CURRICULUM, PEDAGOGY AND BEYOND









Mathematical Modelling in the Primary Years

Amy Somers and Renee Ladner



Acknowledgement of Country

We acknowledge the Wurundjeri people of the Kulin Nation, as the traditional custodians of the lands on which we meet today.

We pay respect to Elders past and present, and to all First Nations people recognising them as the original and ongoing custodians of this land, which was never ceded.

We respect our First Nations peoples as the first teachers of mathematics who continue to teach us by connecting with, respecting and caring for people and country.



Warm Up Question

Estimate how many pieces of fruit there are at this shop. Discuss with the person next to you and justify your estimate.



https://resolve.edu.au/teaching-sequences/year-3/multiplication-resolve-market/task-1-finding-multiplication

Mathematical Modelling in the Primary Years

With the implementation of the revised curriculum for mathematics we see the mathematical processes become more evident and explicit. In this session we will look at the process, mathematical modelling. This session is aimed at primary school teachers and leaders. We will provide ideas and resources that teachers can use to enrich the use of mathematical modelling tasks in their practice and will support teachers to try some tasks for themselves. We will also look at the mathematical modelling cycle and where these tasks have been explicitly linked in the revised mathematics curriculum.

What would you like to get out of today's session?

What is Mathematical Modelling

"Mathematical modelling is a mathematical process involving the identification of a real-world problem, formulating and finding a solution to the problem mathematically using knowledge and understanding of mathematical concepts, structures and relationships, interpreting and communicating the mathematical solution(s) in terms of the situation.

As students mathematical modelling skills become more sophisticated, they begin to **consider** assumptions, choose variables, justify decisions and evaluate the effectiveness of the model.

It is clear that mathematical modelling, as described in the Victorian Curriculum **begins and ends in the real-world**." - Jill Brown



Mathematics 2.0

Strands:

Number

Algebra

Measurement

Space

Statistics

Probability

Proficiencies:

Understanding

Fluency

Reasoning

Problem Solving

Processes:

Mathematical modelling

Computational thinking and simulations

Statistical investigations

Probability experiments and simulations

Singapore's Mathematics Curriculum Framework



Mathematics Curriculum Framework

Understanding of the properties and relationships, operations and algorithms

https://www.moe.gov.sg/-/media/files/secondary/syllabuses/maths/2020-express_na-maths_syllabuses.pdf

Singapore's MM Cycle

Mathematical Modelling Process



https://www.moe.gov.sg/-/media/files/secondary/syllabuses/maths/2020-express na-maths syllabuses.pdf

Australian Curriculum MM Cycle

Mathematical modelling process

Mathematical modelling is an essential dimension of the contemporary discipline of mathematics and is key to making informed decisions or predictions about natural and social phenomena. Students develop an understanding of mathematical modelling when they recognise, connect, and apply mathematical structures to gain insight into situations and solve real-world problems



https://v9.australiancurriculum.edu.au/teacher-resources/understand-this-learning-area/mathematics

Resolve MM Cycle



https://resolve.edu.au/v84-sequences/mathematical-modelling-introduction

Compare and Contrast

- What is the same and what is different?
- Do you have a preference?
- Which one do you think your staff would like best or would you like create a schoolbased model to fit your needs?



Examples and non-examples

How many times can you use a tube of toothpaste to brush your teeth?

How many pencils long is your desk?

Two numbers have a difference of 25. What could they be?

How much will it cost me to provide my party guests with gift bags?

Bushwalking 1- Resolve



If you were going for a 15 km walk in the bush how long would you allow?

What if you were going to walk a different distance?

https://resolve.edu.au/v84-sequences/mathematical-modelling-introduction

Bushwalking 2 - Resolve



When walking, many people have a rest every so often. If you were going for a 15 km walk in the bush how long would you allow including rests?

What if you were going to walk a different distance?

Bushwalking 3 - Resolve



Naismith's Rule estimates the time to allow for a walk:

- * allow one hour for every 5 kilometres on the map plus
- * 1 hour for every 600 metres of ascent.

The 1000 Steps



The 1000 Steps is probably Melbourne's most popular bushwalk. Officially the Kokoda Track Memorial Walk, walkers love the challenge of the steep trail, locals appreciate the convenience and tourists just want a picture of a gorgeous rainforest walk. But to truly appreciate this unique place, you need to visit when it's quiet.

The 1000 Steps/Kokoda Memorial Track

The Kokoda Memorial Walk is

- 1.4 km (one way)
- rises 281 metres

How long does Naismith's rule estimate we should allow to walk up? Do you agree with this? *Naismith's Rule:*

allow one hour for every 5 kilometres on the map plus 1 hour for every 600 metres of ascent



Is your answer reasonable?

Was your answer reasonable? If not, can you work out where you went wrong?

Given this information how long would you allow to go for this walk and why?

How long would you allow if you were taking your class on this walk? Why?



Adapt to your own setting

- Zoo excursion
- Werribee Gorge
- Mt Macedon
- Maroondah Reservoir



Planning considerations

NCCA: National Council for Curriculum and Assessment **Design Principles for Model-Eliciting Activities** Adapted from Lesh and Doerr (2003)

Principle	Description
Reality	The context should be realistic or imaginable for children. They should be able to make sense of the situation based on extensions of their current knowledge.
	A problem can be fictional or drawn from real-life but must be imaginable for children.
Model construction	The activity should involve constructing, describing or predicting a structurally significant system, i.e., the underlying mathematics must be important and relevant for children's learning at the relevant class level
	Think about how the Fruit shop task highlighted mathematical structure. Where problems are drawn from real-life contexts, teachers should ensure the mathematics addressed is significant.
Self- assessment	Criteria embedded in the activity should allow children to self-evaluate and refine their model where necessary.
	Checking if the solution makes sense in the real world allows for self-assessment.
Model documentation	The task should set children up to produce documentation of their thinking
	Younger children may explain their thinking orally and record through mark-making or drawing.
Simple prototype	The problem should be as simple as possible while still creating a need for a significant model.
	Significant models with complex mathematical ideas can be generated from simple problems- see integrated STEM examples above.
Generalisability	Children should be challenged to produce models that are reusable, shareable and modifiable.
	Children should be encouraged to identify generalisable ideas from modeling activities and, where appropriate, have opportunities to trial these in new problems.

Take lots of photos!



Lower primary – how many plants could we fit into one of these garden beds?

Mid-Primary – how many seeds should we plant in these garden beds?

Upper Primary – Create a budget for planting out these garden beds.

Things to consider

- Mathematical modelling is a messy real-life problem
- Teachers need to do the task
- Be comfortable with giving less- if you've done the task- you should be able to anticipate ways students will respond
- Student agency/ decision making
- Problem solving is giving parameters to solve the problem
- This cannot be taught in an EDI model- this is an inquiry approach- use the mathematical modelling cycle

Mathematical modelling or Problem Solving?

How could we use this image to create a Mathematical Modelling task?



https://resolve.edu.au/teaching-sequences/year-3/multiplication-resolve-market/task-1-finding-multiplication



Resources



Mathematics



Ministry of Education SINGAPORE





MATHEMATICAL MODELLING: TOOTHPASTE

Jill Brown, Associate Professor in Mathematics Education, Deakin University and Gloria Stillman retired academic



Figure 1. This is a mathematical modelling task. You need to select relevant variables and estimate values for quantities that are relevant. You might need to collect some empirical data. The toothbrush in the photo is adult toothbrush size. Find a general formula for how many days any size tube of toothpaste will last.





Event App

App Download Instructions

Step 1: Download the App 'Arinex One' from the App Store or Google Play



- Step 2: Enter Event Code: mav
- Step 3: Enter the email you registered with
- Step 4: Enter the Passcode you receive via email and click 'Verify'. Please be sure to check your Junk Mail for the email, or see the Registration Desk if you require further assistance.





Be in it to WIN!

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A02 - (Year 1 to Year 6) Supporting High Potential and Gifted Learners in Mathematics

Pedagogy

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(i) Description

ନ∃ Speaker



Dr Chrissy Monteleone

