. Students become familiar with the structures of the lessons and are able to engage with the content rather than second-guessing what may be happening in any given lesson.

Having a common and systematic approach across the school enables teachers to speak a shared language, build a repertoire of common practices, share knowledge and learning, and create learning environments that enable students to successfully negotiate their learning of mathematics.

Strong support for teachers – through professional learning, induction and regular support from mentors and key staff – helps to build a common approach as well as building the strengths of the teaching staff.

Focusing on numeracy (and literacy) provides the touchstones for success. Students’ success in literacy and numeracy is facilitated through building confidence, skills and independence.

Pedagogies that build mathematics success focus on repeating basic concepts on a regular basis so as to commit concepts (often not found in the communities and homes of Indigenous families) to long term memory. Daily revision of basic mathematical concepts, at a fast and engaging pace, bring about automaticity in such concepts.

Creating rich learning environments with highly visual displays in classrooms, assists students to build independence while scaffolding in their learning.

Providing resources for teachers with commercial programs that are aligned with national curriculum learning outcomes enables teachers to ensure that there is a coherent program across the years of schooling and enables students to reach national benchmarks of learning.

School demographics (Northern Peninsula Area State College)

- Year range: P-12
- Total enrolments: 527
- Location: Very Remote
- ICSEA (school): 733
- ICSEA (distribution of students): 59% | 27% | 11% | 2%
- Teaching staff: 49
- FTE teaching staff: 48.1
- Non-teaching staff: 17
- FTE non-teaching staff: 13.7
- Indigenous students %: 97%
- Enrolments: Girls/Boys: 263/264
- Language background other than English: 95%
- Student attendance rate %: 67%

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