

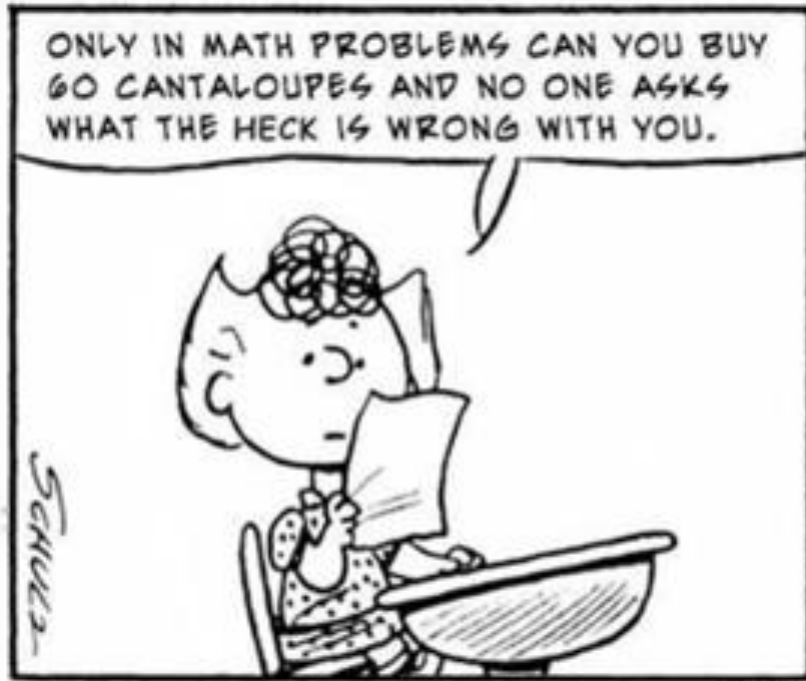
Bringing Life to Maths

Anna Wethereld

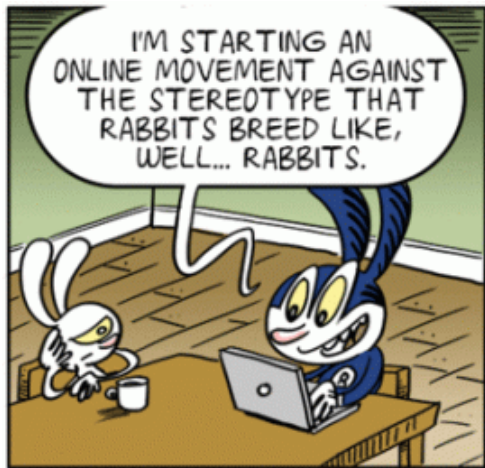
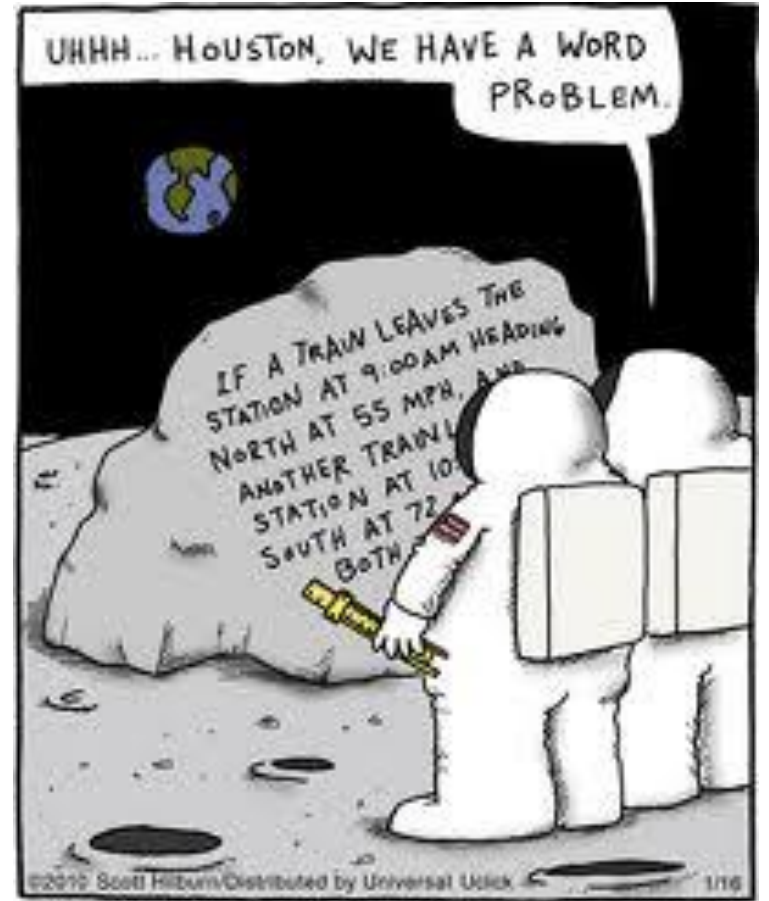
Source Education & Consulting

23 November 2023





SKARIM



A world without mathematics?



'Today was a bad day': Optus CEO apologises for mass outage

David Swan, Sarah Keogh and Olivia Ireland

Updated November 8, 2023 – 4:27pm, first published at 6:26am

Save Share 563 View all comments



Optus chief executive Kelly Bayer Rosmarin is facing pressure to explain why millions of people were left without critical communication services for more than 12 hours on Wednesday as she implored customers to stick with the company.

The outage, which began at 4am AEDT and lasted until around 6pm on Wednesday, affected about 10 million Optus customers and around 400,000 businesses, and crippled transport systems, hospitals and government departments across the country.

KEY POINTS

- Optus customers were unable to access the internet and make or receive calls from 4am AEDT on Wednesday.
- The issue has affected hospitals, Uber drivers and payment systems.
- There is no indication that the issue is a cybersecurity incident.
- Communications Minister Michelle Rowland said the outage was caused by a "deep fault" within the network and urged Optus to step up customer engagement.

What would disappear?

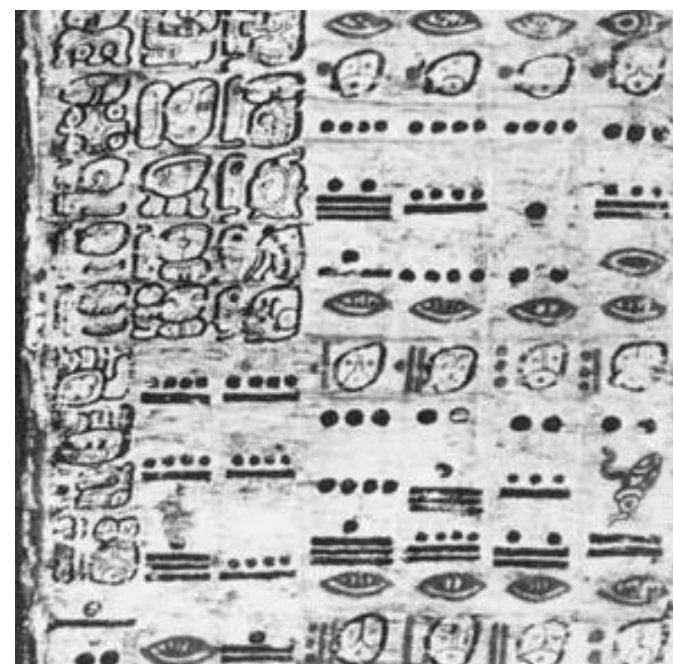
What would we no longer be able to do?

How would our lives change?

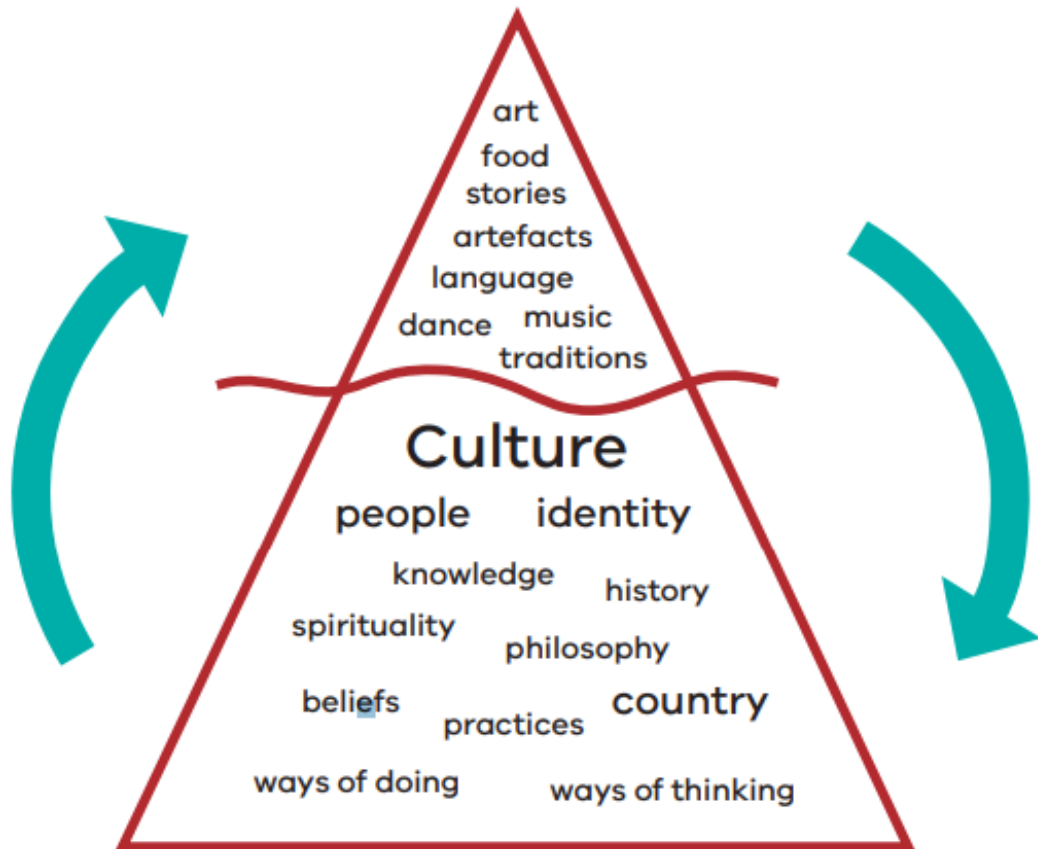


Ethnomathematics

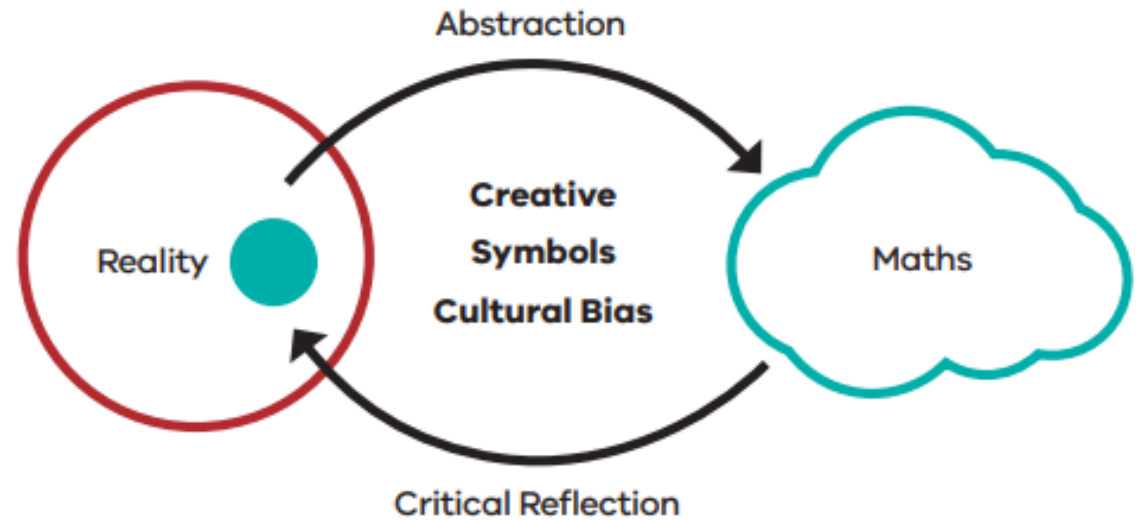
- How different cultures approach Mathematics



The Iceberg model



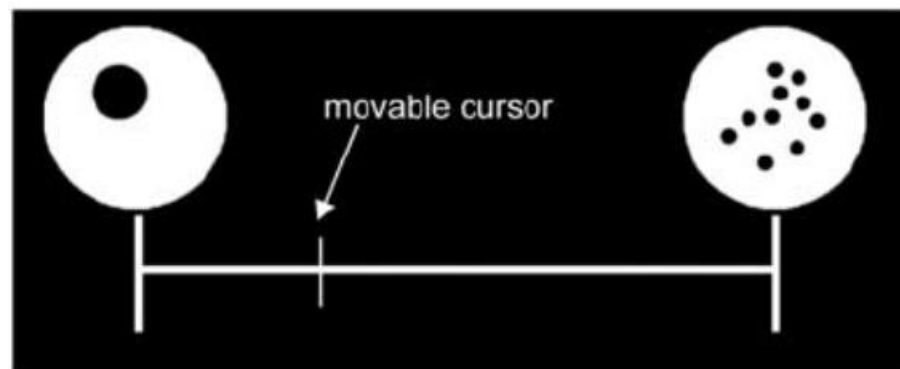
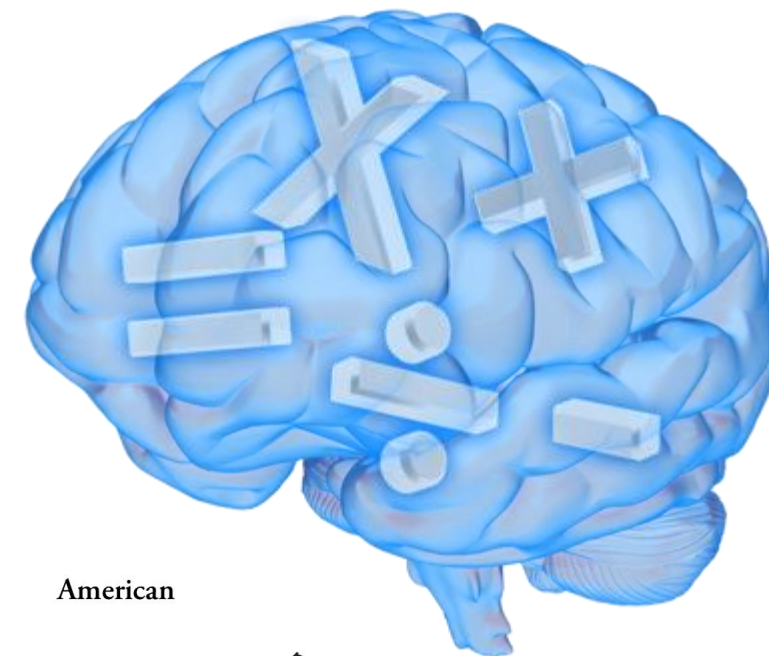
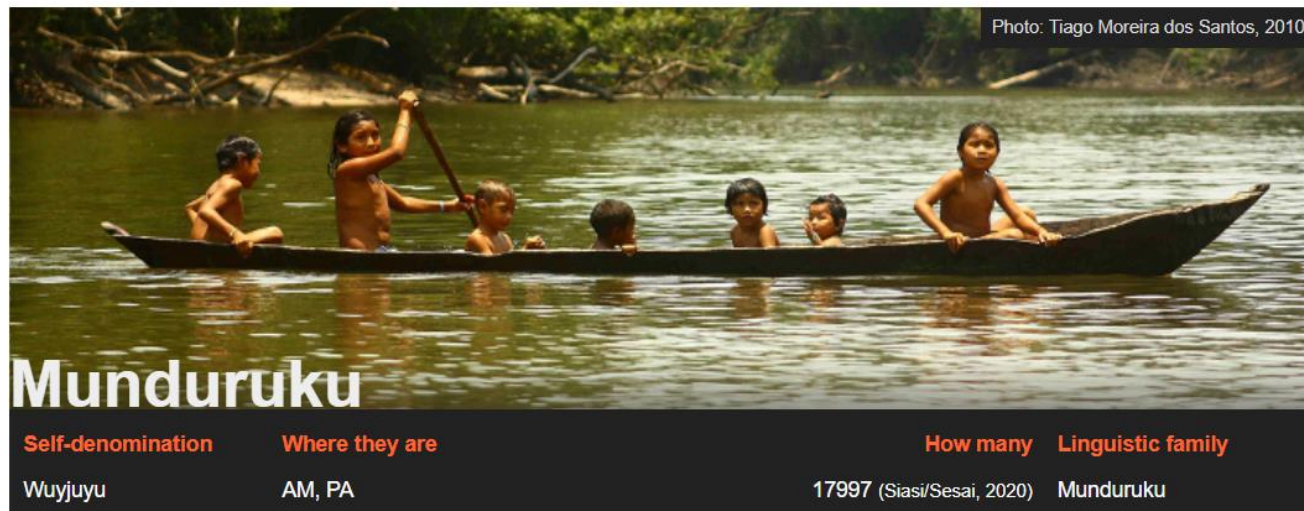
The Goompi model



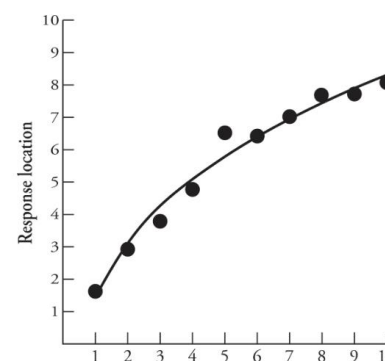
*From: Teaching Mathematics from a Cultural Perspective
By Dr Chris Matthews*



Neuroscience of numbers

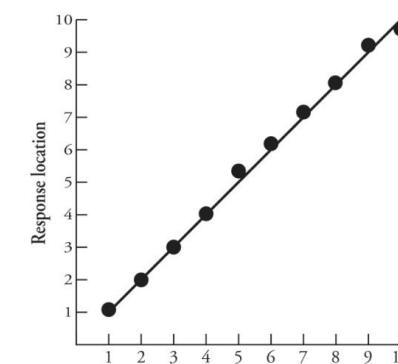


Munduruku



Number of dots shown on screen

American



Number of dots shown on screen

Accessed at:

https://www.researchgate.net/publication/5338665_Log_or_Linear_Distinct_Intuitions_of_the_Number_Scale_in_Western_and_Amazonian_Indigene_Cultures

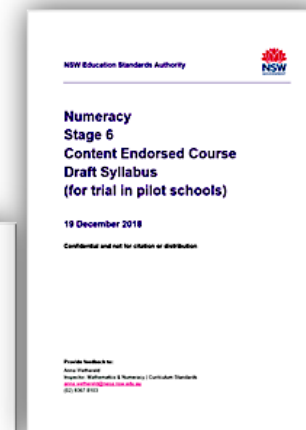
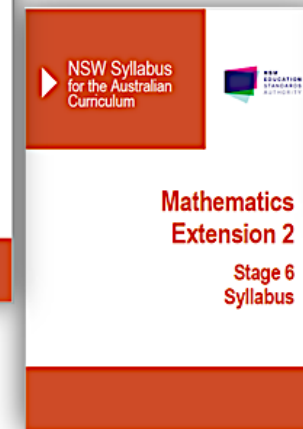
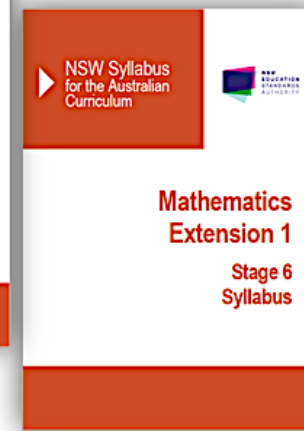
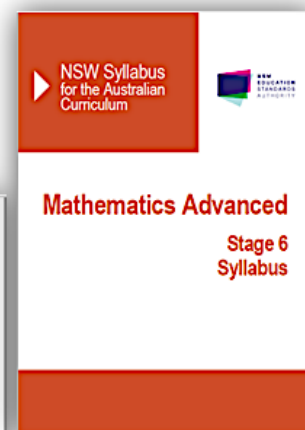
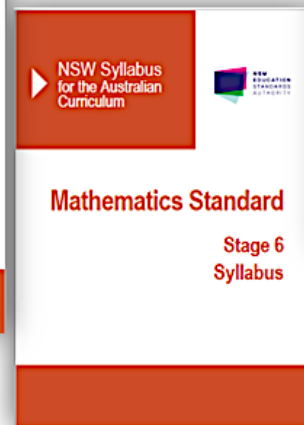
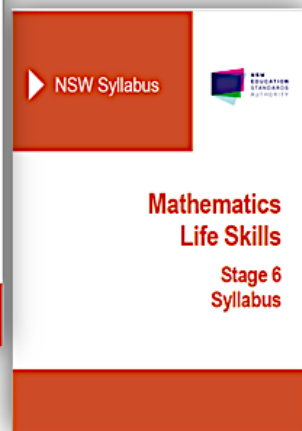
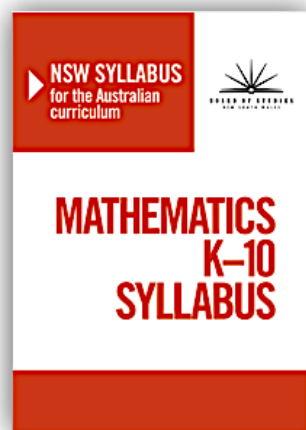
<https://pib.socioambiental.org/en/Povo:Munduruku>



The NSW Working
Mathematically journey...

...our history and culture

The Working Mathematically journey...



Some time ago... 1966

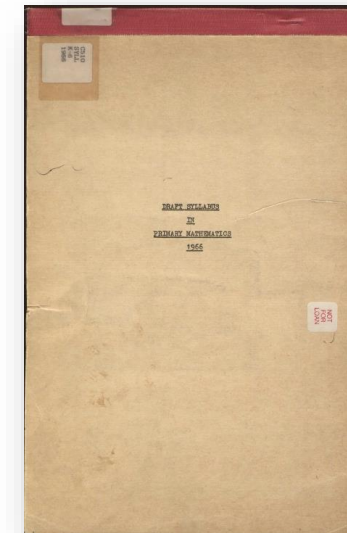


INTRODUCTION

Mathematics had its roots in the needs of primitive man and has grown as these needs have increased with the complexity of evolving civilisation. Relics of past civilisations give clear evidence of the practical use of mathematics and modern society is steadily increasing the field of its application. Thus mathematics is seen to have an important utilitarian value.

Mathematics has also been interesting to man in a different way. It is a form of logic and has been studied for its own sake. It has an internal structure, the uncovering and describing of which has challenged man through the ages. The discovery of aspects of this structure involves the use of systematic and orderly thinking. This represents the cultural side of mathematics.

This course of study for the Primary School recognises the utilitarian and cultural aspects of mathematics.



Some time ago... 1966



AIMS

To assist the child to understand and interpret his environment.

To satisfy the present mathematical needs of the child,

To lay a sound foundation for future mathematical studies,

To create favourable attitudes towards and to stimulate interest in mathematics,

To develop

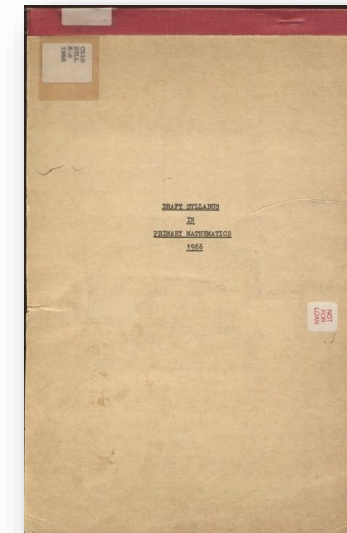
- understanding of fundamental ideas of numbers, measurements and shapes
- skill in computation and problem-solving
- knowledge of language and relationships

through the provision of opportunities to

- explore, discover, describe and record relationships
- create patterns and make statements about the relationships contained in them,

To show the contribution which mathematics has made and is making to our present civilisation.

Understanding
Skills
Knowledge



A fair while ago... 1989



Mathematics K–12 Statement of Principles

Preface

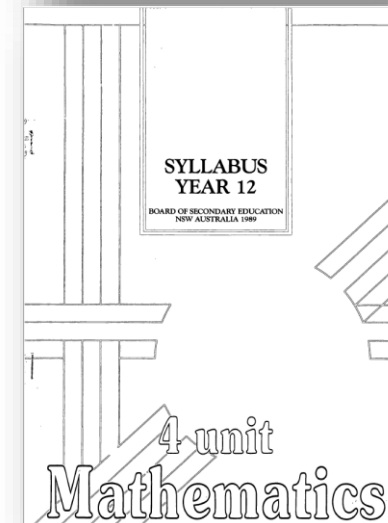
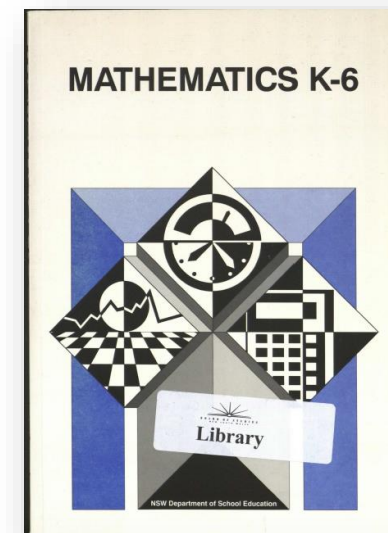
This K–12 Statement of Principles describes the general principles which underlie all ideas in this syllabus.

The nature of mathematics

Mathematics is the study of number and space

More particularly it is:

- a search for patterns and relationships. This search, utilising acquired knowledge and skills, leads to the development of concepts and generalisations, which can be applied in finding solutions to problems, improving our understanding of the world around us and meeting the specific needs of people.
- a way of thinking, characterised by processes such as exploring, manipulating, discovering, ordering, classifying, generalising, abstracting, estimating, calculating, predicting, describing, deducing, drawing and measuring.
- a powerful, precise and concise means of communication, used to represent, to interpret, to explain and to predict.
- a creative activity. Accordingly, it involves invention, intuition and discovery.





A fair while ago... 1989

Understanding
Skills
Knowledge

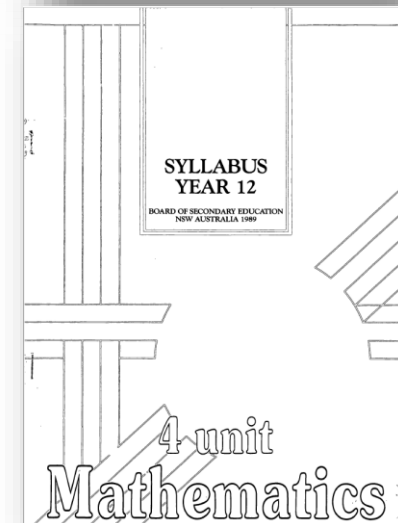
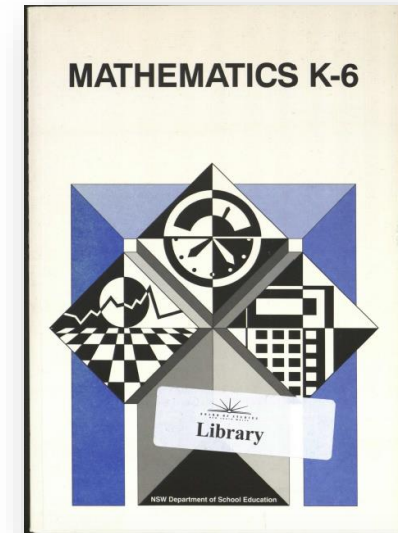
MATHEMATICAL THINKING

Mathematics has two aspects. It is both a body of **knowledge** and a **set of processes**. As processes can only be developed through content, so appropriate mathematical topics are needed as the vehicle through which they are taught. The teacher's task is to present the selected content in a way which will assist the development of these processes. To illustrate this, consider the following classroom situation.

When children come to school they are already, in most cases, accomplished problem solvers. Teachers need to build on the strategies and experiences children bring with them to strengthen and extend their processes of learning and solving problems. There is no way to be absolutely sure of the methods children have used and are using. Teachers need to observe them as they solve problems and to base subsequent teaching on those observations.

One kind of reasoning power necessary for the modern world is that of critical judgement, a capacity needed to enable people to sort through the mass of information with which they are being constantly bombarded. Many of the above processes are essential in this regard. Much information in our society is presented in a mathematical form so people need an understanding of mathematics to be able to make informed decisions, for example, when buying and selling a house, making investments, etc.

The mathematics taught, therefore, should emphasise the relationships between the **students' everyday world** and its **mathematical representations**. For this purpose, the teacher helps students to estimate quantities, to compare and to order a series of objects according to a criterion such as volume, area or length. Obviously, teachers must use situations or problems for investigation and resolution which are derived from the students' world and from **events which make sense to the students.**





A fair while ago... 1989

MATHEMATICAL PROBLEMS

In problem solving, there are basically four stages

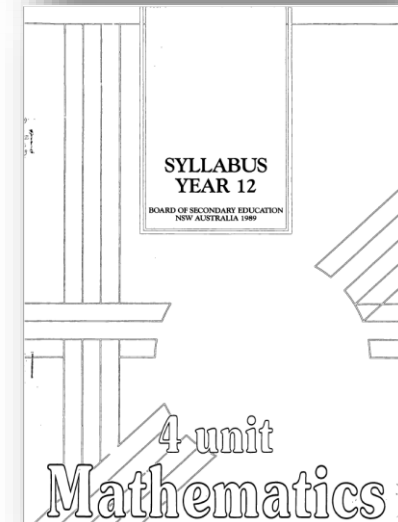
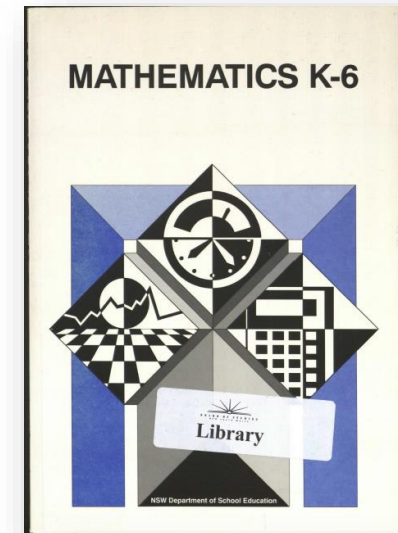
- problem or question formulating
- problem solving or question investigating
- verifying the solution
- reflecting on the process and solution.

In solving problems, students commonly pass through all these interacting stages. Although there is a fairly natural order to these stages, students will not pass through all of these stages for all problems.

Because there are no set questions to start with, the initial exploration of the situation is important in order to identify the question to be answered. Any solution found needs some justification and then needs to be reflected upon by the learner so that understanding is consolidated and effective learning takes place.

A problem has three characteristics:

- there is a goal to be reached
- an obstacle prevents ready solution
- the solver is motivated to reach a solution.



A while ago...2003



9.1 Working Mathematically

Working Mathematically encompasses five interrelated processes. These processes come into play when developing new skills and concepts and also when applying existing knowledge to solve routine and non-routine problems both within and beyond mathematics. At times the focus may be on a particular process or group of processes, but often the five processes overlap. While this strand has a set of separate outcomes, it is integrated into the content of each of the five content strands in the syllabus.

Working Mathematically provides opportunities for students to engage in genuine mathematical activity and to develop the skills to become flexible and creative users of mathematics.

The five processes for Working Mathematically are:

Questioning	Students ask questions in relation to mathematical situations and their mathematical experiences. Encouraging students to ask questions builds on and stimulates their curiosity and interest in mathematics. 'I wonder if' and 'what if' types of questions encourage students to make conjectures and/or predictions.
Applying Strategies	Students develop, select and use a range of strategies, including the selection and use of appropriate technology, to explore and solve problems.
Communicating	Students develop and use appropriate language and representations to formulate and express mathematical ideas in written, oral and diagrammatic form.
Reasoning	Students develop and use processes for exploring relationships, checking solutions and giving reasons to support their conclusions. Students also need to develop and use logical reasoning, proof and justification.
Reflecting	Students reflect on their experiences and critical understanding to make connections with, and generalisations about, existing knowledge and understanding. Students make connections with the use of mathematics in the real world by identifying where, and how, particular ideas and concepts are used.



Mathematics
Years 7–10

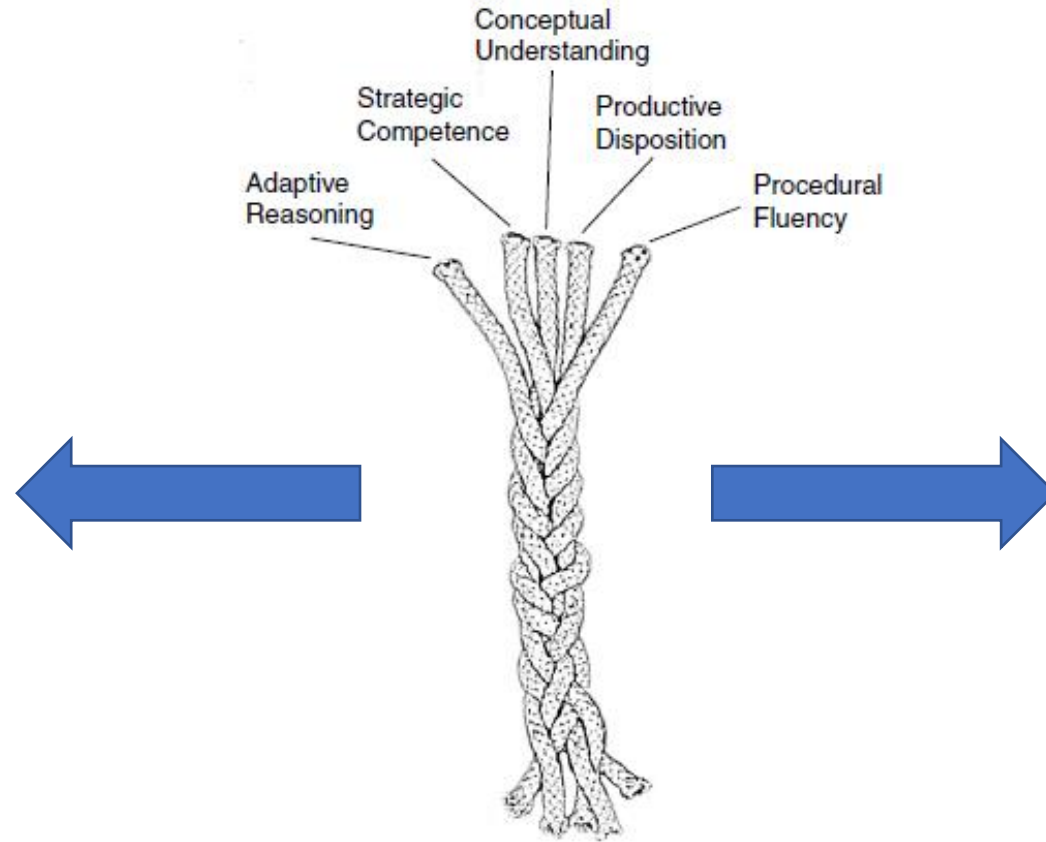
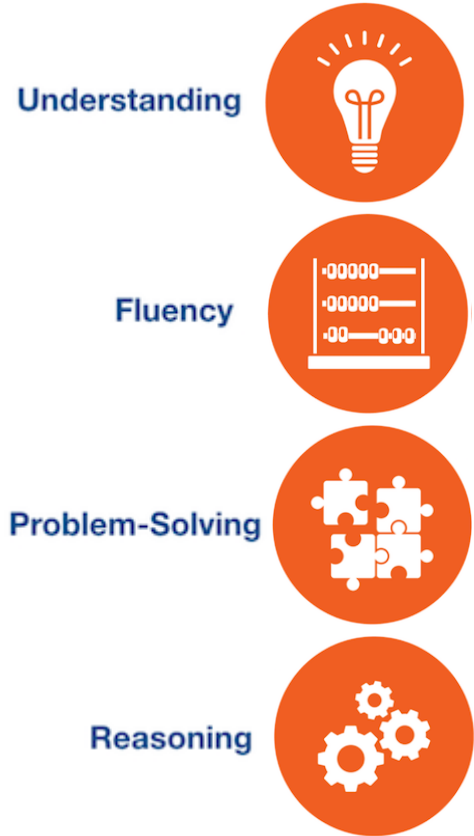
Syllabus

(Incorporating Content and Outcomes
for Stage 2 to Stage 5)

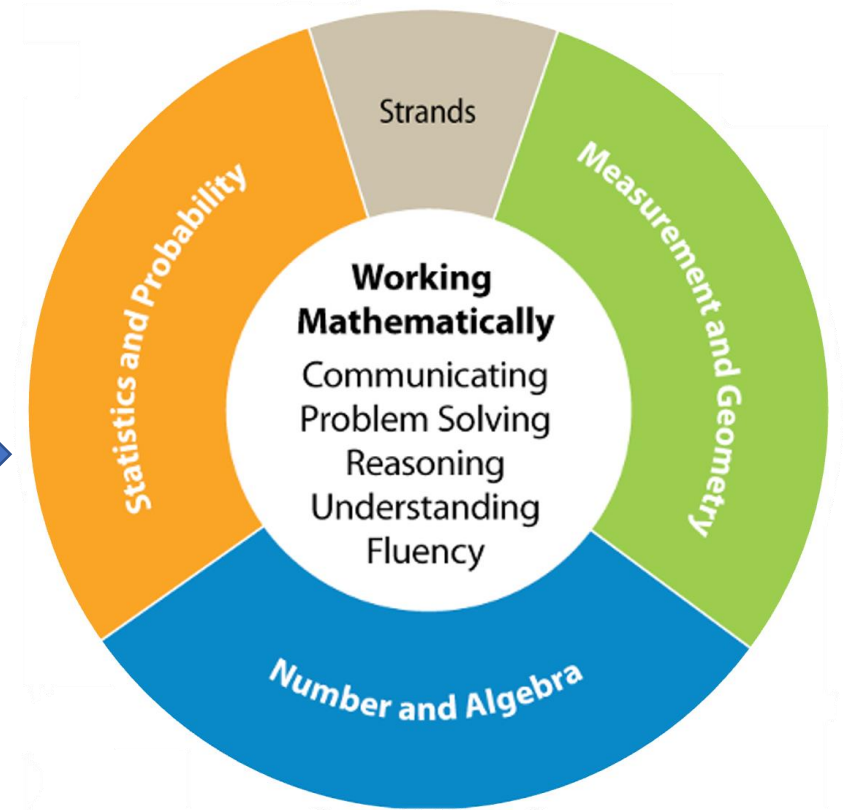
2003



Not so long ago...2012

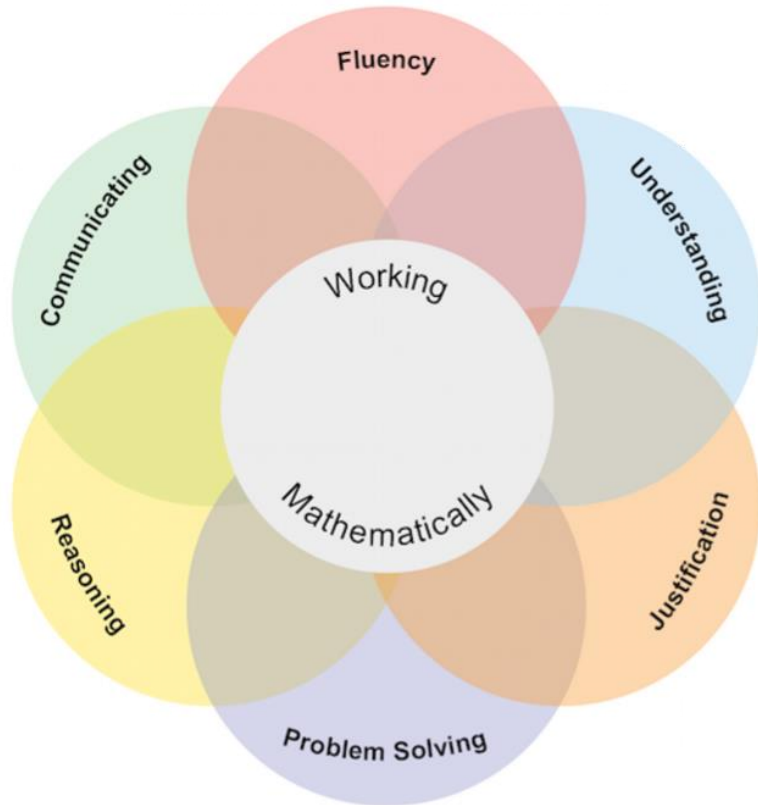


Intertwined Strands of Proficiency

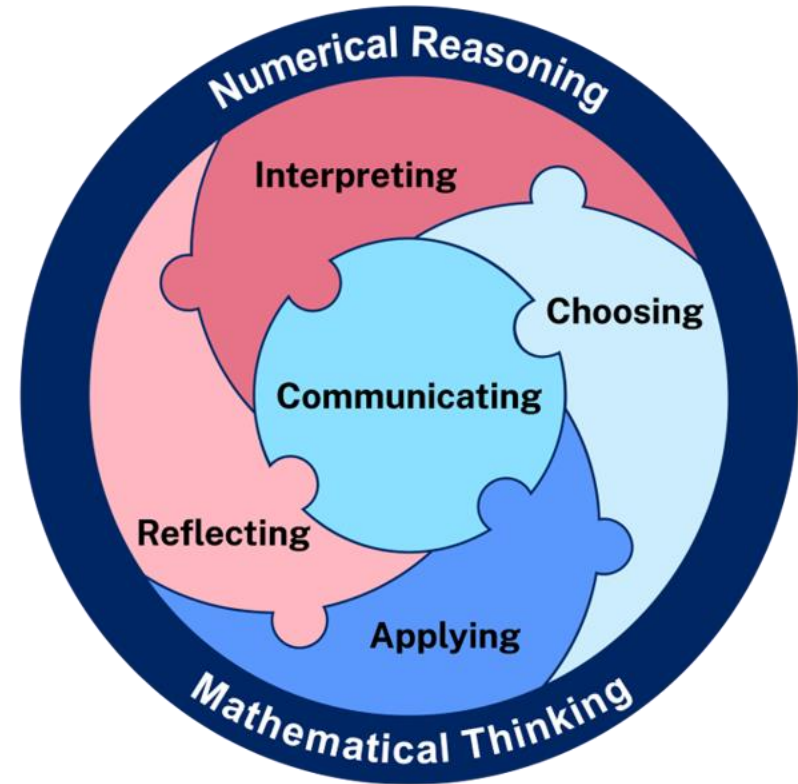


2018 to 2022

Stage 6 syllabuses 2017-18



Numeracy CEC syllabus 2022



WM does not have a dedicated outcome.

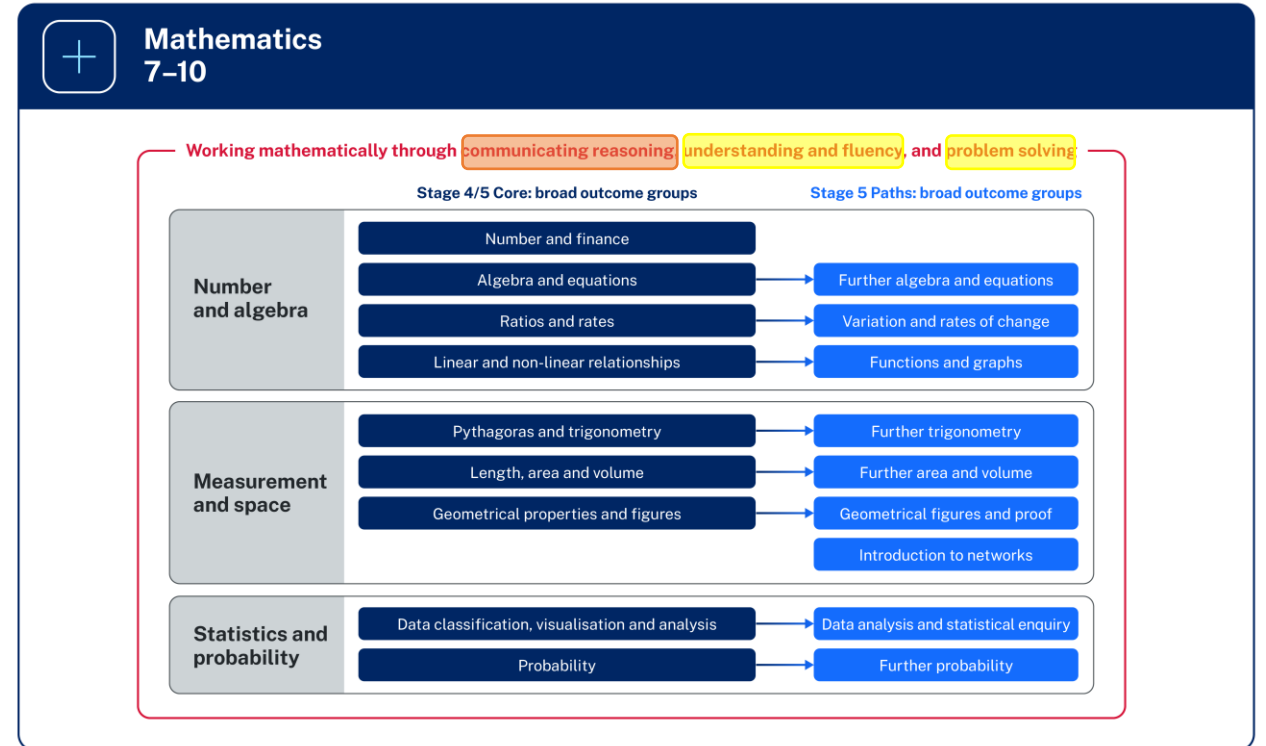
Working Mathematically is integral to the learning process in mathematics.



Now and into the future...

New K-10 Syllabus

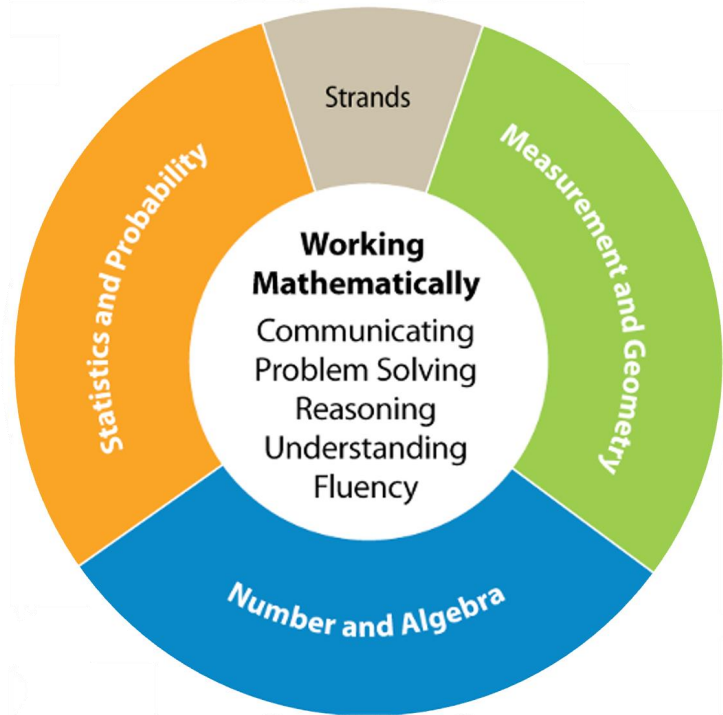
- The *Working mathematically* processes present in the new Mathematics K–10 syllabus are:
- Communicating
- Understanding and fluency
- Reasoning
- Problem solving



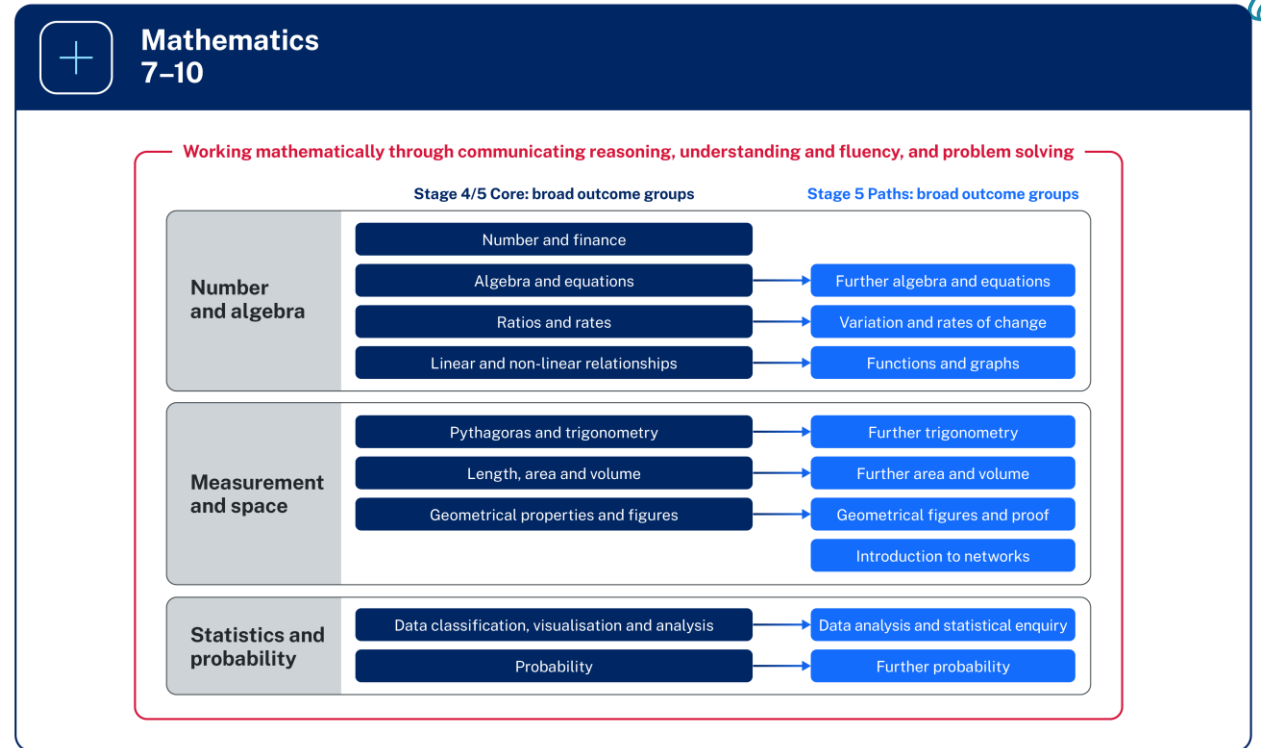
MAO-WM-01 Working mathematically: develops understanding and fluency in mathematics through exploring and connecting mathematical concepts, choosing and applying mathematical techniques to solve problems, and communicating their thinking and reasoning coherently and clearly



The Working Mathematically journey...



Objective: develop understanding and fluency in mathematics through inquiry, exploring and connecting mathematical concepts, choosing and applying problem-solving skills and mathematical techniques, communication and reasoning

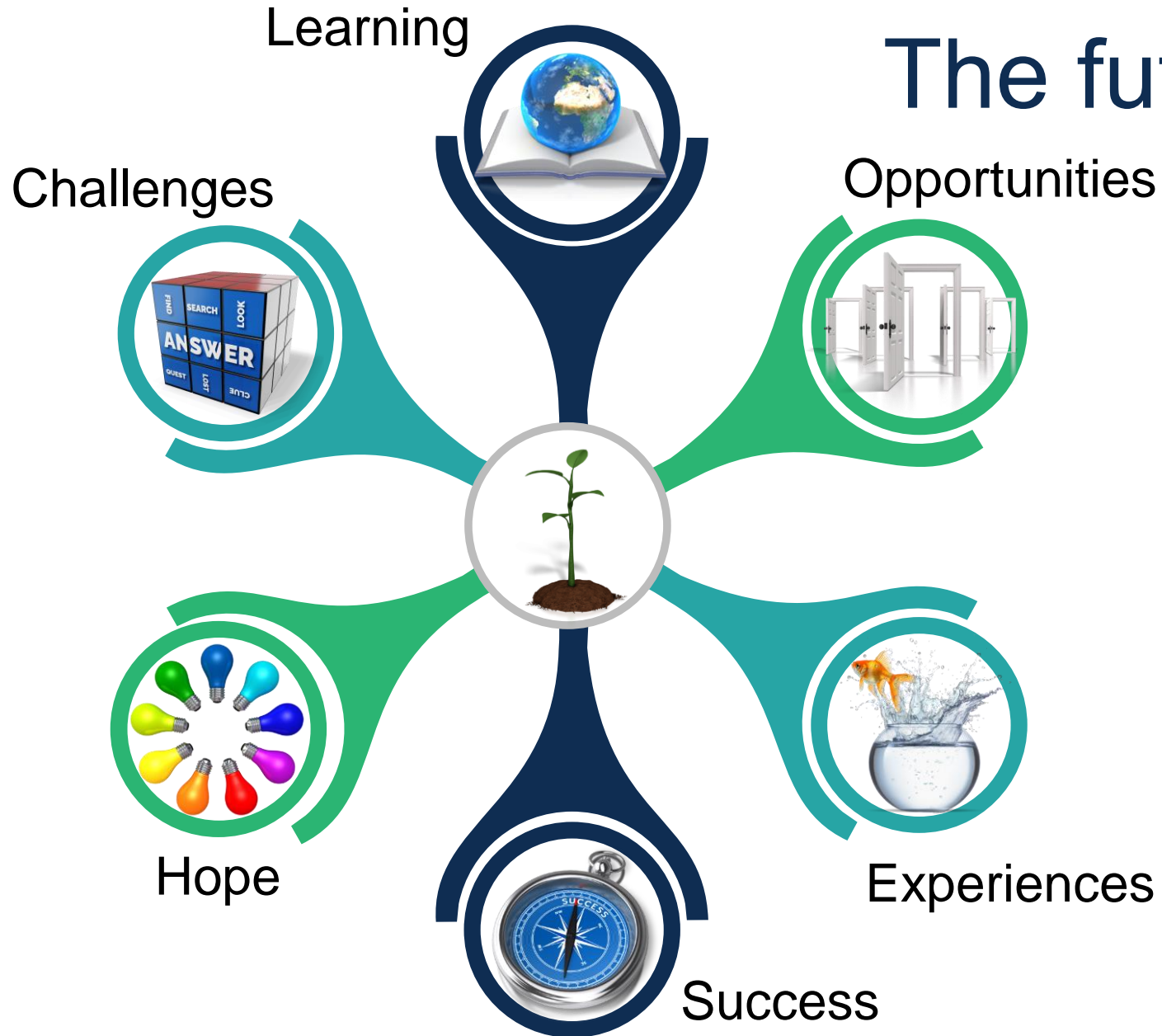


MAO-WM-01 Working mathematically: develops understanding and fluency in mathematics through exploring and connecting mathematical concepts, choosing and applying mathematical techniques to solve problems, and communicating their thinking and reasoning coherently and clearly

Where to now...

... *Black + White = grey*

The future...the vision



The world is moving at a tremendous rate; going no one knows where. We must prepare our children, not for the world of the past, not for our world, but for their world – the world of the future.

John Dewey, radio broadcast, early 1940s



The future...considerations

To remain competitive workers will need to acquire skills continually which requires flexibility, a positive attitude to lifelong learning and curiosity.
OECD The future of education and skills 2030

Our rapidly changing world of work requires young people today to rethink the skills they need to build a successful career and thrive in the future.
FYA, The New Work Smarts, 2017



74% of students believe that lifelong learning will be essential for them to future proof their career.
Australian Government
2021, Australian Jobs
2021

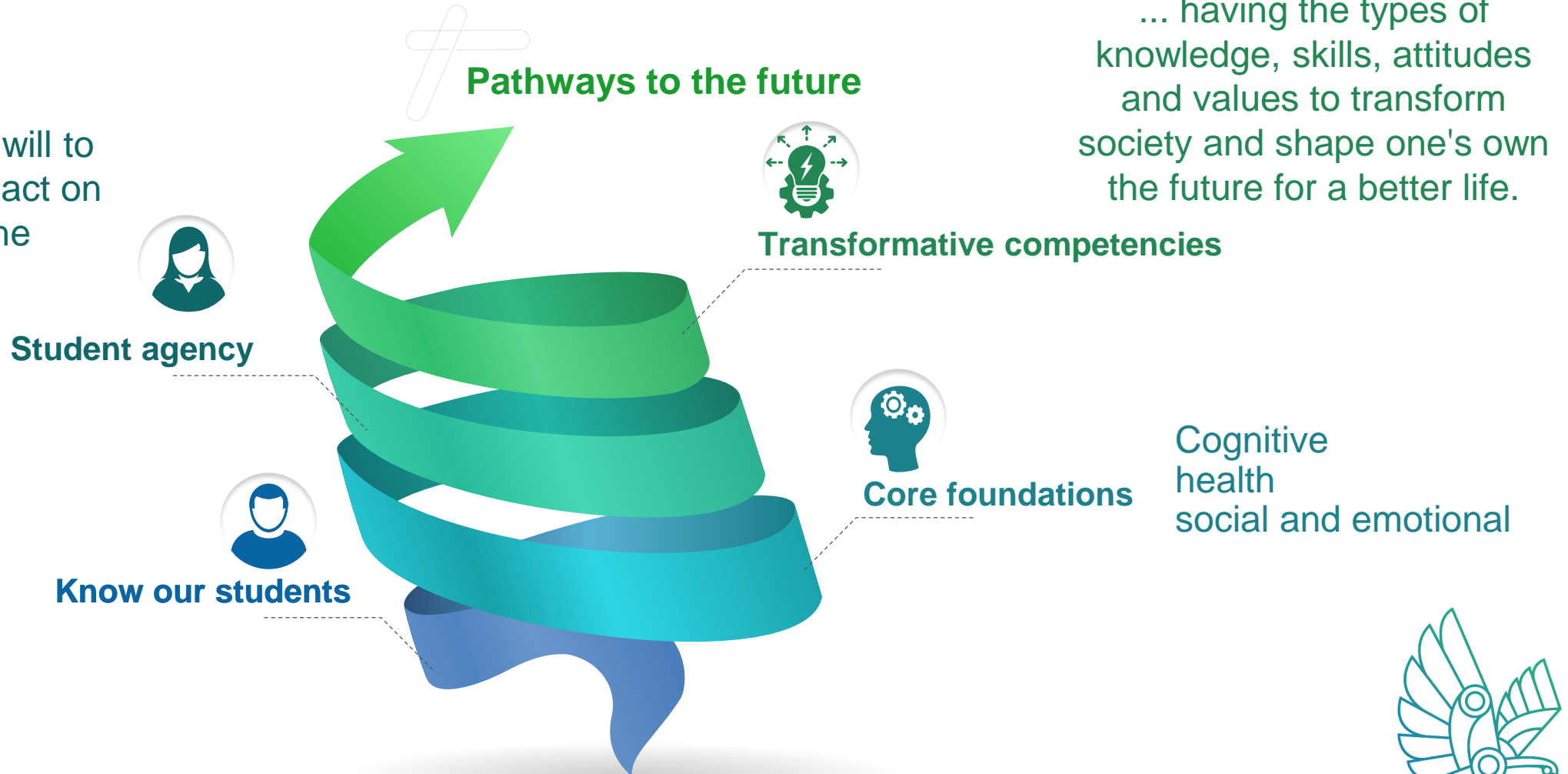
Core foundations

- **Cognitive** – Literacy and numeracy
- **Health** – Physical and mental health, well-being
- **Social and emotional** – Morals and ethics



The future... the goal

... the capacity and will to make a positive impact on one's own life and the world around them.

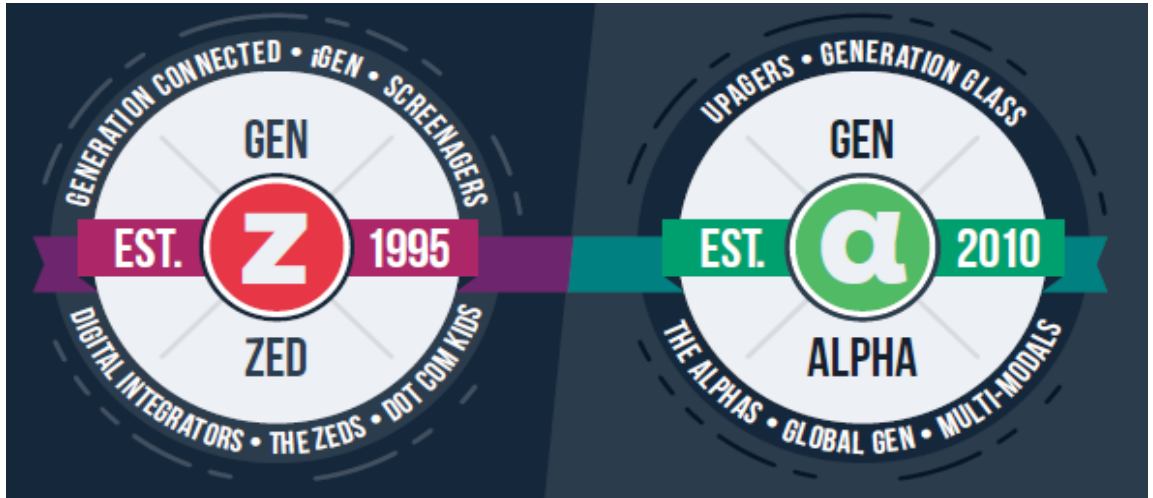


... having the types of knowledge, skills, attitudes and values to transform society and shape one's own the future for a better life.





PLAY FORTNITE ON MOBILE DEVICES
There are many ways to play Fortnite on mobile devices!





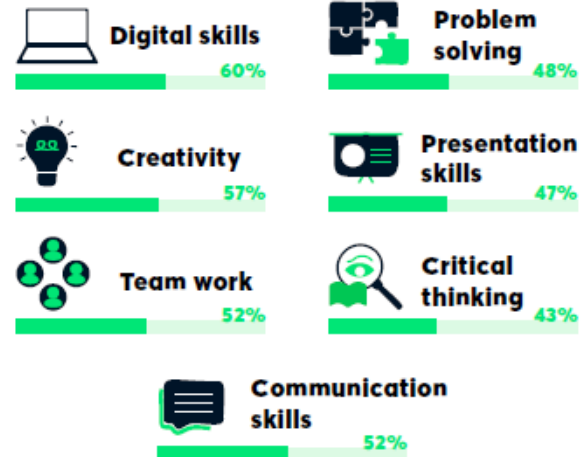
	GEN Z	GEN ALPHA	GEN BETA
EDUCATION OUTCOMES	Employable	Adaptable	Entrepreneurial
SCHOOL FOCUS	Exam results	Learning skills	Life skills
MARKETING	Peers	Influencers	Artificial intelligence
WORK STYLE	Participative	Collaborative	Co-creators
IDEAL LEADER	Coordinator	Empowerer	Enlarger
PAYMENTS	Credit card	Digital	Virtual
TECHNOLOGY	Touchscreen	Voice-recognition	Gesture control
CONSUMER TRENDS	Customised	Personalised	Predictive
ADVICE	Professional credentials	Social validation	Peer influence
BUSINESS CONTEXT	Changing trends	Frequent disruption	Continuous volatility



TODAY'S STUDENTS ARE EQUIPPED WITH SKILLS AND CURIOSITY

% of parents who believe students are extremely/very equipped

COMPETENCIES



CHARACTER QUALITIES



Skills for the future



The 7 general capabilities in the Australian Curriculum are:

- Critical and Creative Thinking
- Digital Literacy
- Ethical Understanding
- Intercultural Understanding
- Literacy
- Numeracy
- Personal and Social capability

Skills for the future

- Digital engagement
- Initiative and innovation
- Learning
- Numeracy
- Oral communication
- Planning and organising
- Problem-solving
- Reading
- Teamwork
- Writing



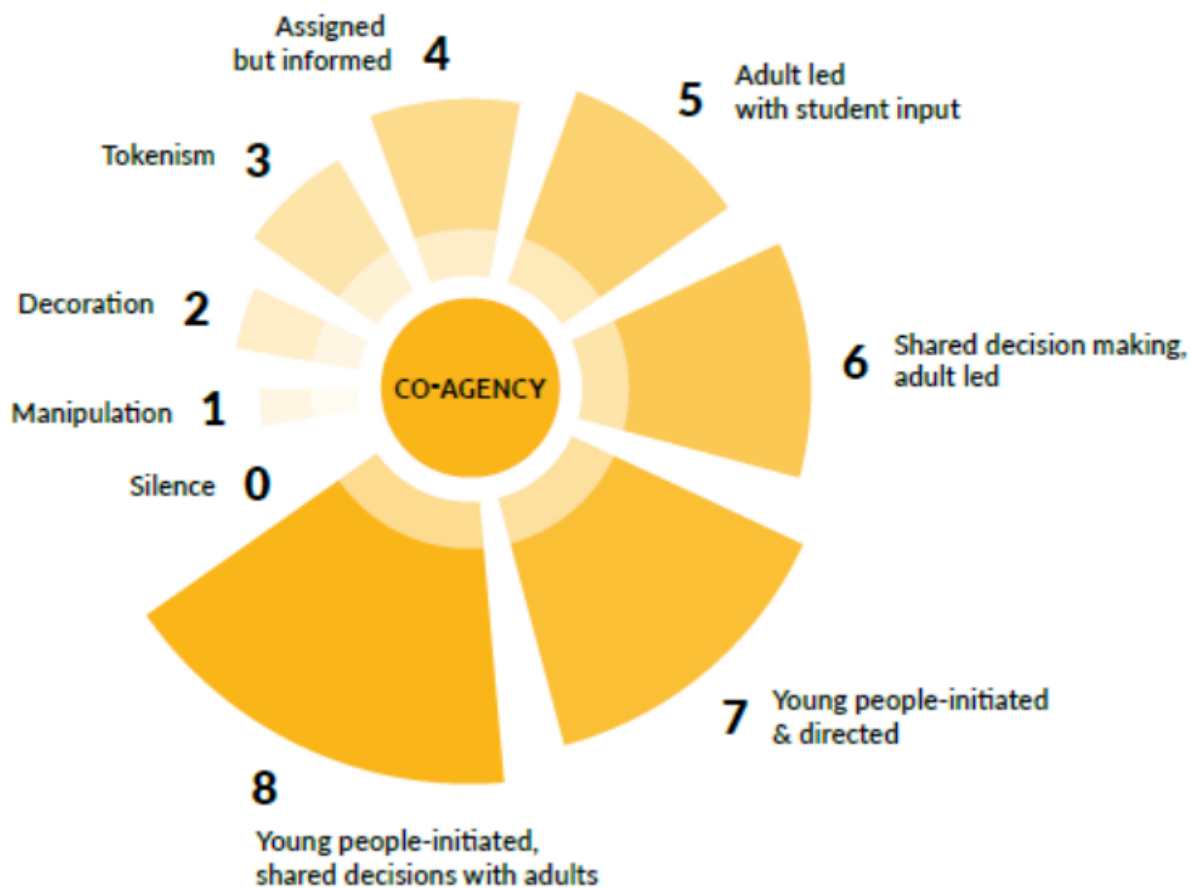
Jobs and Skills Australia



Student agency

The Sun model

The light is brightest when we shine together



Student agency has 3 key dimensions:

Autonomy: The extent to which students have the freedom to make their own choices and decisions about their learning.

Affiliation: The extent to which students feel connected to and supported by their teachers, peers, and the school community.

Competence: The extent to which students feel confident in their ability to succeed in school.

- Student agency is best developed when there is a high level of co-agency between students and adults.
- Co-agency is when teachers and students become co-creators in the teaching and learning process.



Transformative competencies

There are 3 key transformative competencies:

- **Creating new value:** ask questions, have a sense of purpose, collaborate with others and “think outside the box”
 - *curiosity, creativity, critical thinking, adaptability and innovation*
- **Reconciling tensions and dilemmas:** acquiring a deeper understanding of opposing positions, develop arguments to support one's own position, and find practical solutions to problems
 - *empathy, respect, creativity, problem-solving skills, resilience and responsibility towards others*
- **Taking responsibility:** reflecting on and evaluating one's experience and learning
 - *integrity, compassion, respect, self-regulation, self-awareness, reflective thinking, trust*



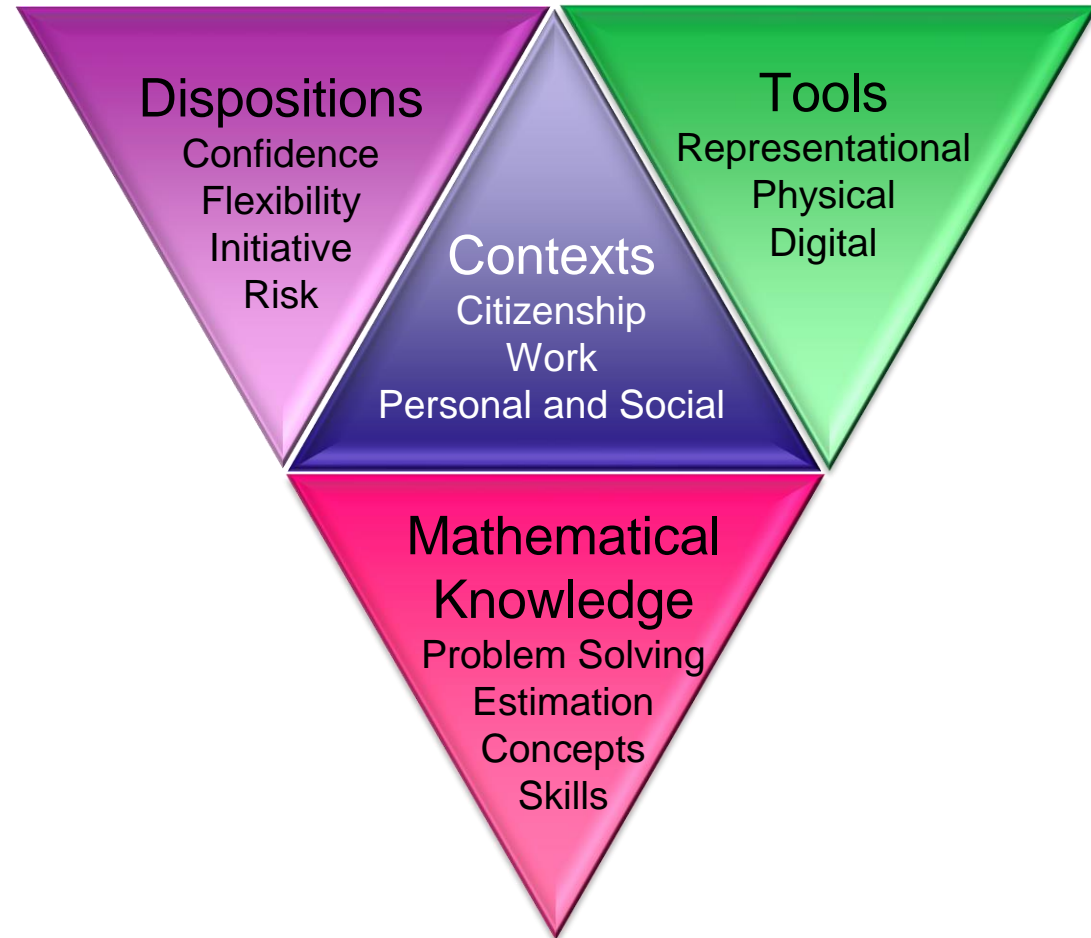
Bringing it together...

Life + Mathematics = ...

Being in the present

*No borders, just
horizons - only
freedom.*

Amelia Earhart



Accessed from: Goos, Geiger and Dole (2012)
http://espace.library.uq.edu.au/view/UQ:278741/UQ278741_fulltext.pdf



No opportunity is too small!

Which of these is the biggest big thing?



**The big golden guitar
(Tamworth)**

<https://bigthingsofaustralia.com/the-big-golden-guitar/>



**The big merino
(Goulburn)**

<https://www.bigmerino.com.au/about-the-big-merino/>



**The big kookaburra
(Kurri Kurri)**

<https://bigthingsofaustralia.com/the-big-kookaburra/>



**The big wine bottle
(Pokolbin)**

<https://landofthebiggs.com/big-wine-bottle-pokolbin-nsw/>

Make some noise!

Peer interactions give students the opportunity to test their understanding and validate their conjectures through mathematical discussions.

Goos (2004)



Move, explore, experiment!

Visualisation is one of the most important processes through which to encourage critical thinking in the classroom.

Makina (2010).



Make some noise!

Peer interactions give students the opportunity to test their understanding and validate their conjectures through mathematical discussions.

Goos (2004)



It provides us with an opportunity to identify misunderstandings and misconceptions and where they may be occurring.



A world of opportunities

What's
going
on?

Topical issues

Know your students

Consider both of your worlds

Students become co-creators

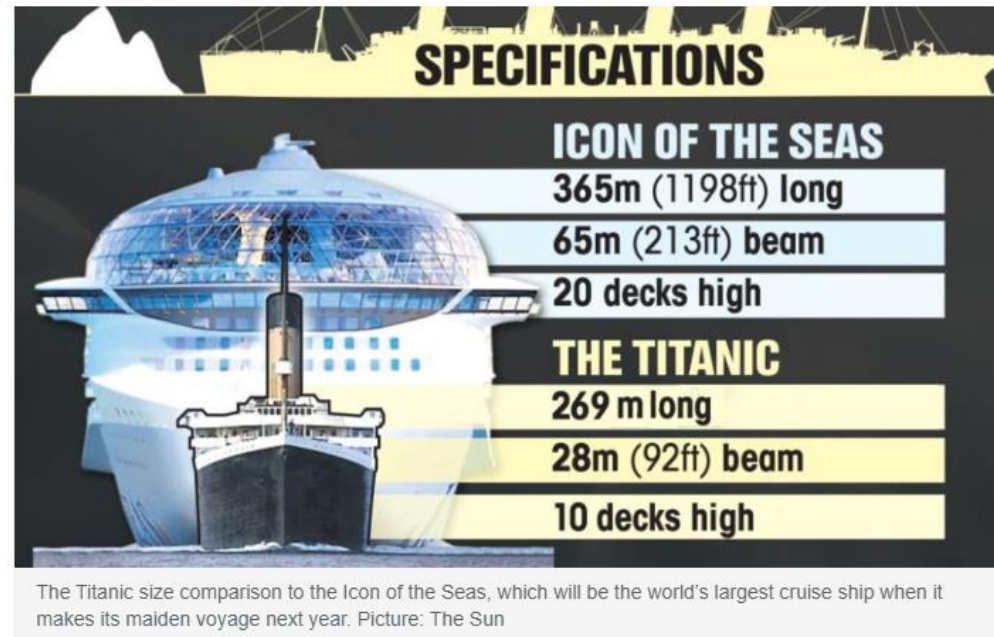
Influencers Overtaking Journalists as News Source, Study Finds



FILE - Influencer Murilo Duarte streams a live video at the Jardim João XXIII slum in Sao Paulo, Brazil, on April 19, 2023.

Accessed at:

<https://www.voanews.com/a/influencers-overtaking-journalists-as-news-source-study-finds/7136682.html>



Accessed at: <https://www.news.com.au/travel/travel-updates/travel-stories/insane-image-reveals-true-size-of-titanic-compared-to-modern-day-cruise-ship/news-story/5232c870c1b75833742c10d309e39e8f>



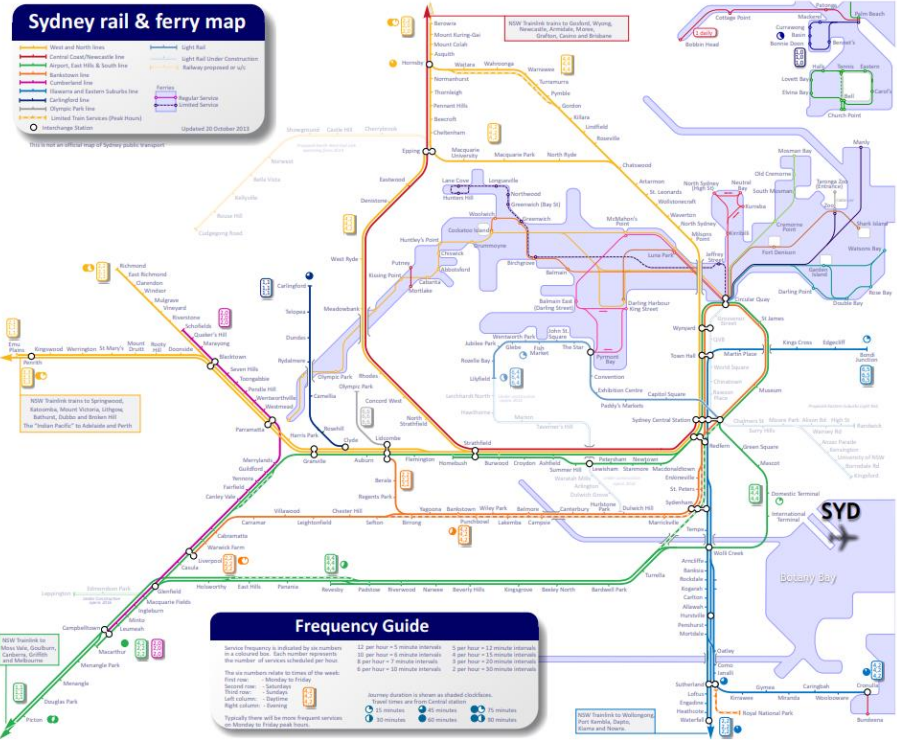
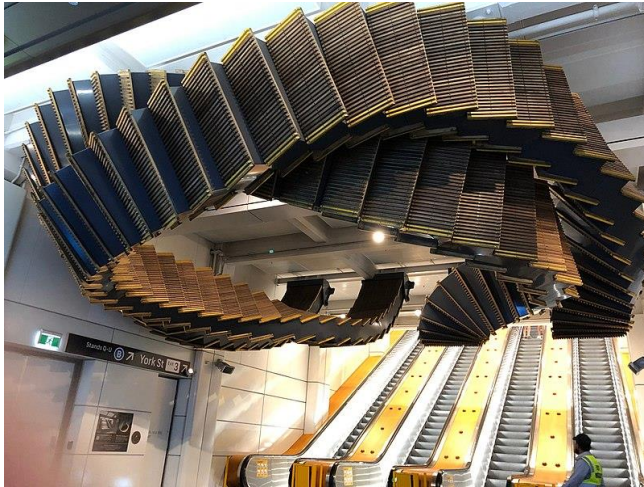
Accessed at:

<https://www.gumtree.com.au/advice/circular-economy-report-2022/>



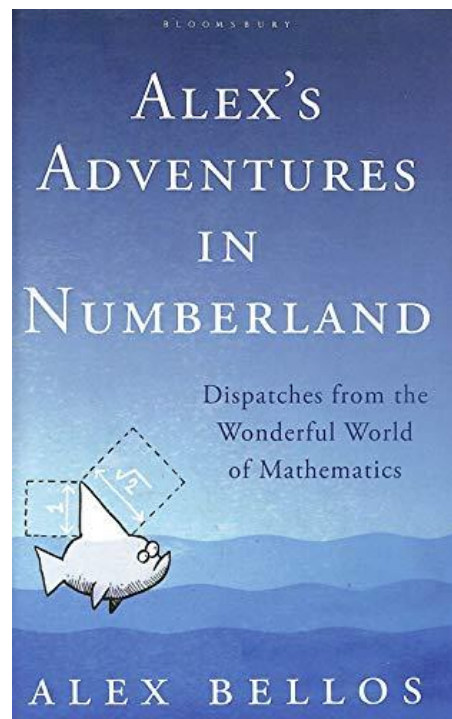
A world of opportunities...

Our everyday



A world of opportunities...

What's that your reading or watching?



Accessed at: <https://www.independent.co.uk/arts-entertainment/books/news/where-s-the-brains-behind-wally-6261459.html>



A world of opportunities...

What's the answer to this problem?

The Math Equation That Tried to Stump the Internet

Sometimes BODMAS is just PEMDAS by another name. And no, the answer is not 100.

$$8 \div 2(2+2) = ?$$

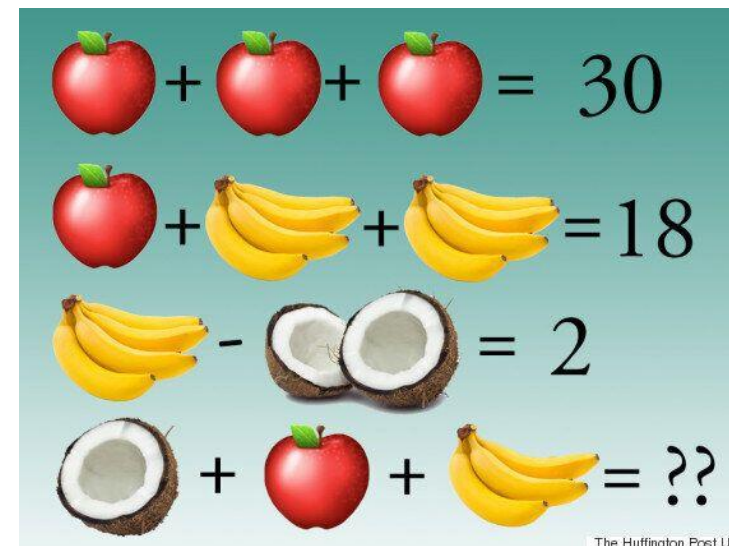
<https://www.nytimes.com/2019/08/02/science/math-equation-pedmas-bemdas-bedmas.html>



Accessed at:
<https://numberle.org/>

There were some people on a train. 19 people get off the train at the first stop. 17 people get on the train. Now there are 63 people on the train. How many people were on the train to begin with?

<https://www.insider.com/hard-viral-math-questions-2017-12#this-math-problem-from-singapore-went-viral-in-the-us-4>



Accessed at:
https://www.huffingtonpost.co.uk/2016/02/18/simple-algebra-fruit-puzzle-divides-facebook-users_n_9261620.html



Accessed at:
<https://imgur.com/gallery/SNcVaf0>



A world of opportunities...

A bit of magic!

1. Write down the number of your house address 35
 2. Multiply your house number by 2 70
 3. Add 5 to this number 75
 4. Multiply your answer by 50 3750
 5. Add your age to this number 3771
 6. Add 365 to your answer 4136
 7. Subtract 615 3521
- So I live at number 35 and am 21!**





SOURCE
EDUCATION & CONSULTING

Thank you

Anna Wethereld

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