Mathematics Program

Last updated – 23/1/2015

Compiled by Karena Aczel and Julie Thomas, (2014).
With acknowledgements to NCR Mathematics Team for their work, Yumi Deadly Team and contributors to past BISS Mathematics Program documents.
Our school at a glance

**Bribie Island State School** is a modern and innovative school that offers high-quality education for all students from Prep through to Year 7.

Our current student enrolment is 690.

The school is multicultural with a diverse range of nationalities represented. Students who identify as being of Aboriginal or Torres Strait Islander descent is 3%. 9% of our students live in households where English is one of two or more languages spoken.

We have a significant number of students with disabilities as we are the district designated school for students with visual and physical impairments.

Our school has a current ICSEA² ranking of 939. This score indicates that this community's socio-educational advantage sits marginally below the national average.

Rationale

At **Bribie Island State School**, mathematics is an integral and highly valued component of the curriculum. Students identify and explore mathematics concepts and skills through active investigation and problem-solving. They understand that mathematics can help them to make meaning of their world and to participate fully in real-world situations that involve mathematics.

When learning about mathematics, students recognise that there are particular ways of working with concepts in mathematics. Students also recognise that there are particular facts and procedures required for knowing and understanding in mathematics. Students and teachers value mathematics as a way of investigating, thinking, reasoning and relating to real-life situations.

Mathematics is a way of making sense of the world. The mathematics Learning Area helps students to know about mathematics, know how to do mathematics, and know when and where to use it. All people need the capacity to make sense of and be critical about numerical information. To achieve this, they need a disposition to think and act mathematically, and the confidence and intuition to apply mathematical concepts to explore and solve everyday problems that confront them.

Skills needed for mathematics include mental computation and deep understandings of how numbers work. They also require meta-cognitive/higher order skills such as reflection, analysis, estimation, justification, synthesis and communication skills. These skills are needed to describe each of these in appropriate language and format, and are developed through the meaningful embedding of the proficiency strands¹ (understanding, fluency, Problem-solving and reasoning).

1. Australian Curriculum, Assessment and Reporting Authority. 2013. *Australian Curriculum: Mathematics for Prep (F)-10 Version 5.1*
### Our Numeracy Data Story

#### NAPLAN

#### Table: NAPLAN Results

<table>
<thead>
<tr>
<th>% At or Above National Minimum Standard (NMS) - Achievement</th>
<th>NMS - Improvement Relative to Nation</th>
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<tbody>
<tr>
<td>This School</td>
<td>Nation</td>
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<td><strong>Year 3</strong></td>
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<td>N</td>
<td>91.7</td>
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</tbody>
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#### Table: U2B Results

<table>
<thead>
<tr>
<th>% Upper Two Bands (U2B) - Achievement</th>
<th>U2B - Improvement Relative to Nation</th>
</tr>
</thead>
<tbody>
<tr>
<td>This School</td>
<td>Nation</td>
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<td><strong>Year 5</strong></td>
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<td><strong>Year 7</strong></td>
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#### Summary Counts

<table>
<thead>
<tr>
<th>NMS Summary Counts</th>
<th>2013 Achievement</th>
<th>2012-13 Improvement</th>
<th>2008-13 Improvement</th>
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<tbody>
<tr>
<td>10</td>
<td>6</td>
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School Opinion Survey data

Our school opinion survey data indicates levels of parent and student satisfaction at our school above 'like school' and 'state Primary school' averages in regard to the development of maths skills at our school.

### Parent

#### Student

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Belief statements

What we believe about Numeracy

Mathematics and numeracy are not the same thing.

To be numerate is to ‘use mathematics effectively to meet the general demands of life at home, in paid work, and for participation in community and civic life.’ In school education, numeracy is a fundamental component of learning … across all areas of the curriculum.

It involves the disposition to use, in context, a combination of:

- underpinning mathematical concepts and skills from across the discipline
- mathematical thinking and strategies
- general thinking skills
- grounded appreciation of context.


Numeracy within the mathematics classroom is identifying the mathematics in a context relevant to the student. The teacher’s role is to provide students with the skills and confidence to use the mathematics they have identified. In applying and using this mathematics, independently and outside the mathematics ‘lesson’, students demonstrate numerate behaviour. In the early phase, numeracy is primarily about teaching children the skills they need to give them confidence in using mathematics — an essential ingredient if students are to be numerate.

What we believe about the effective maths learner

To learn mathematics, children must construct concepts and relationships among concepts in their own minds. To do this, children need to explore and investigate, to discuss and justify. A quality teaching program in mathematics has this tenet central to the processes of learning and teaching.

The language of school mathematics by its nature is full of symbols and abstractions. It is critical that the apparent complexities of the discipline do not impede the basic need of children to create and recreate their own meanings. We must provide experiences that allow for students’ concrete interactions with mathematical ideas. This view of learning is termed constructivism. Learning is an internal process — a gradual refinement of ideas, understandings and processes, best nurtured through the provision of meaningful contexts, planned experiences, high-quality resources and a supportive environment. Our acceptance of a constructivist approach to teaching and learning assumes a de-emphasis of the traditional textbook approach to teaching mathematics as the main way for children to learn.

Looks Like:

- on task, interacting, engaged, focused, having a go, persistent, peer tutoring

Sounds Like:

- Mathematical language, asks questions, discussions, justify, clarify, ask for assistance

Feels Like:

- feels confident, feels safe, supported, challenged, enriched, smart, successful
What we believe about the effective maths teacher

Highly effective teachers of Numeracy:

- Provide positive encouragement
- Are engaging
- Relate math to real life
- Are fun
- Are reflective
- Are prepared
- Not restricted to classroom
- Are supportive
- Provide opportunities for students to teach students
- Demonstrate using concrete materials
- Provide challenges for their students
- Flexible
- Clear language
- Cross-curricular
- Knowledge of students and their learning
- Are data informed
- Believe that becoming numerate requires connected understandings
- Anticipate that all students can become numerate
- Plan for and maximise Numeracy-rich opportunities for teaching and learning
- Use systematic assessment to inform planning and teaching
- Embed problem solving and reasoning in daily lessons

We believe that the maths teacher will support students to make connections between mathematical concepts and ideas. The maths teacher will aim to inspire learners to see the value and order in mathematics, encouraging learners to reason about new contexts and novel problems.

What we believe about the maths classroom

In 2014 the teaching staff at Bribie Island State School considered the nature of a highly effective mathematics classroom (P–7). The results represent our expected view of a typical maths classroom and are listed below.

What should a maths classroom look like?

- Available concrete materials (relevant),
- Mathematical literacy (posters, charts, diagrams, models)
- Numeracy goals (whole class, individual)
- Range of mental (cognitive) skill building routines
- Variety of presentation (ICT’s, board, books, activities)
- Variety of seating, grouping (group work, peer tutoring)
- Evidence of Learning goals – (and measures)
- Inquiry/investigations
- Visual aids/posters
• T/A support
• Resources
• Concrete materials
• Active participation
• Feedback and reflection
• It has active and engaged learners.
• It has involved and supportive teachers
• Samples of students’ learning and investigation are on display
• There will be evidence of ICT use in mathematics
• Students are learning and investigating in different ways
• There is evidence of higher order thinking

What should a maths classroom **sound** like?

• Purposeful discussions can be heard between students; between students and teachers.
• Students discussing their learning using mathematical language.
• Passionate justifications can be heard.
• Insightful, provocative questions are being asked.
• Collaboration and sharing of ideas is valued.
• Clicking dice, snapping blocks, clapping hands.
• Laughter and excited, confident voices.
• “Aaaha! Now I understand”
• Words of encouragement, praise and support are common.

What should a maths classroom **feel** like?

• Supportive and SAFE (confidence).
• Valuing different ideas and strategies (collaboration).
• Success is achievable for everyone.
• Maths is FUN and exciting!
• Students take responsibility for their own learning.
• Challenging. Not all solutions come easily.
Australian Curriculum: Mathematics

Learning mathematics creates opportunities for and enriches the lives of all Australians. The Australian Curriculum: Mathematics provides students with essential mathematical skills and knowledge in Number and Algebra, Measurement and Geometry, and Statistics and Probability. It develops the numeracy capabilities that all students need in their personal, work and civic life, and provides the fundamentals on which mathematical specialties and professional applications of mathematics are built.

The Australian Curriculum: Mathematics aims to ensure that students:

- are confident, creative users and communicators of mathematics, able to investigate, represent and interpret situations in their personal and work lives and as active citizens
- develop an increasingly sophisticated understanding of mathematical concepts and fluency with processes, and are able to pose and solve problems and reason in Number and Algebra, Measurement and Geometry, and Statistics and Probability
- recognise connections between the areas of mathematics and other disciplines and appreciate mathematics as an accessible and enjoyable discipline to study.

The Australian Curriculum: Mathematics is organised around the interaction of three content strands and four proficiency strands.

The content strands are Number and Algebra, Measurement and Geometry, and Statistics and Probability. They describe what is to be taught and learnt.

The proficiency strands are Understanding, Fluency, Problem Solving, and Reasoning. They describe how content is explored or developed, that is, the thinking and doing of mathematics. They provide the language to build in the developmental aspects of the learning of mathematics and have been incorporated into the content descriptions of the three content strands described above. This approach has been adopted to ensure students’ proficiency in mathematical skills develops throughout the curriculum and becomes increasingly sophisticated over the years of schooling.

Across Foundation to Year 10, achievement standards indicate the quality of learning that students should typically demonstrate by a particular point in their schooling. Achievement standards comprise a written description and student work samples.

LITERACIES OF MATHEMATICS/NUMERACY

Literacy – from Australian Curriculum

Students become literate as they develop the knowledge, skills and dispositions to interpret and use language confidently for learning and communicating in and out of school and for participating effectively in society. Literacy involves students in listening to, reading, viewing, speaking, writing and creating oral, print, visual and digital texts, and using and modifying language for different purposes in a range of contexts.

Literacy is an important aspect of mathematics. Students develop literacy in mathematics as they learn the vocabulary associated with number, space, measurement and mathematical concepts and processes. This vocabulary includes synonyms (minus, subtract), technical terminology (digits, lowest common denominator), passive voice (If 7 is taken from 10) and common words with specific meanings in a mathematical context (angle, area). They develop the ability to create and interpret a range of texts typical of Mathematics ranging from calendars and maps to complex data displays.

Students use literacy to understand and interpret word problems and instructions that contain the particular language features of mathematics. They use literacy to pose and answer questions, engage in mathematical problem solving, and to discuss, produce and explain solutions.

An achievement standard describes the quality of learning (the extent of knowledge, the depth of understanding, and the sophistication of skills) that would indicate the student is well placed to commence the learning required at the next level of achievement.
Assessment

At Bribie Island State School, teachers undertake assessment for three purposes:

- Assessment FOR learning (diagnostic)
- Assessment AS learning (formative)
- Assessment OF learning (summative)

Assessment FOR learning

At Bribie Island State School, we believe that diagnostic assessment data provides insight to a student’s understanding. It is critical to effective planning and teaching.

Assessment for learning:

- can be a routine part of teaching and learning
- can involve the use of diagnostic tasks and tests
- can identify misconceptions and inefficiencies in students’ reasoning
- should involve ongoing collection of relevant data
- Provides a basis for differentiated teaching and learning.

Assessment AS learning

At Bribie Island State School, we believe that formative assessment data provides evidence of a student’s developing concept knowledge and reasoning ability throughout a teaching and learning sequence.

Assessment as learning:

- can be a routine part of teaching and learning
- can involve the use of formal and informal monitoring tasks
- can occur at different phases of a maths lesson
- must involve feedback to the student
- can occur individually, in group situations, in a whole class context
- will be considered as evidence for making A-E judgments

We believe students should receive regular feedback on how well their knowledge, skills and understanding are developing. Our feedback will enable them to recognise their own strengths and areas for further development in mathematics, and allow us and them to plan the next steps in their learning.

Feedback in our classrooms will take many forms: discussion with the whole class, with groups and individuals; written annotations; modelled responses; and peer and self-reflection. The feedback will:

- focus on the activity and what is expected
- be constructive
- provide meaningful information to students about their learning
- correct misunderstandings
- identify and reinforce students’ strengths
- state clearly how students can improve.

Assessment OF learning

At Bribie Island State School, summative assessment data provides evidence of a student’s developing concept knowledge and reasoning ability, as judged against a set of agreed and moderated standards.
Assessment OF learning:

- typically occurs at the end of a teaching and learning sequence
- will utilise a range and balance of assessment techniques
- provides varied opportunities for students to demonstrate what they know and what they can do
- aligns curriculum intent, pedagogy and the Achievement Standard statements of the Australian Curriculum
- uses task-specific criteria and standards to make consistent A-E judgments

The C2C project provides schools with a comprehensive set of assessment and monitoring tasks to assist with the implementation of the Prep (Foundation) to Year 10 Australian Curriculum in Mathematics.

**Differentiation**

**DIFFERENTIATED INSTRUCTION (content, process, product, environment)**

**Differentiation Curriculum** refers to teaching that is adapted to take into account the individual differences and needs of students in any one classroom. *(Van Kraayenoord, 1997)*

At Bribie Island State School we differentiate based on;

**CONTENT** – The knowledge and skills that students need to learn, apply, master a concept.

**PROCESS** – The way we teach lessons/ activities or alternate ways the students learn the content.

**PRODUCT** – What the students know and produce.

**LEARNING ENVIRONMENT** – The way the classroom is structured. The physical space and how it looks.

**DIFFERENTIATED INSTRUCTION AT BISS:**

- Differentiated learning goals
- Differentiated instruction with regards to mathematics
- Differentiated groups using dashboard or BISS class groupings document
- Time for student tracking and feedback in relation to goals
- Use of school based data sets to inform planning
- Targeted use of teacher aide time
- Variation in choice of instructional strategy
- Differentiated curriculum intent based on student needs
- Support and enrichment
Instruction

CLEAR CURRICULUM INTENT (flow chart)

Professional development opportunities provided to all staff to support 'best practice' in the teaching of reading, and 'implementation of whole school ' strategies

NATIONAL CURRICULUM
MATHEMATICS

In the Australian Curriculum, students become literate as they develop the knowledge, skills and dispositions to interpret and use language confidently for learning and communicating in and out of school and for participating effectively in society. Literacy involves students in listening to, reading, viewing, speaking, writing and creating oral, print, visual and digital texts, and using and modifying language for different purposes in a range of contexts.

Our School Curriculum Framework, incorporating both National curriculum and QCARF.

Term overview expectations, including GTMJ to ensure teaching and learning are clear to

Our term/week/lesson explicit teaching and learning focus
Personal Curriculum Planning

ALIGNMENT OF PLANNING, TEACHING, ASSESSMENT OF MATHEMATICS AT BISS

(Flowchart)

**ALIGNMENT OF PLANNING, TEACHING AND ASSESSMENT OF MATHEMATICS AT BISS**

⇒ NAPLAN, - Numeracy - data collected Term 3/4
⇒ PAT M - Mathematics - Data collected term 1 and 4
⇒ NCR DIAGNOSTIC TESTS - data collected via pre and post-tests in term 1, 2, 3, 4

*Analysis of Data—This informs unit planning*

Data entered onto one school to track student growth across the school, and assist with data collection for reporting on students.

Return to school target setting document to review school expectations for student achievement.

Term planner (unpacking) for Mathematics (additional to C2C unit plan for English.)

Numeracy learning goals each term, with success criteria and tracking.

Differentiation documents to support.

Criteria/reading goals/all made clear to students and parents

Reading Comprehension—Questioning—QAR—Whole of school focus
⇒ Whole of school language
⇒ Whole of school implementation
⇒ Growth in student results in this area

**MATHEMATICS ROUTINES—At BISS we expect to see (minimum requirements)**

⇒ Numeracy block (twice weekly)
⇒ hands on experiences
⇒ connections to familiar/real world situations

Assessment of Mathematics (on the report card, this includes diagnostics to form the students overall Mathematics mark).
⇒ Diagnostic—Assessment for learning
⇒ Formative—Assessment as learning
⇒ Summative—Assessment of learning

Moderation of judgements around mathematics within year level PLC (coalition schools at key junctures throughout the year). Please refer to BISS Target Setting document.

Reporting on students. Comments are locked, so new comments must be submitted to Karena.

Parent teacher feedback sessions

Continued celebration of student success and growth
CONSISTENCY OF APPROACH

CONSISTENT PRACTICE – ACROSS THE SCHOOL

- Mathematics is taught every day, in every classroom.
- Teachers use a hands on approach to teaching mathematics and numeracy that includes a variety of teaching approaches that scaffold students from fully supported instruction to independent mathematical thinking.
- Teachers explicitly focus on and teach students how to use mental strategies.
- There is on-going assessment and monitoring of every student.
- Mathematics instruction is differentiated according to the needs of students.
- Support for students with mathematical/numeracy difficulties is on-going and is provided within a whole-school support network.
- Training and development in the teaching of mathematics is provided for all teachers.
- The school works with the Maths Text — Mental Maths from yr 1-6
- The school has a year subscription to Mathletics in 2015 after trials in yr 5 2014
- School commitment to adopting yr level focus words for Vocab study – English and Mathematics words

OUR RELATIONSHIP WITH YUMI DEADLY MATHS
These experiences are distilled into the following six imperatives on which YDM is based:

1. That all people deserve the deepest mathematics teaching and learning that empowers them to understand their world mathematically and to solve their problems in their reality;

2. That all people can be empowered in their lives by mathematics if they understand it as a conceptual structure, life-describing language, and problem-solving tool;

3. That all people can excel in mathematics and remain strong and proud in their culture and heritage if taught actively, contextually, with respect and high expectations and in a culturally safe manner;

4. That all teachers can be empowered to teach mathematics with the outcomes above if they have the support of their school and system and the knowledge, resources and expectations to deliver effective pedagogy;

5. That all communities can benefit from the mathematics teaching and learning practices above if school and community are connected through high expectations in an education program of which mathematics is a part; and

6. That a strong empowering mathematics program can profoundly and positively affect students’ future employment and life chances, and have a positive influence on school and community.

These imperatives are based on particular views of the nature of four components of YDM:

- Mathematics
- Mathematics learning
- Mathematics teaching
- School–community relations.

**YUMI PEDAGOGICAL REFLECTIONS**

- Can I link the task to reality?
- Have I got an interesting and meaningful context?
- Can I make it personal for the students?
- Could make it a cooperative group challenge?
- Can I provide choice and allow student self-responsibility and ownership?
- Can I embed the learning within a story?
- Can I use the outdoors?
- Can I involve students physically (kinaesthetic learning)?
- Could I use a simulation role play?
- Can I make it concrete?
- Can I exploit the use of technology?
- Can I use the visual aspects?
- Can I make the task open-ended and investigative?
- Can I make it a genuine problem solving challenge?
- Can I allow for multiple entry and exit points (differentiation)?
- Have I got something for everyone?
- Do the symbols the students are required to use have meaning in reality?
At Bribie Island State School, we recommend a numeracy block to occur at least twice a week, in each classroom. The below example (recommended by NCR Mathematics Team) is an example of best practice in terms of a numeracy block.

### BALANCED APPROACH TO TEACHING (I do, we do, you do)

<table>
<thead>
<tr>
<th>The 'IOW'</th>
<th>What it looks like in the classroom</th>
<th>Expectations of the Teacher</th>
<th>Resources</th>
<th>Links to Pedagogical Framework: A.I.M?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commenentary Teaching (Author M.)</strong></td>
<td>• Teaching and learning are seen as complementary</td>
<td>• Lightly effective teacher. Improves to assist a student to use more efficient strategies.</td>
<td>• AC Bandlines and content structure.</td>
<td>• DLQ Practice and deepen new knowledge.</td>
</tr>
<tr>
<td><strong>Lesson Structure</strong></td>
<td><strong>Phase 1: Mental Warm Up (10 mins.)</strong></td>
<td>• Transitions from big ideas (Number, Ruler and Add)</td>
<td>• Teacher facilitates sharing and discussion.</td>
<td>• DLQ Establishing &amp; maintaining classroom norms &amp; expectations.</td>
</tr>
<tr>
<td></td>
<td><strong>Phase 2: Explicit Teaching (20-30 mins.)</strong></td>
<td>• MENTAL Math is engaging tasks.</td>
<td>• Tasks can be differentiated to suit student needs.</td>
<td>• DLQ Enriching students.</td>
</tr>
<tr>
<td></td>
<td><strong>Phase 3: Open-ended Learning (15-20 mins.)</strong></td>
<td>• Open-ended learning tasks</td>
<td>• Teachers must model the same positive disposition to math teaching and learning.</td>
<td>Student / Teacher Feedback</td>
</tr>
<tr>
<td></td>
<td><strong>Phase 4: Reflection (3 mins.)</strong></td>
<td>• Reflect on concept and understanding</td>
<td>• Reflect on thinking and reasoning</td>
<td>Student / Teacher Feedback</td>
</tr>
</tbody>
</table>

### ESSENTIAL READING COMPREHENSION SKILLS

Adapted from the work of Sheena Cameron. Implemented across our school focus areas.
DATA IN ACTION AT BISS

A snapshot of pre and post-test data collected in 2014 using the NCR Diagnostic Tests. A BISS recommendation for data collection.

| NAME    | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | TOTAL |
|---------|---|---|---|---|---|---|---|---|---|----|--
| Chontae |   |   | 1 |   |   |   |   |   |   | 1  | 5    |
| Tarla   |   |   | 1 | 1 |   |   |   |   | 1  | 1  | 7    |
| Natalie |   |   |   |   |   |   |   |   |   | 1  | 1    |
| Victoria|   |   | 1 | 1 |   |   |   |   | 1  | 1  | 3    |
| Jordan  |   |   |   |   | 1 | 1 |   |   |   | 1  | 2    |
| Tyler   |   |   |   |   |   |   |   |   | 1  | 1  | 2    |
| Madeyme |   |   |   |   |   |   |   |   |   | 1  | 1    |
| Malcolm |   |   |   | 1 | 1 |   |   |   |   | 1  | 2    |
| Nash    |   |   |   |   |   |   |   |   | 1  | 1  | 3    |
Recommended Resources

This is a suggested list of resources that support the NCR Mental Warm Ups.

PEA ACs are equipped with these materials for in-class modelling.

Schools may source these materials in advance to support follow up work in classrooms.

- Warm Up Cards (supplied digitally)
- Dice (6, 10 and 20)
- Counters (plain, transparent, double sided)
- Coloured counters – two different colours
- Connecting blocks (unifix or centicubes etc…)
- Calculators
- Tens Frames
- Playing Cards
- Plastic fruit (or bears / other small objects) – red/yellow
- Dominoes (6 dot)
- Maths Mat
- Place Value Beads (100 beads)
- Foam Cups
- Number Cards (0-9, 0-100)
- Laminated Part-Part-Whole Cards (supplied digitally)
- Laminated Number Sentence Cards (supplied digitally)
- Laminated ‘One is a Snail, Ten is a Crab’ picture cards (supplied digitally)
- Laminated Gameboards (supplied digitally)
  - ‘Covers’
  - ‘Clear the Deck’
  - ‘Apple Nim’
- Book: ‘One is a Snail, Ten is a Crab’ or access to the online slideshare version
- Whiteboard markers
- Mini whiteboards