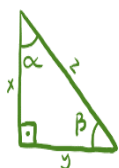




MATHEMATICS AND ENJOYMENT IN MATHS

Mathematics is the science that deals with the logic of quantity, shape and arrangement¹².



Early mathematicians came up with logics (e.g. trigonometry) that allow people to manipulate and work with quantities, shapes or spaces.

Mathematics is essential for civilization in such fields as construction, engineering, economics and finance.



People can become disheartened when maths becomes all about cranking out computations, or when they experience difficulties in getting the 'right' answers. Therefore, it is more useful for maths learning to focus on the process of understanding logics and finding many strategies to solve mathematical problems.

Enjoyment in Maths

Data from the Trends in International Mathematics and Science Study (2015)³ show that across Australia and in Tasmania:

- More Year 4 than Year 8 students agree (a little or a lot) that they enjoy learning Maths.
- On average, about 1 in 3 students indicate that Maths makes them nervous.

I enjoy learning Mathematics



Mathematics make me nervous



NUMERACY SKILLS⁵

Not everyone needs high level mathematics, but everyone needs numeracy—the maths that we use to make sense of the world around us. Below are key numeracy skills that everyone needs. With time and practice, people's skills in these areas can grow in sophistication.



Number Sense:

Understanding numbers and seeing the relationships between numbers.



Representation:

Representing and interpreting numbers with objects, followed by pictures, words and symbols.



Spatial Sense:

Understanding of 2- or 3-dimensional shapes, relative sizes, positions, directions and movements.



Measurement:

Figuring out how to describe how much of something there is using units such as cups, grams or metres.



Estimation:

Making good guesses about the amount or the size of something (bigger, heavier etc.).



Pattern Recognition:

Recognising patterns helps to make predictions, make logical connections and use reasoning skills.



Problem solving:

Thinking through mathematical problems, performing calculations, and recognising there are multiple pathways to finding a solution.

DATA FROM INTERNATIONAL & NATIONAL SURVEYS

The **National Assessment Program - Literacy and Numeracy (NAPLAN)** assesses numeracy skills of Year 3, 5, 7 and 9 students in all Australian states annually. Based on NAPLAN^{4,9}:

- Tasmania is not underperforming in comparison to other states.
- A very high proportion of Tasmanian students reach the national minimum standard in numeracy.

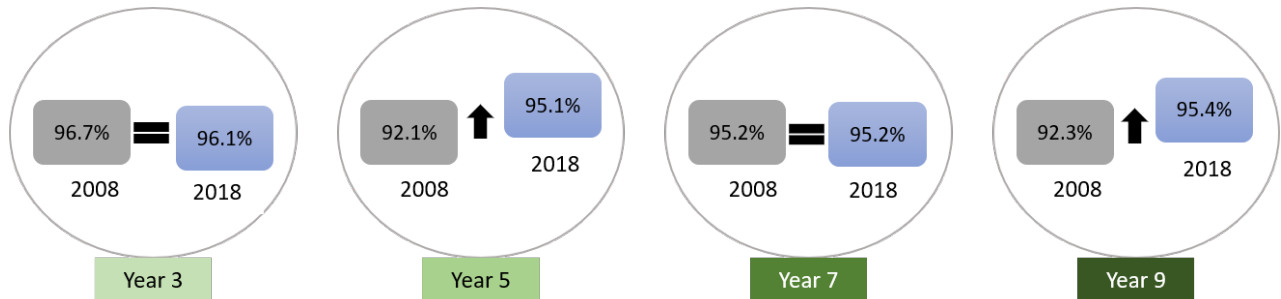


Figure 1. Percentage of Tasmanian students who reached NAPLAN's national minimum numeracy standard for each grade level.

The **Programme for International Student Assessment (PISA)**² collects data from a sample of 15-year-olds (usually Year 10) every three years to evaluate students' performance in reading, science and mathematics. From PISA's most recent data cycles (Figure 2), findings indicate:

- Tasmania has a lower maths achievement score than most other states and territories.
- The gap between Tasmania and the top-achieving state has reduced somewhat over time.
- Overall, the maths achievement scores of 15-year-olds across Australia have dropped over time.

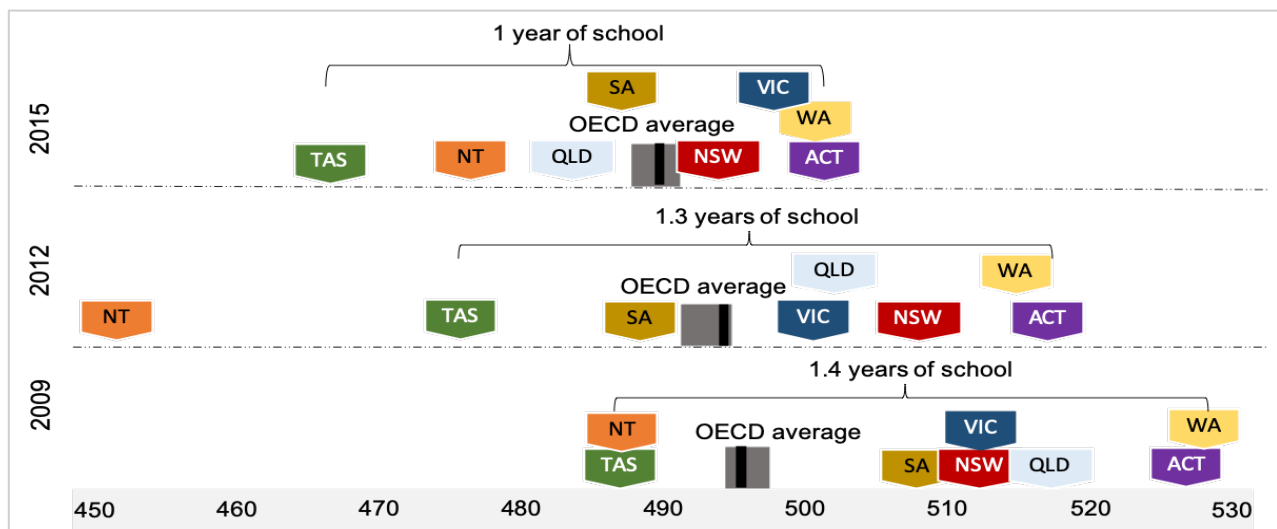


Figure 2. Mathematics achievement score of each Australian state in 2009, 2012 and 2015 PISA data cycles. The difference in school years is based on the difference between Tasmania and the highest performing state in that year.

SUPPORTING LEARNERS' DEVELOPING MATHEMATICAL SKILLS^{6,10,17}



BUILD A POSITIVE ATTITUDE TOWARDS MATHEMATICS

- Change words from:
 - "I am not good at this" to "What am I missing?" or "What do I already know that might help?"
 - "I can't do maths" to "I am going to train my brain in maths".
 - "This is too hard" to "This takes some time and effort to solve".
- Set realistic expectations and believe in yours or your children's ability to develop mathematical skills.

INCLUDE MATHEMATICS IN CHILDREN'S INTERESTS AND ACTIVITIES

- For example:
 - *In sport*: If a child plays cricket, get them to figure out each team member's batting average.
 - *In art*: Use number patterns (from a multiplication table) to create interesting artistic designs or use a compass to create an artwork.
- Provide support in developing maths vocabularies during the activities (see A Maths Dictionary for Kids⁷).



SOLVE MATHEMATICAL PROBLEMS IN A VARIETY OF WAYS

- Solve maths problems in pairs, small groups, as a class or by connecting online (e.g. Calculation Nation¹⁵, Wootube¹⁸).
- Explore other resources and additional practices together:
 - e.g. See Khan Academy¹¹ (free) Mathletics¹⁴, Origo¹⁶ (priced) Wolfram Alpha¹⁷ provides detailed solutions to any math problems, helping learners to understand how the problem can be solved.

THINKING & TALKING THROUGH MATHEMATICAL PROBLEMS¹⁷

- Ask learners to:
 - Explain or paraphrase the math concepts and problems (What is the question asking? What does it mean by "a third"?).
 - Explain their chosen strategy and why the strategy works.
 - Consider alternative strategies (Did anyone solve this problem differently?).
 - Generate problems on their own (Can you make up a problem that is like the previous one we did?).
 - Discuss and understand mistakes (Can you explain why you added the numbers instead of subtracting them?).



SCHOOL LEADERSHIP & PROFESSIONAL DEVELOPMENT

- Promote in-school professional development specific to mathematics:
 - Principal leadership for numeracy⁶.
 - Specialist teachers with mathematical and pedagogical content knowledge⁶.
 - See also Mathematical Association of Tasmania¹³ for professional development programs and support.
- Provide support for teachers to develop skills in collecting and using data about their students' mathematical learning to inform teaching practices.
- Make use of evidence-based teaching resources such as *Dimensions*¹ or *Scoutle*⁸ that aligns with the Australian curriculum.

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