THE MATHEMATICAL ASSOCIATION OF VICTORIA

THE COMMON DENOMINATOR 1/23

CHANGING TIMES AND PRACTICES

INSIDE

Catherine Attard – Professor of Mathematics Education, Western Sydney University

The time for change in how and what mathematics is taught in Australian schools has arrived. The need for mathematics education to evolve is not recent. However, changes to educational practices are typically much slower than the rate of change in the world we live in. For example, digital technologies have dramatically changed how we receive and process information, how we communicate, and how we learn, yet it wasn't until the COVID-19 pandemic forced schools into remote learning mode that many educators saw the value of digital resources in mathematics education. Similarly, student engagement with mathematics has continued to challenge educators for many decades and while educators are continually presented with new programs, strategies, and initiatives, student attainment and retention in mathematics courses beyond the compulsory years remain in need of improvement.

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FROM THE PRESIDENT

Kerryn Sandford

As we begin 2023, I have found myself reflecting on how this wonderful profession has changed over the 25 years I have been working in education. I remember having to submit close to 90 job applications to finally land my first job as a graduate teacher as there were so many more applicants than there were jobs available. These days, the situation is very much the reverse with schools struggling to recruit the staff they need, particularly in specialist areas including mathematics. As a school leader, I am all too aware of the challenges we currently face around the workforce and what this may mean for the future of mathematics teaching and learning and the potential long-term ramifications.

From my own experience, I see a lot of what sits 'behind' the various data sets around this issue. I have conversations with people thinking of leaving as well as those who have already made the decision. I hear their explanations and, for the most part, I can only emphasise with their experience. I also see what this leads to: the disruption caused when experienced and effective educators leave the school environment and others, often new to the profession or new to the teaching of the subject, come in to replace them. The 'shuffling' that occurs as schools scramble to cover classes with educators from other areas to try to get the best fit for the students. The need for ongoing development and support of teachers who, perhaps, did not specifically train to teach mathematics and do not feel confident with this work. The need to also support those providing the support as they too are feeling the squeeze with their expertise being more keenly sought across the school and system. For schools in our regional and rural areas, these issues are significantly compounded. For some schools, experienced educators may be in the minority in their schools or departments and the responsibilities that fall to these people, even greater.

In considering these issues, I find strength in what I see on the ground. The way teachers and leaders rally around each other, their students and communities to provide the best possible education for their students. I see how teachers are adapting their practice to better suit the changes in student behaviour and motivations that are likely a big part of what sits at the heart of the cause for these workforce shortages. The ways we, as a system, are modifying and adapting practice, driven by the needs of the workforce and of schools as they look for ways to build capacity of their staff without placing too much strain on the operational needs of the school itself. At MAV, we too are modifying and adapting how we go about providing support to the workforce and to leaders to help meet these challenges. MAV continues to provide services and opportunities as it always has, such as the December annual conference. The 2022 conference was hugely successful, it provided an opportunity for mathematics educators to come together, learn some new things, revisit some older things and to just learn from each other. The conversations I heard (and overheard), were positive and enthusiastic. It was a great chance to see and touch base with colleagues that I have not seen for years and to catch up on what everyone is doing, how they are implementing new programs such as the new VCE-VM Numeracy courses and the new VCE study designs, and to share stories and experiences.

Beyond the conference, MAV provides a wide range of additional supports for schools, teachers and networks. Have a look at our website, which also provides information about our advocacy, in-school consulting, student activities and challenges like the Maths Talent Quest and the MAV shop. We are keen to support schools and teachers to build capacity and if we can help by providing the expertise in ways that suit your local context, then we can design a program that does that.

While MAV continues to provide the services that schools and educators need, we recognise that these needs are changing, and we are adapting accordingly. We have new and exciting initiatives being developed and will share more in the coming months. I encourage you to provide MAV with feedback about your needs and ideas for support. We are open to developing new ways of working and modifying our approach to support schools and educators to maximise student learning of numeracy and mathematics in all schools, contexts and communities. I wish you all a very successful, fulfilling and inspiring 2023!

UPCOMING MAV EVENTS

For more information and to reserve your place at any of the events below, visit www.mav.vic.edu.au.

EVENT	DATE	YEARS	PRESENTERS
VCE mini conference Melbourne (RMIT)	10/2/23	VCE	Various
SAC workshop - General Maths	20/2/23 Virtual	VCE	Various
SAC workshop - Maths Methods	21/2/23 Virtual	VCE	Various
SAC workshop - Specialist Maths	22/2/23 Virtual	VCE	Various
VCE mini conference Bendigo (La Trobe University)	24/2/23	VCE	Various
SAC workshop - Specialist Maths	7/3/23 Virtual	VCE	Various
SAC workshop - General Maths	8/3/23 Virtual	VCE	Various
SAC workshop - Maths Methods	9/3/23 Virtual	VCE	Various
Meet the Assessors - All studies (Williamstown)	20/3/23	VCE	Various
Meet the Assessors - Further Maths and Specialist Maths (Burwood)	22/3/23	VCE	Various
Meet the Assessors - Maths Methods (Burwood)	27/3/23	VCE	Various
Meet the Assessors - Maths Methods	28/3/23 Virtual	VCE	Various
Meet the Assessors - Further Maths and Specialist Maths	29/3/23 Virtual	VCE	Various
MAV Regional conference	26/5/23	P - 12	Various
Primary maths conference	15/6/23 and 16/6/23	P - 6	Various

YOUR MEMBERSHIP

First and foremost, we thank our members for your continued investment in MAV. With your loyalty and support, we can continuously provide you with valuable benefits and actively develop our work in the mathematics community. Put simply; you make what we do possible.

At MAV, we promote the importance of mathematics in society through our programs and services. Our organisation has over 1400 members from various educational sectors, including individuals, schools, universities, and other institutions. Thus, it gives over 17,000 mathematics educators across Victoria access to membership benefits.

We work to facilitate a cutting-edge community of mathematics educators whose goal is to ultimately improve your professional practice, and the outcomes for your students.

WHY JOIN?

- Develop into a more proficient, assured, and knowledgeable maths educator.
- Develop your knowledge skills on your path to leadership in mathematics.
- Participate in educational activities catered to your requirements, career stage, and teaching levels by joining a network of educators.
- Continue your professional education to broaden your knowledge and experience.
- Keep up with the most recent developments in mathematics teaching, including trends, knowledge, and resources.
- Join the only comprehensive Victorian mathematics education community.

Head to www.mav.vic.edu.au/membership. Or login and go to the *My Details* page to renew your membership.

NEW ONLINE MEMBER COMMUNITY

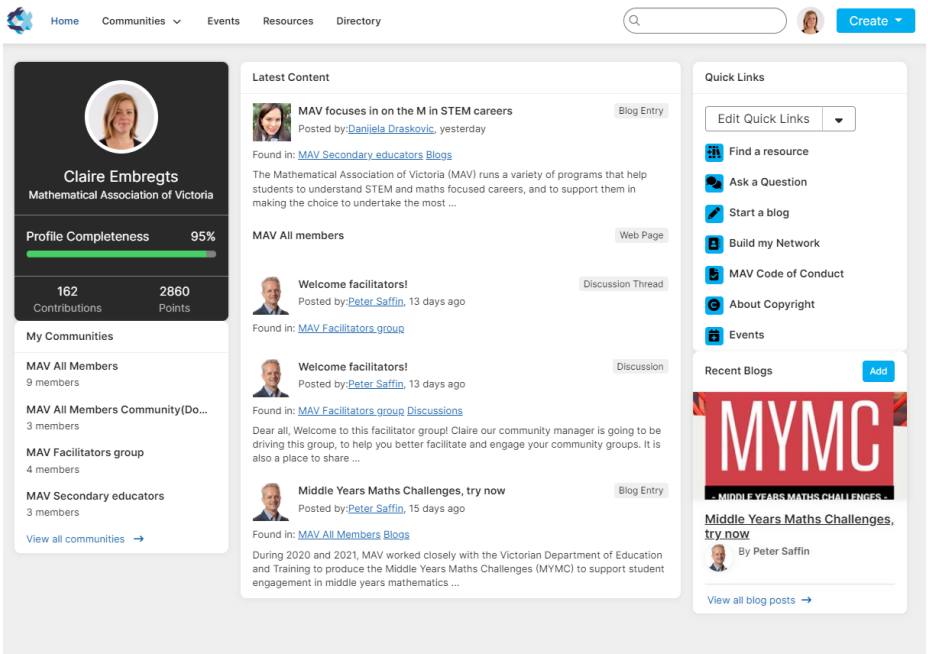
Claire Embregts – Community strategy manager, MAV

MAV's new online community is an opportunity for Victorian mathematics educators to establish valuable peer-to-peer networks with a dynamic community of like-minded teachers, educators, experts, and MAV members. We have built this space for educators to support one another, seek answers to questions, improve practice, and deepen knowledge and skills in a collaborative online community, all while helping educators build professional networks in all settings.

MAV has continued its research and collaboration efforts to better understand the experiences of our members. Through this work, it has become evident that MAV members require and deserve an online space where they can utilise opportunities to network with peers, connect with experts, seek and share resources from all regions across the states, and seek direct peer support from MAV.

Our community offers a wide range of participation options and flexibility, and it will help MAV use information and insights more effectively to guide other projects and support for maths educators. We provide the platform to gather ideas and explore what's possible and also provide formal recognition that the views of our community have been received and listened to. All efforts have been made to ensure the online community is optimised for devices and screens of all sizes, so you can access it via your a smart phone or tablet or your desktop PC. The maths educator community will allow you to:

- Enjoy opportunities for collaboration with peers from the sector and state, reducing professional isolation.
- Find your niche and connect with educators to explore topics of interest.
- Deepen your impact and the quality of your practice through deep discussions about new ideas, pedagogy, resources, and practices.
- Access support and resources to help you with teaching and learning.
- Share your expertise, knowledge, and resources with others.
- Access opportunities for professional development webinars and events.
- Connect more deeply with MAV – your professional association.



Our community includes teachers and educators from early childhood, primary and secondary, and VCE and vocational subjects. If you are an educator, maths or numeracy leader, head of faculty, or have an interest in improving maths education, you are one of us!

You can register for MAV's maths educator community, www.mathscommunity.com.au/mav

CHANGING TIMES AND PRACTICES

Catherine Attard – Professor of Mathematics Education, Western Sydney University

CONT. FROM PAGE 1.

Put simply, the students in our classrooms today are different to those we taught two, five, or ten years ago, but for many, teaching practices have not evolved to the same degree. So, what should we change, and what should remain the same? How can we reduce the number of times we hear the question, ' Why do I need to learn this?', or the comment, 'I'm just not a maths person?' How do we adapt and evolve our practices to make mathematics comprehensible to all students?

STUDENT ENGAGEMENT

To improve student engagement with mathematics we first need to understand that it is a multi-dimensional construct, consisting of cognitive, operative, and affective domains (Attard, 2014; Fredricks et al., 2004). In other words, students who are engaged with mathematics are more than just 'on task'. Rather, they are 'in task', thinking hard (cognitively engaged), working hard (operatively engaged), and feeling good about mathematics (affectively engaged). In addition, students who are engaged value their learning and view themselves as users of mathematics both within and outside the classroom, and in their future lives. The Framework for Engagement with Mathematics in Figure 1 provides details of the elements and actions that contribute to student engagement.

The Framework is divided into two separate but inter-related sections: Pedagogical Relationships and Pedagogical Repertoires. For engagement to occur, positive pedagogical relationships must be developed which then allow for engaging pedagogical repertoires to be planned and taught. These engaging repertoires, or practices, are what we should be considering in relation to the needs of contemporary mathematics learners.

CHANGING PRACTICES

Consider the following questions: Do you and the teachers at your school:

- Make connections to previous lessons and prior assessment of students' learning?
- Make connections to a topic covered in another area of the curriculum?
- Make connections to students' current interests?

Code	Element
Pedagogical relationships In an engaging mathematics classroom, positive pedagogical relationships exist where these elements occur:	
PK	Pre-existing Knowledge: students' backgrounds and pre-existing knowledge are acknowledged and contribute to the learning of others
CI	Continuous Interaction: interaction amongst students and between teacher and students is continuous
PCK	Pedagogical Content Knowledge: the teacher models enthusiasm and an enjoyment of mathematics and has a strong Pedagogical Content Knowledge
TA	Teacher Awareness: the teacher is aware of each student's mathematical abilities and learning needs
CF	Constructive Feedback: feedback to students is constructive, purposeful and timely
Pedagogical repertoires Pedagogical repertoires include the following aspects:	
SC	Substantive Conversation: there is substantive conversation about mathematical concepts and their applications to life
CT	Challenging Tasks: tasks are positive, provide opportunity for all students to achieve a level of success and are challenging for all
PC	Provision of Choice: students are provided an element of choice
ST	Student-centred Technology: Technology is embedded and used to enhance mathematical understanding through a student-centred approach to learning
RT	Relevant Tasks: the relevance of the mathematics curriculum is explicitly linked to students' lives outside the classroom and empowers students with the capacity to transform and reform their lives
VT	Variety of Tasks: mathematics lessons regularly include a variety of tasks that cater to the diverse needs of learners

Figure 1. Framework for Engagement with Mathematics (FEM) (Attard, 2014).

- Make connections to a previous topic where they may have discussed a similar idea in another form?
- Cover one idea in a variety of ways?
- Aim to make connections with students?

These questions are a good place to start when reflecting on current practices and considering new ones. The emphasis on connections is an important one, particularly when we are enacting the mathematics curriculum. Traditionally, mathematics content was taught in isolated topics with the view that this assisted in 'covering' the curriculum. However, this does not assist in the development of conceptual understanding. In her book *About Teaching Mathematics*, Marilyn Burns (2022), talks about making a shift from covering the curriculum to 'uncovering' it. She makes the point that teachers often stress and become anxious about ticking all the curriculum boxes, resulting in a return to deficit practices that treat topics in isolation and teaching in a procedural rather than conceptual manner. 'Covering' the curriculum does imply a teacher-centred approach, where 'uncovering' the curriculum implies a student-centred, sense-making approach that allows students opportunities to make mathematics connections and engage in deeper learning. Tasks that promote connections and student engagement in mathematics include:

- Open-ended tasks
- Rich tasks
- Problem solving and investigation
- Inquiry-based learning
- Tasks that promote critical and creative thinking
- Tasks that spark curiosity.

CHANGING TIMES AND PRACTICES (CONT.)

Catherine Attard – Professor of Mathematics Education, Western Sydney University

An excellent example of a task that promotes connections is this investigation: *Do right handed-people have bigger left feet?* To successfully engage with this investigation students need to draw on and make connections with knowledge and skills from number, measurement, statistics and probability. They would also be accessing a range of big ideas. In addition, the physical nature of the task and the fact that it is about the students makes it particularly engaging.

Of course, a task is only as good as the pedagogy it is embedded within. For example, you could use a rich task that promotes connections across a range of mathematical concepts and incorporates high levels of problem-solving and mathematical reasoning. However, if students are not grouped appropriately, not provided with opportunities to share their thinking or use appropriate materials (digital and/or concrete) and engage in deep reflection, the potential for deep learning within the task may not be reached. Pedagogies that promote engagement and learning include:

- Purposeful and flexible grouping of students
- A balance of formative and summative assessments
- Effective use of digital resources (pedagogy driving technology rather than technology driving pedagogy)
- Opportunities for differentiation
- Contextualised learning
- Dialogic practices.

CHANGING TECHNOLOGY-RELATED PRACTICES

As mentioned earlier, COVID-19 was a catalyst for many teachers to begin or further develop their skills in using digital resources in the teaching of mathematics. However, due to the inconsistencies in resourcing and teacher technology-related confidence and experience, not all teaching and learning using digital resources was successful. Regardless of the degree of success, the opportunity provided by the pandemic to use digital resources is one that should be taken as a valuable opportunity to evolve how we teach mathematics.

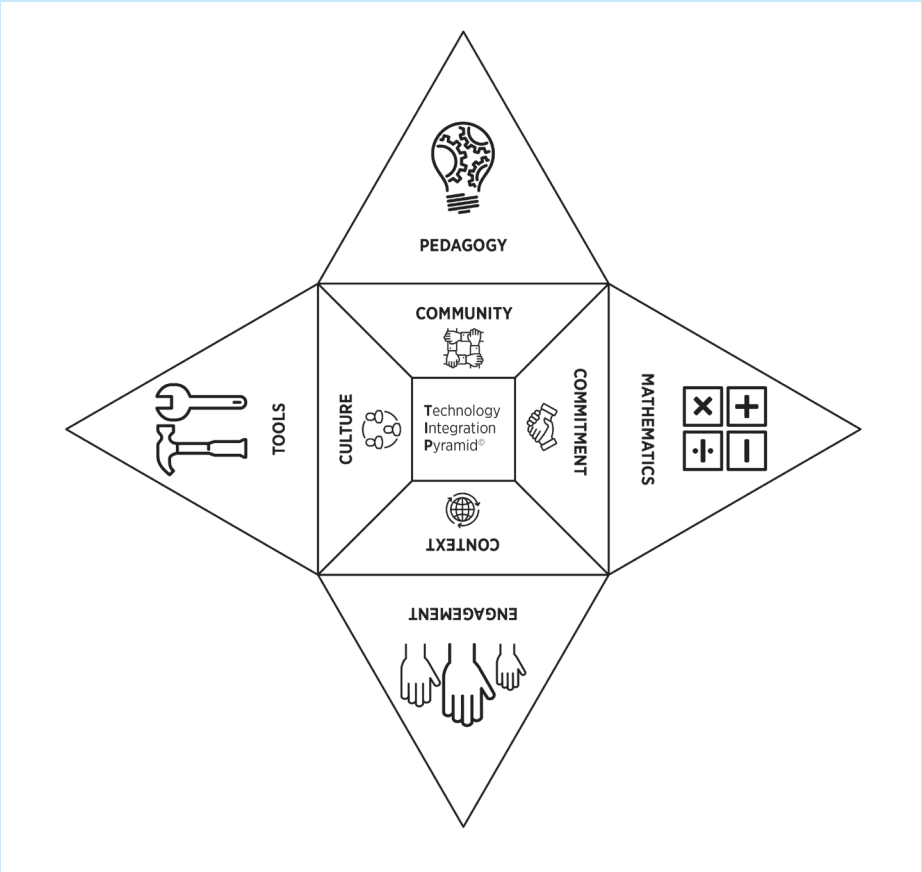


Figure 2. The Technology Integration Pyramid (Mathematics) (Attard & Holmes, 2020).

Acknowledging that no two school contexts are the same, the Technology Integration Pyramid (Mathematics) (TIP-M) (Figure 2) was developed to assist teachers in planning for technology-enabled mathematics education (Attard & Holmes, 2020). The base of the pyramid details the complexities of the influences on technology-infused instruction that should be acknowledged and if appropriate, addressed, for teachers to effectively use digital resources (Figure 3).

When teachers and school leaders fully understand the influences on how digital resources are accessed and used in the mathematics classroom, they are then more likely to realise the potential of those resources. To assist them, the sides of the TIP(M) represent four critical classroom considerations for planning. These are pedagogy, mathematics, engagement, and tools (Table 1).

The four considerations are inter-related and congruent, implying equal importance amongst the elements, and while the base of the pyramid provides a starting point to understanding the nuanced technology landscape that exists within each school, the four sides of the pyramid provide a focus for teacher decision making, ensuring student engagement is paramount. The TIP(M) provides teachers with a model that will assist in developing 'best practice' in individual mathematics classrooms.

IS THERE A BEST PRACTICE IN MATHEMATICS?

When considering if and how mathematics education practice needs to change, we must also then reflect on whether there is, in fact, a universal best practice in mathematics education. Should all mathematics classrooms look the same? Should all students experience the same mathematics education? The unique nature of each school and classroom is evidence that the only best practice in mathematics education is the education that best addresses the needs of your students, at your school, in this moment. When contemplating how to develop and adapt your practices to align with changing times, know your students, know your

Culture	Community	Context	Commitment
• School leadership • Professional development • Collaboration (teachers working in teams/individual) • Innovation	• Parents • Other local stakeholders (business, media, government) • Colleagues • Students	• Socio-economic status • Location (regional/rural/remote/metro/per-urban) • Funding • System (policy, type, restrictions)	• Support (technical and instructional) • Individual beliefs (mathematics, technology, teaching and learning) • Teacher self-efficacy with technology • Willingness to innovate

Mathematics	Tools	Pedagogy	Engagement
• Content (topics in isolation vs. connected) • Process – problem solving vs. fluency • Representations (dynamic) (making connections between) • Computation and/or higher order thinking	• Devices (BYOD, type, number, affordances, constraints) • Software (type, affordances, constraints) • Administration (connectivity, updates, downloads)	• Social constructivist • Differentiation • Assessment • Grouping • Number of devices (shared or 1-1) • Flipped • Tech for teaching and/or learning • Organisation/management • Lesson design • Student as consumer vs. producer	• Operative engagement • Affective engagement • Cognitive engagement • Develops positive pedagogical relationships • Expands pedagogical repertoires

Table 1.

content and how to teach it, and know the resources you have at hand. Only then can you develop practices that will improve student engagement and achievement in mathematics.

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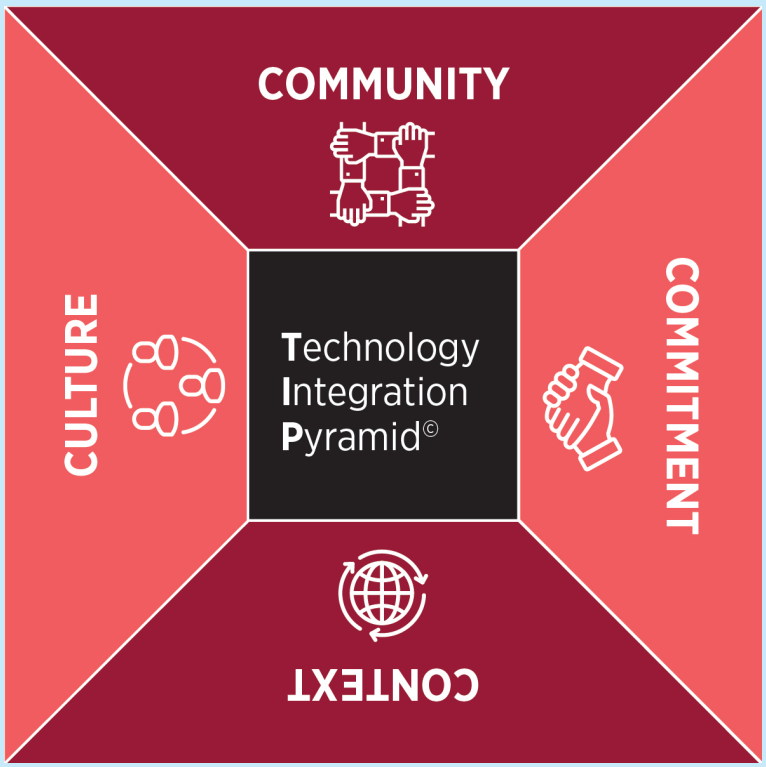


Figure 3: Technology Integration Pyramid (Mathematics) base (Attard & Holmes, 2020).

STEM ACTIVITIES IN ASTRONOMY

Stephen Broderick – St Ursula's College, Toowoomba

MATHEMATICS WITH SUNSPOTS

We are now entering solar cycle number 25 and little by little, sunspots are beginning to appear on the surface of the Sun. Sunspots are cooler, darker regions approximately 4500°C in temperature which appear on the photosphere of the Sun which is around 6000 °C. Sunspots are formed as a consequence of strong magnetic fields forcing the hot plasma away from the surface of the Sun, making the region appear cooler when observed through a telescope with a white light solar filter.

The sunspot number or Wolf number (W) was introduced by Rudolf Wolf in 1848 as a means of characterising solar activity. The Wolf number is defined as:

W = 10g + s, where (g) is the number of sunspot groups on the Sun and (s), is the total number of all sunspots in these groups. For example, in Figure 1, there are 3 groups of sunspots and a total of 8 sunspots.

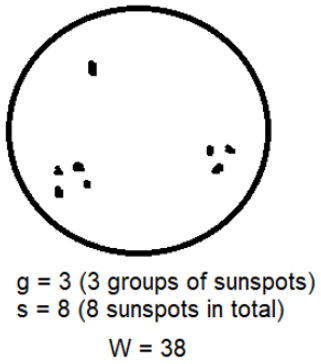


Figure 1. Drawing of the Sun with three sunspot groups.

Therefore, the Wolf number is
W = 10 × 3 + 8 = 38. The sunspot number for the image in Figure 2 is 11.
W = 10 × 1 + 1 = 11

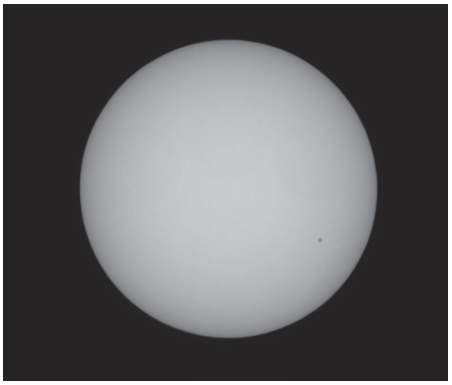


Figure 2.

Daily or past images of the Sun can be obtained from various sites on the web, such as the NASA Soho Observatory site, soho.nascom.nasa.gov/sunspots/

Another useful website is the Suntoday. suntoday.lmsal.com./suntoday

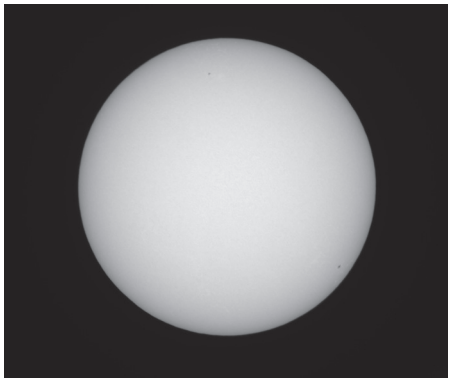


Figure 3. Solar image of the Sun taken on 21 January 2022. The two sunspots are widely separated with one sunspot in the northern hemisphere and the other sunspot in the southern hemisphere. The Wolf number (sunspot number) is 22. (10 × 2 + 2 = 22).

Questions
(Answers are in brackets)

Q1. What is the smallest possible sunspot number?
(This occurs when there is only 1 sunspot, W = 10 × 1 + 1 = 11)

Q2. What is the sunspot number for this image of the Sun?

(W = 10 × 4 +7 = 47)

Q3. What are all the possible values for the number of groups (g) and the number of sunspots (s), given the sunspot number is 32?
(1 group, 22 sunspots, sunspot number 32 = 10 x 1 + 22, and 2 groups, 12 sunspots, sunspot number 32 = 10 x 2 + 12).

DETERMINING THE PERIOD FOR THE SUNSPOT CYCLE

Figure 4 represents the daily sunspot number from 1800 to 2007.

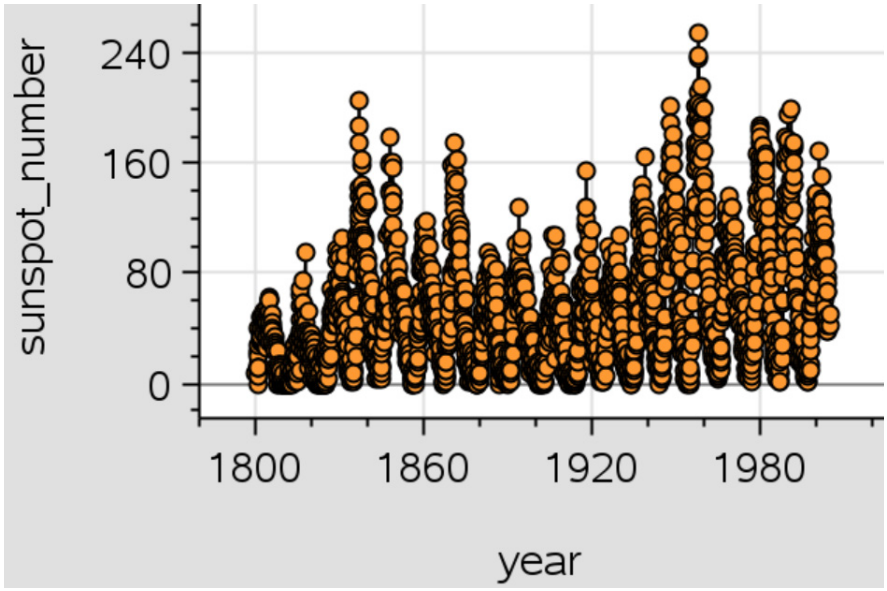


Figure 4. Plot of sunspot number versus year from 1800 – 2007.

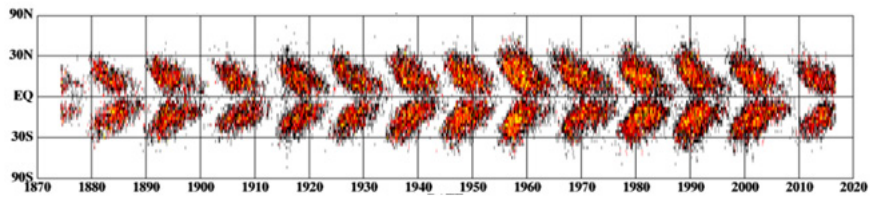


Figure 5: Butterfly diagram representing the recorded position of sunspots from 1875 to 2015 in the northern and southern hemispheres of the Sun. Each butterfly represents 11 years of sunspot activity.

The graph indicates that the sunspot number reaches a maximum and then decreases over a regular period of time.

Q4. Based on the graph in Figure 4, what is the period for the sunspot cycle? *(Approximately 11 years, there are 19 peaks over 207 years. 207 divided by 19 = 10.89 years)*

DETERMINING THE ROTATIONAL PERIOD OF THE SUN

Galileo determined that the rotational period of the Sun was approximately 27 days. He did this by following a sunspot. Since the Sun is a plasma, rotation is quickest at the equator and slowest at the poles. The rotational period of a sunspot at the equator is approximately 25 days and can be as slow as 38 days near the poles. The images of the Sun below were taken with the author's refractor telescope and camera. The sunspot which is located around the 4 o'clock position (circled in blue) on the solar disk was tracked from 21 January to 1 February. The rotational period should be approximately 25 days.

Based on the movement of the sunspot, it has taken just over 12 days from 21 January to 1 February for the Sun to rotate through nearly 180°. Therefore for 360°, the rotational period of the Sun would be just over 24 days, which is approximately 25 days.

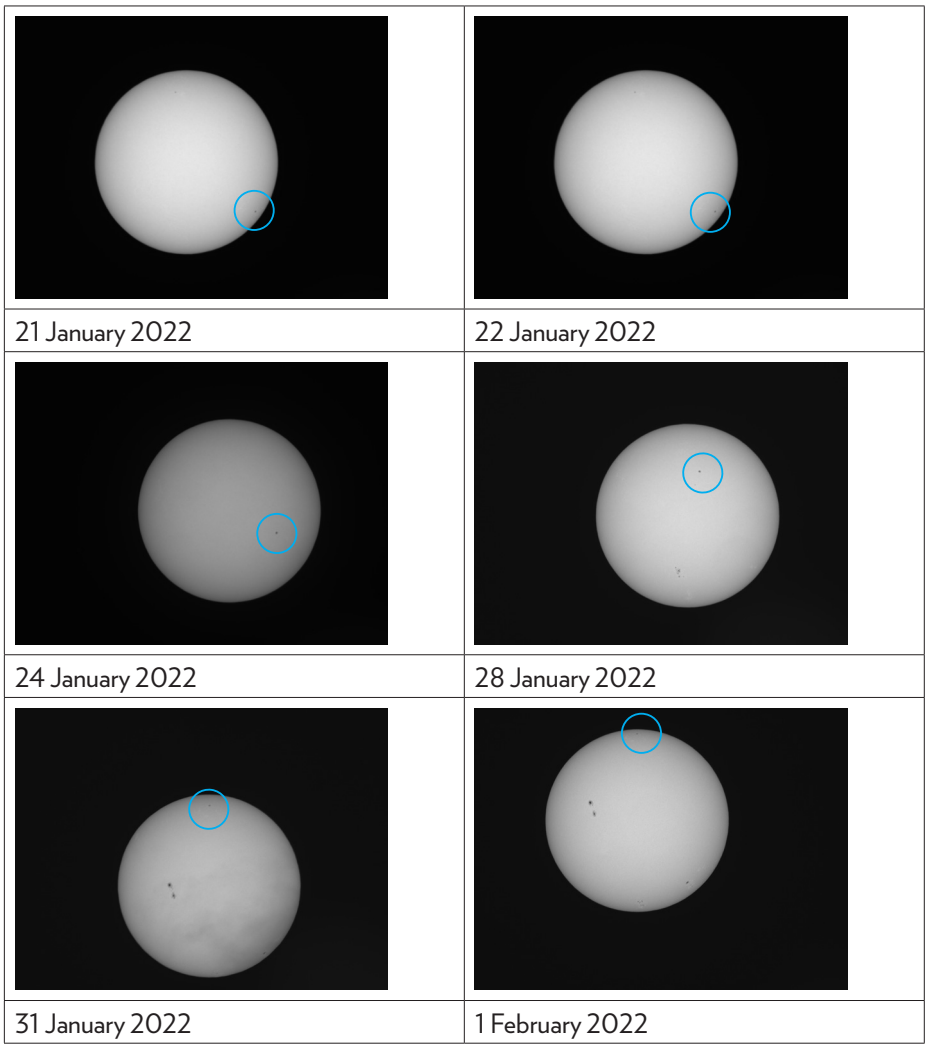


Figure 6. Determining the rotational period of the Sun by following a sunspot (circled) across the face of the Sun.

PROVING THE EARTH'S ORBIT IS ELLIPTICAL

Images of the Sun obtained at perihelion (when the Earth is closest to the Sun) and aphelion (when the Earth is furthest from the Sun) should reveal differences in size if the orbit of the Earth is elliptical.

The images in Figure 7 were taken with the author's refractor telescope and camera; however, images from the web can also be used. It is apparent from the images of the Sun at perihelion and aphelion that the orbit of the Earth is elliptical since the diameter of the Sun varies over the six month period.

DETERMINING THE DISTANCE TO THE ISS (INTERNATIONAL SPACE STATION)

The website Transit-finder (https://transit-finder.com) allows you to find dates and times of transits by the ISS of the Sun and Moon. To see solar transits, you will need a solar filter. The lunar transits are much easier, safer and more spectacular to observe.

Sometimes you will need to travel a few kilometres to be able to observe a transit. Transit-finder has a default travel distance of 80 km. You can set this to a smaller distance if you don't wish to travel very far for a transit.

On page 10, Figure 7 shows a screenshot of a close pass of the ISS and the Moon as seen on Transit-finder. It was just outside the observer's location. The website indicated that the ISS would be approximately 887 km away with an angular diameter of 31.14".

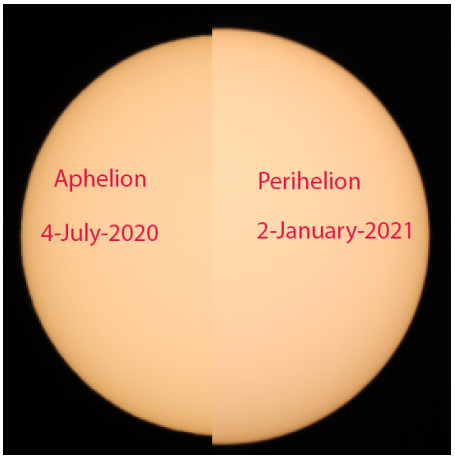


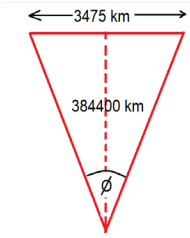
Figure 7. Images of the Sun at perihelion and aphelion verifying that the Earth's orbit is elliptical, since the disk of the Sun changes in size.

STEM ACTIVITIES IN ASTRONOMY (CONT.)

Stephen Broderick – St Ursula's College, Toowoomba

This image shows the shadow of the ISS (circled in blue) as it transits the Moon. The transit lasted 1.06 seconds.

Using, trigonometry, the distance to the ISS can be determined. First use the tangent ratio to determine the angular diameter (θ) of the Moon. Since we know the diameter of the Moon and the distance to the Moon. Diameter = 3475 km, distance to the Moon = 384400 km. Using the tan ratio gives:

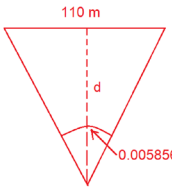


$$\tan\theta = \frac{3475}{384400}$$

$$\theta = \tan^{-1}\left(\frac{3475}{384400}\right)$$

$$\theta = 0.5179°$$

Next, we can determine the distance to the ISS as it transits the Moon. The length of the ISS is approximately 110 m and the angular diameter of the Moon is 0.5179°. The angular diameter of the ISS was obtained by using the Photoshop ruler tool. From the ruler tool, the width of Moon is 3537 pixels, while the width of the ISS is 40 pixels. Therefore, the angular diameter of the ISS is 40/3537 × 0.5179°=0.005857°. This is around 21". (The predicted value on the website was 31.14").



$$\tan(0.005857) = \frac{110}{d}$$

$$d = \frac{110}{\tan(0.005857)}$$

$$d = 1076068.9 \text{ metres}$$

This means the ISS was approximately 1076 kilometres from the Toowoomba Waste Management centre when it transited the Moon.

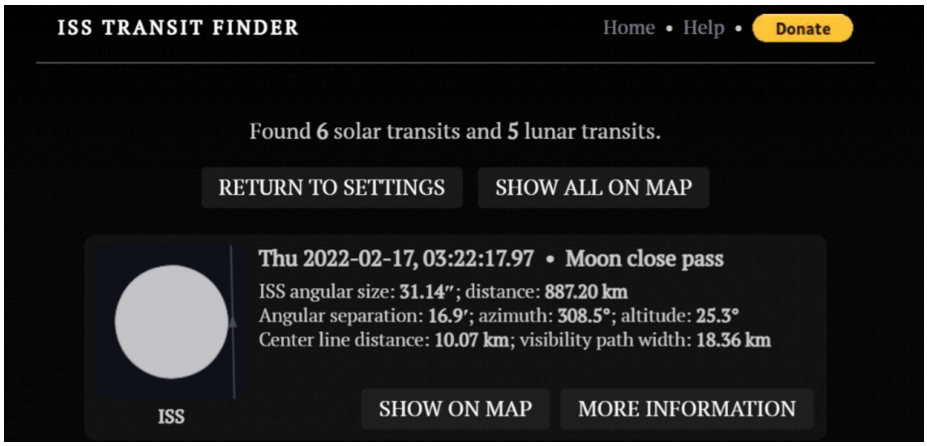


Figure 7. Screenshot from the Transit Finder website showing where the ISS is in relation to the Moon. The observer's location is 10 km from the centre line. Travelling a distance of 10 km would place the observer in the best location to observe the transit.

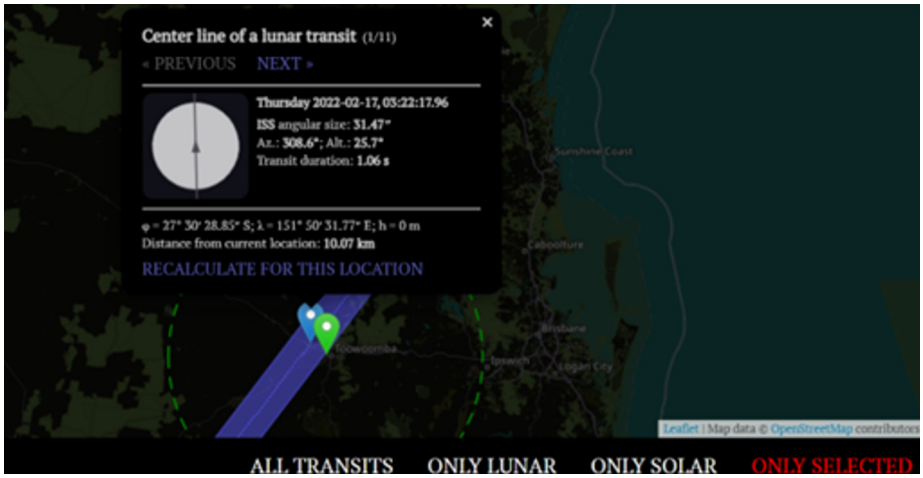


Figure 8. After travelling 10 km for the transit, the chosen location was the Toowoomba Waste Management Centre. The 1.06 second transit occurred at 3:22.17 am (17 seconds after 3:22am) on 17 February 2022.

The predicted value on the website was 887 km. The orbits of artificial satellites are constantly changing due to semi-random factors such as atmospheric drag.

Figure 9. The complete 1.06 second exposure with several stacked images of the ISS.

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Transit-finder, https://transit-finder.com

Suntoday http://suntoday.lmsal.com./suntoday/?suntoday_date=2022-02-15

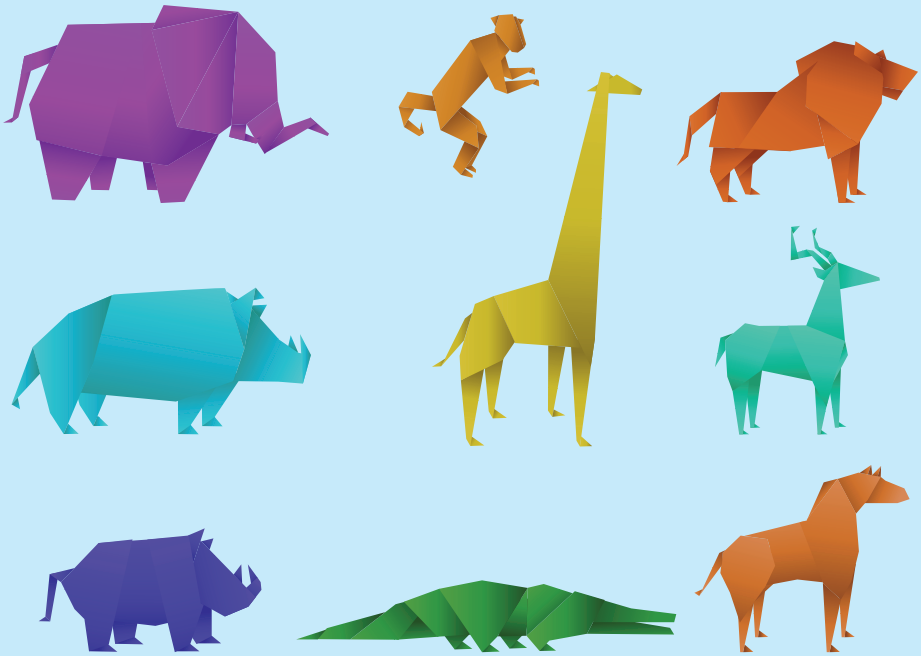
Soho Observatory https://sohowww.nascom.nasa.gov

Beck, R. Hilbrecht, H. Reinsch, K. and Volker, P. *Solar Astronomy Handbook* (1995), Willmann-Bell. Inc, Virginia, USA.

STIMULATING THINKING

Judy Gregg – Mathematics education consultant

A picture sparks 1000 maths concepts! Use this picture as a prompt to stimulate thinking. If you have other ideas for investigations or lessons that could stem from the ideas here, add them to the conversation on our social channels. You can find us on Facebook and Instagram @maths.vic, LinkedIn @ maths-vic and on Twitter, @maths_vic.



EARLY YEARS

- How many animals do you see?
- One animal has left! How many were there originally?
- Which animal is the tallest?
- Order from shortest to tallest
- Can you sort these animals into different groups? How did you decide what group they belonged to?
- Can you make a pattern with the animals?
- Which animal do you think would be the heaviest?

FOUNDATION - YEAR 3

- Which animal is the longest? Tallest? What would you use to measure them?
- Draw a zoo for the animals and then draw a map on how to get to each animal's enclosure.
- How many heads and feet altogether?
- Which animal do you think would weigh the least amount? How could you find out?
- The zoo keeper feeds each type of animal one at a time. He begins feeding the elephant at 9am. It takes him 15 minutes to feed each animal. Next he feeds the monkey, the lion, the rhinoceros and so on moving across each row (in this picture) systematically. What time would he feed the giraffe?
- What do you think is the chance of each animal being asleep when you visit their enclosure? For example, is it likely, possibly, unlikely that the monkey will be asleep when you go there?
- If the lion eats 9 kilograms of food each day, how much will it eat in a week?

YEARS 3 - 6

- If these animals lived in a zoo that only had one large exercise area, draw up a schedule where each type of animal could spend some time in the exercise area each day with their own kind.
- How much do you think each animal would eat in a day? What do you think it would cost to feed all these animals for a day?
- How many animals would there be altogether if three of these animals had two babies each, two of them had one baby each, and four of them had three babies each?
- Find out how many kilograms of food each animal eats per day and graph this information in two different ways.
- Rhinoceros drink approximately 72 litres of water per day. How much water would they drink in a week? In a month?
- Which fraction of the animals are rhinoceros? How would you record that as a fraction or a decimal?
- Find out how much each animal weighs on average and then figure out the average weight of all of these animals.
- Place these animals on a graph according to their height.

YEAR 7 AND BEYOND

- Work out the area and perimeter of each of your enclosures, based on an approximate realistic size that you think each animal would need at the zoo.
- Find out the average height and weight of each type of animal and record the ratio of height to weight and compare these to each of the other animals.
- Find out approximately how many of each of these species of animals exist in the world. What percentage is each of these species compared to the total number of all of these animals?
- Use grid paper to draw each animal proportionate to their size in real life.
- Approximately 2.7 million people visit the zoo each year. How many per day would that be? How many of those do you think are adults? Children?
- It's $42 for adults to go to the zoo and $21 for children during the week. On the weekends and holidays it is free for children. How much do you think the zoo makes per year in ticket sales?
- Draw a bird's eye view of at least two of these animals.
- What shapes make up each animal? Draw the shape outlines on the animal.
- Can you design a tangram with shapes that can be used to produce each animal? Give your tangram puzzle to a friend so they can make the animal.

THE VERY HUNGRY CATERPILLAR

Amy Somers – Numeracy leading teacher, Lyndale Greens Primary School

As a kid, *The Very Hungry Caterpillar* by Eric Carle was one of my favourite books. As a parent and a teacher this book remains a favourite for a number of reasons. It can be used to help teach children about counting, days of the week, healthy eating, life cycles and more. The beautiful illustrations resonate with both adults and children.

I particularly like the board book version as it invites children to touch it and put their fingers in the holes of the food, helping them to develop one to one correspondence. The pages are also easier to grip and harder to rip for little hands.

I use this book to investigate mathematical ideas with my kids and students including looking at days of the week, counting and ordering, and making butterflies to investigate symmetry. At home, a lot of the mathematical activities linked to this book centre around food and healthy eating.

CURRICULUM LINKS

Victorian Curriculum Level C: *Use number names in sequence to count in everyday situations, initially from one to five.*

Victorian Curriculum Level D: *Recognise number name, numerals and quantities, initially up to five and beyond.*

Victorian Curriculum Foundation: *Connect days of the week to familiar events and actions.*

Victorian Curriculum Level 4: *Create symmetrical patterns, pictures and shapes with and without digital technologies.*

TEACHING IDEAS

When reading *The Very Hungry Caterpillar* with young kids, I use the calendar to look at what day it is today, what day it was yesterday and what day it will be tomorrow. I also talk about what we do on different days and compare that to what the caterpillar did, for example the caterpillar ate through one apple on Monday, and on Monday we go to swimming and have PE. Using a calendar to map out the story is powerful. Kids can draw an egg hatching on Sunday, a caterpillar eating through one apple on Monday etc. You can also link this story to teaching students about life cycles. You can buy caterpillars or chrysalises online and watch them develop at home or in the classroom. Our Year 1 team did this and the students were so excited to check on their chrysalises every day! It would be interesting to map out a caterpillar's actual life cycle on a calendar and compare it to the story or even investigate the life cycles of different caterpillars and see how long different caterpillars take to turn into butterflies.

As a counting activity, I use the holes in the books to count how many pieces of fruit/food there are and then get out that many pieces of fruit and look at how many that is. When counting the pieces of fruit we use the book to check that we have the same amount as the hungry caterpillar and compare the amount we have to the amount the caterpillar has. We talk about whether or not we could eat that much, for example we wouldn't eat five oranges in one day but four strawberries would be fine. If we don't have that type of fruit, or it isn't in season we talk about this and substitute it for another type of fruit e.g. using blueberries instead of plums. We look for that number through the day: four cars parked at the side of the road or finding the number four on a letterbox.

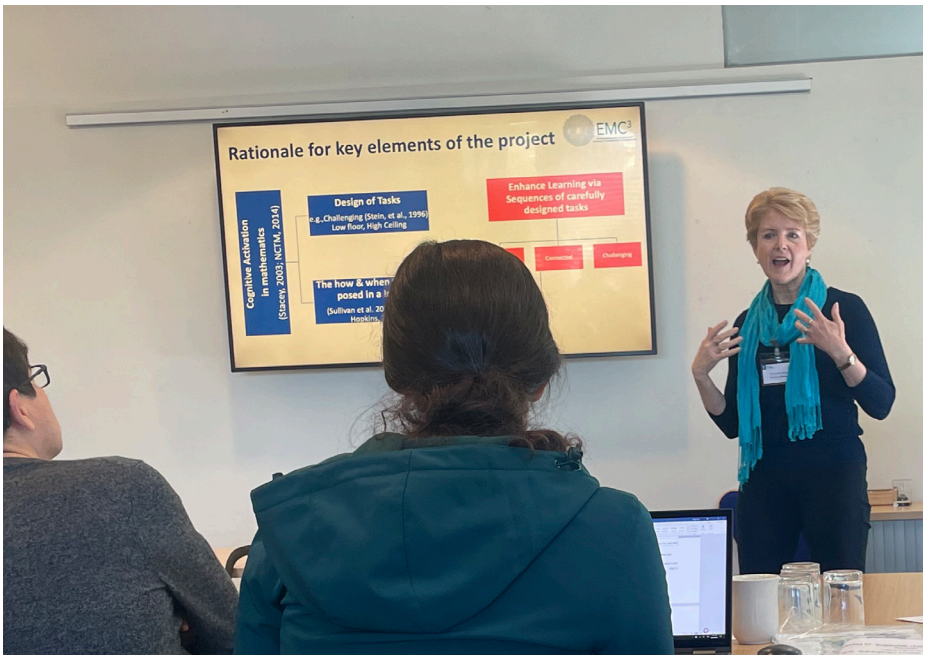
We order our fruit pieces from biggest to smallest and eat them in that order. My son usually wants to eat the biggest one first!

This is also a great book to read while exploring symmetry. Kids love blobbing paint on one side of a piece of paper then folding it in half, squeezing the paint down then opening it up to see their very own beautiful butterfly!

The Very Hungry Caterpillar is available from the MAVshop, www.mav.vic.edu.au/MAV-Shop.

If you have used this book in your classroom, we'd love you to share your experiences and contribute an article to a future edition of Common Denominator. Email office@mav.vic.edu.au for more information.

ONE MINUTE WITH JANETTE BOBIS



I'M…

Janette Bobis, Professor of Mathematics Education at the University of Sydney.

MY RESEARCH IS….

Where I learn most about students, teachers and myself. I've always had a research interest in how young children develop mental computation strategies and a sense of number (number sense). I think this interest developed in my first years of teaching primary school when I noticed how many students would accept answers without really thinking if they made sense or not.

My research projects include a focus on challenging mathematics tasks in the early years with colleagues from Monash University, an out-of-field project with The University of Sydney, Monash and Western Sydney University colleagues, and a project with the Australian Academy of Science and a Canadian colleague to explore professional learning opportunities for teachers provided by the reSolve team.

ACADEMIA SUITS ME ….

It provides me with a freedom to explore my interests and provides opportunities to meet amazing people, visit exciting places and constantly learn. Academia has encouraged me to keep learning new things and to reflect on what I thought I already knew.

TEACHERS ARE ….

Heroes! Throughout the pandemic teachers transformed their practices overnight, risked their health to support student learning, spent countless hours preparing lessons and materials to be delivered online. When so many other occupations had to down tools and stop work altogether, teachers knew that was not an option for them - for the sake of their students they kept teaching. I'm proud to be a teacher.

EFFECTIVE TEACHING STRATEGIES…

Can be learnt! But they really need to be practiced. They also need to be adapted to suit different contexts to be most effective. I enjoy learning about teaching practices from research and then trialling them in my own classroom. I particularly get a lot of satisfaction when teachers say, 'that won't work with my students' but when they try, it does work! Moral of the story: Don't knock it until you try it. And just give it a go!

THE BEST WAY TO SHARE KNOWLEDGE IS…

To be passionate about your message. And don't just 'tell' people information; they have to experience it, be intrigued by it and what to learn more. I love when students ask, 'tell me more…'.

MENTAL COMPUTATIONAL STRATEGIES….

Should make sense to students. People who are 'good' at mental computation often don't use strategies they were formally taught at school. They often use strategies that are flexible, make sense to them and they feel confident using.

MY YEARS IN THE CLASSROOM TAUGHT ME …

That if your students like you, then it is much easier to teach them. I remember being told by a very experienced primary teacher in my first few weeks of teaching that 'We are not here to be liked by our students, we are just here to teach them!' Boy, was he wrong! It didn't take long to figure out that my Year 5 class were so much more willing to learn when they liked the teacher. By 'like', I really mean 'respect'.

EARLY YEARS STUDENTS…

Are always so excited to explore and learn new things. I often wonder how we can keep that excitement and wonder about learning going for much longer! But no matter how old the student, I still love that 'Aha' moment…when you can see in a child's face that they understand something new.

THE BEST THING TO DO IN SYDNEY IS…

Walk across the Harbour Bridge, it is free and you get the best views of the harbour, Opera House, Circular Quay, Pinchgut Island (Fort Denison) and Luna Park.

MY HOPE FOR OUR FUTURE TEACHERS IS….

That they get the recognition that they deserve. And that they realise how important and influential they can be to transforming the lives of their students. I would like our future teachers to teach in a supportive learning community; one that values creativity, imagination and agency for both teachers and their students. I also hope that our future teachers experience rewarding and fulfilling careers as educators.

BEACH OR MOUNTAINS?

Beach and mountains!

COUNTING IN THE EARLY YEARS

Belinda Johnston – Teacher, Holmesglen Institute of TAFE.

Early years educators tune in and respond to children's play which contributes to strong curriculum foundations. Children's interests and understandings are constantly shifting and evolving. An observant educator notices, makes assessments and jumps into those teachable moments to challenge and extend children's thinking. When children build mathematical understandings during experiences that are interesting and relevant to them, they are more likely to make connections and use these new understandings in other areas of learning. (Department of Education, Employment and Workplace Relations for the Council of Australian Governments, 2009).

A play-based approach sees children motivated by the things that hold meaning for them, like sharks or superheroes. A shared interest in superheroes could invite children to hypothesise about how high Supergirl can fly and how they could measure it to find the answer. The educator's role during this type of inquiry is to notice the different types of mathematical understandings that each child brings and respond in ways that builds on individual learning.

The following learning story is a beautiful example of this kind of noticing and the meaningful forward planning that can come from it.

COUNTING OUR WAY TO THE CLIMBING TREE

On this morning's walk, Van was ahead of everyone else. I could see that he was chatting to himself and looking down at his feet. When we all caught up with each other at the climbing tree, I asked him if he had enjoyed his walk. 'It took me 84 steps to get here today. 84 steps to get to our climbing tree! That's a lot of steps, isn't it?' I agreed that this certainly was a lot of steps and that he must have concentrated very hard to count every step. I wondered aloud how far 84 steps might be.

'I'm going to measure the tree!' Van ran over to the far end of the fallen tree and climbed up. He stood up and took two or three tentative steps and then crouched back down to his hands and knees. Van travelled the length of the tree like this. Later when we were walking back to pre-school, I joined Van and asked him if he had counted any other distances today. 'Yep!' he said, 'It's only 26 crawls for the whole tree.'

ANALYSIS

Van showed an interest in numbers and counting in other areas of the curriculum, and this is a wonderful example of using his emerging understanding of numbers to make sense of the world around him (EYLF Outcome 4: use play to investigate, imagine and explore ideas). He confidently communicated these understandings on this occasion, using the terms 'walk' and 'crawl' as units of measurement. This makes me think that Van has thought about the different amount of space covered by a step compared to a crawl. I wonder how else we can invite Van to measure distance using his body?

GOAL

For Van to increase his understanding of measurement and distance and develop a vocabulary to describe these understandings (EYLF Outcome 4: record and communicate mathematical ideas and concepts. EYLF Outcome 5: Use language to explain mathematical ideas).

Reflecting as a team, the educators decided to share Van's findings with the group. The children made guesses about the distance to other places in their community that they regularly visited and talked about ways that they could measure it.

One child shared that it was 'two episodes of *Bluey* to get to kinder'. Van found a stick during a bush kinder session that he measured to be 'one step'. He used this around the kinder (and at home!) to measure many things and compared them to the climbing tree. Other children mimicked this, using items like cars, blocks and loose parts to explore different spaces and to create maps of their area.

Our educators were surprised that responding to children's mathematical understandings in this way could lead to explorations of community and belonging to a place.

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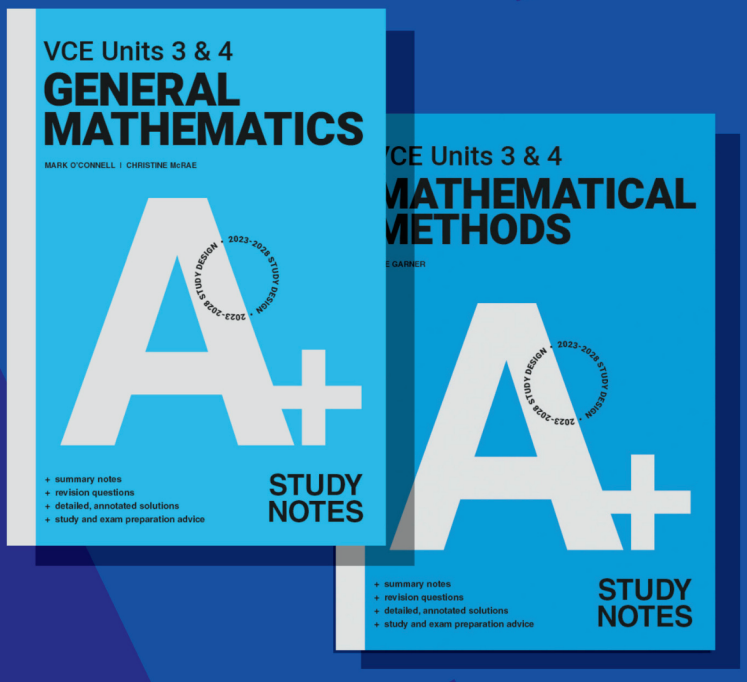

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Nelson

COMPARATIVE ANALYSIS OF CENSUS DATA

Andrew Stewart

This article is the second in a series examining how to utilise Census data in the classroom, this exploration could be useful in preparing SACs for VCE students.

The first article in the series was published in the Term 4 2022 edition of *Common Denominator*, which is available to download from www.mav.vic.edu.au.

In this article, Census data from six Victorian Local Government Areas (LGAs) – Melbourne, Melton, Mildura, Mitchell, Moira and Monash – will be used to set up a comparison spreadsheet.

In a new spreadsheet, label six columns in row 10 as shown in Figure 1 – leaving column B blank. Data will be compared for area, population and median ages of these LGAs, and the population density will be calculated.

From the special file (2021Census_geog_desc_1st_release.xlsx), go to the fourth sheet labelled 2021_ASGS_Non_ABS_Structures. Scroll down to row 797 (in the middle of the LGA data for Victoria). Click on cell B797 and drag across to column E and down to row 802. Copy. In the new spreadsheet, click on cell A12 and Paste. At the top of the spreadsheet, click on the label B to highlight the column. In the Edit menu, click on Delete to remove this column. Save this spreadsheet as Example.xlsx into a new folder labelled EXAMPLE.

Our spreadsheet now looks like Figure 2.

Column A contains the LGA label and file number being used (useful references for the data acquisition process). (The LGA number in the old column B is of no use in the spreadsheet construction – it was easier to collect all the data in one big block!). Column B now contains the name of the LGA and column C contains the area (in square kilometres) of that LGA.

Access the Census Data on the internet, and download the Community Profile spreadsheets for each of our six chosen LGAs into the EXAMPLE folder. It is essential that all LGA data files are in the same folder. The identical format of the Community Profile spreadsheets means that a particular data value in one spreadsheet will be at the same address in all other spreadsheets.

	A	B	C	D	E	F	G
9							
10	Code		Name	Area	Population	Density	Age

Figure 1.

	A	B	C	D	E	F
9						
10	Code	Name	Area	Population	Density	Age
11	LGA24600	Melbourne	37.5452			
12	LGA24650	Melton	527.5374			
13	LGA24780	Mildura	22081.9206			
14	LGA24850	Mitchell	2862.0837			
15	LGA24900	Moira	4045.9201			
16	LGA24970	Monash	81.4829			

Figure 2.

	A	B	C	D	E	F
9				G04.N40		G02.B13
10	Code	Name	Area	Population	Density	Age
11	LGA24600	Melbourne	37.5452	149615		30
12	LGA24650	Melton	527.5374	178960		33
13	LGA24780	Mildura	22081.9206	56972		40
14	LGA24850	Mitchell	2862.0837	49460		36
15	LGA24900	Moira	4045.9201	30522		48
16	LGA24970	Monash	81.4829	190397		38

Figure 3.

Open any one of the downloaded LGA files, click on sheet G02 to see that the median age is in cell B13. Click on sheet G04 to see that the total number of persons (population) is in cell N40. Close the LGA file. In cell D9 type in G04.N40, and in cell F9 type in G02.B13 to remind us where this data can be found.

In our spreadsheet in cell D11, type in =[GCP_LGA24600.xlsx]G04!N40, and press ENTER. Navigate the folder windows to find and open the EXAMPLE folder, select GCP_LGA24600 and press ENTER. This process informs the computer where the spreadsheet is located. The value appearing in the cell will be the population for Melbourne LGA.

Copy cell D11 and paste into cell F11.

Click on cell F11. All the text that appears at the start is how the computer will find that particular LGA spreadsheet in its memory. Click on this entry and carefully change the sheet label from G04 to G02 and the cell address from N40 to B13. Press ENTER. As this spreadsheet location is known, no confirmation is needed.

Copy cell D11 and paste individually into cells D12 – D16 (or use FillDown). Click on cell D12 and amend the GCP_LGA code to GCP_LGA24650. Press ENTER, click on GCP_LGA24650 in the EXAMPLE folder window and press ENTER again to confirm the spreadsheet location. Amend the GCP_LGA codes in cells D13 to D16 in turn and confirm the spreadsheet locations.

Copy cell F11 and paste individually into cells F12 – F16 (or use FillDown). Click on cell F12 and amend the GCP_LGA code to GCP_LGA24650. As the spreadsheet location is known, no confirmation is needed.

Amend the GCP_LGA codes in cells F13 to F16 in turn. Save. Figure 3 shows the completed table.

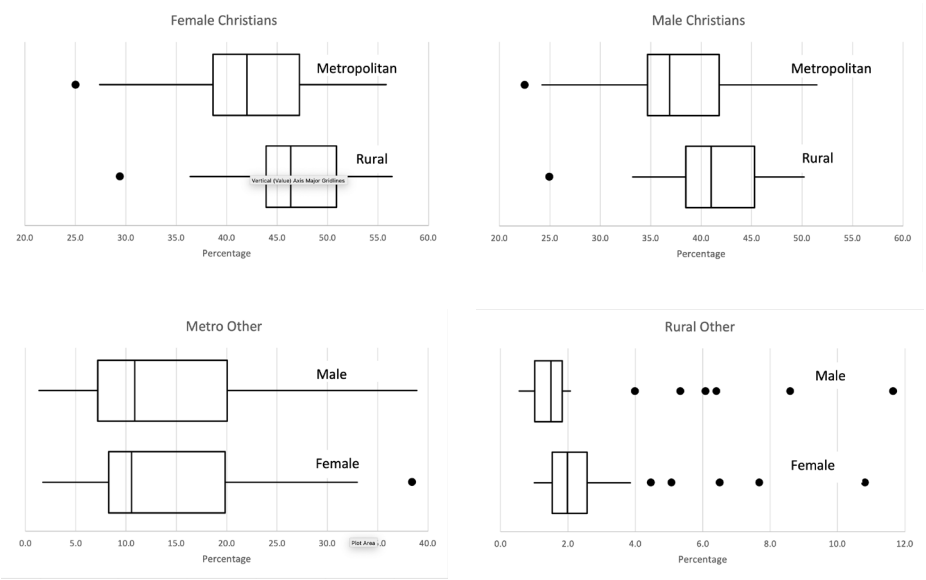
The median Age is much higher in many rural LGAs than metropolitan LGAs. Moira has a median Age of 48, but other rural LGAs have median Ages in the 50's.

The downloaded data can be used to calculate the population density (people per square kilometre). Click in cell E11. Type in =D11/C11 and press ENTER. Click in cell E12 again and select FORMAT/CELLS/NUMBER to set the number of decimal places to zero (0).

Copy cell E11 and paste individually into cells E12 – E1 (or use FillDown). The Density values range from 3 for Mildura to 3985 for Melbourne. Rural LGAs have smaller populations spread over large areas, and at least 30 LGAs have a population density value in single digits! Melton (339) has a mix of rural and urban living.

Use a large table with more than, say, 30 values, to look for associations. From a table containing all 79 Victorian LGAs, the association between median age (sheet G02, cell B13) and own house (%) (sheet G37, cells G14, G16, G25, G31), has an *r* value of 0.949. The whole table was sorted by population (smallest to largest). Limiting the LGAs to the 49 with populations under 100 000 generates an *r* value of 0.939, and further limiting the LGAs to the 40 with populations under 50 000 generates an *r* value of 0.921. The 30 LGAs with populations greater than 100 000 generates an *r* value of 0.880. The whole table was sorted by location (metropolitan (31 LGAs), rural (48 LGAs), allocated using www.viccouncils.asn.au/find-your-council/council-map). For metropolitan LGAs, the *r* value is 0.885 and for rural LGAs the *r* value is 0.940.

Sheet G14 provides data on religious affiliation – Christian (males –B30, females – C30), secular (males – B43, females – C43), those not stating (males – B44, females – C44), total individuals (males – B46, females – C46) and other faiths (Buddhism, Hinduism, Islam, ...) by difference. Calculation determined the net percentage of males and females in each LGA who are Christian or affiliated with another faith.



In the four boxplots shown above, the top pair compares location by gender for Christians and the bottom pair compare gender by location for other faiths.

The top graphs show that a greater proportion of rural residents claim Christian affiliation than metropolitan residents, with females showing greater affiliation than males for both. The bottom graphs show that a far greater proportion of metropolitan residents claim other faith affiliation than rural residents (and the highest percentages for both rural locations came from the same LGA!).

These analyses have given thought-provoking results, and explaining the reasons will require input from outside the mathematics classroom – a possible cross-curriculum project? Some of these data sets could be used for Investigations (Year 11 General Mathematics) or SACs (Year 12 General Mathematics). Would students correctly show all the outliers (six for males and five for females) for other faiths in rural LGAs?

The full-size spreadsheet table is a starting point for all these kinds of explorations, and the time spent in constructing and developing it will pay off in the provision of a resource capable of supporting teaching at many year levels. Happy data exploring!

REFERENCE

www.viccouncils.asn.au/find-your-council/council-map

MAV SACS
SUGGESTED STARTING POINTS
2022 | ALL STUDIES

For more SAC inspiration, check out MAV's SACS suggested starting points - a very handy resource for VCE mathematics teachers. It has been written by experienced VCE mathematics teachers and is for use by teachers to aid in assessment of student School Assessed Coursework for Further, Methods and Specialist Mathematics.

MAV SACS suggested starting points is available from the MAVshop, www.mav.vic.edu.au/MAV-Shop.

MAV runs SAC specific professional development workshops. You can find a listing on page 3 or at www.mav.vic.edu.au/events.

UNDERSTANDING MULTIPLICATION

Paul Tuchtan – Mathematics learning coach, Balcombe Grammar

DEVELOPING UNDERSTANDING OF MULTIPLICATION YEAR 2-6

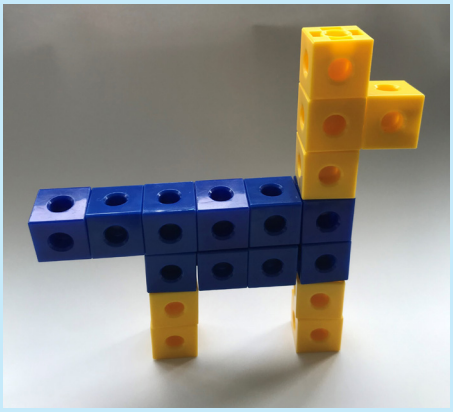
As educators, we know that multiplication is more than just knowing times tables by heart. To understand multiplication students need to understand arrays - how arrays can be formed and how arrays can be used efficiently and effectively to solve multiplication problems.

LESSON INTRODUCTION

Students will need 20 multi-link blocks each. 10 of one colour and 10 of another.

CHALLENGE 1

Using some, most or all the blocks, make a flat object. Our Year 3 class made dogs.



CHALLENGE 2

Inform the students that one of the colours used will be worth 1 point and the other colour used worth 2 points. Ask students to find the value of their object, e.g. yellow is worth 1 point and blue is worth 2 points.

Swap the value of the points around. What is your object's other value? As the value has now swapped blue is worth 1 and yellow is worth 2 points.

See Table 1. This step is really important - take time to ensure your students understand that the value of their object changes, depending on the number of each colour block used. You should not proceed until all students have understood this.

CHALLENGE 3

Ask students to remake or change their object so that it equals exactly 25 points. See Table 2.

Yellow = 1 point	8 blocks	8 points	1 x 8
Blue = 2 points	10 blocks	20 points	2 x 10
Total	**18 blocks**	**28 points**	**8 + 10**
Yellow = 2 point	8 blocks	16 points	2 x 8
Blue = 1 points	10 blocks	10 points	1 x 10
Total	**18 blocks**	**26 points**	**16 + 10**

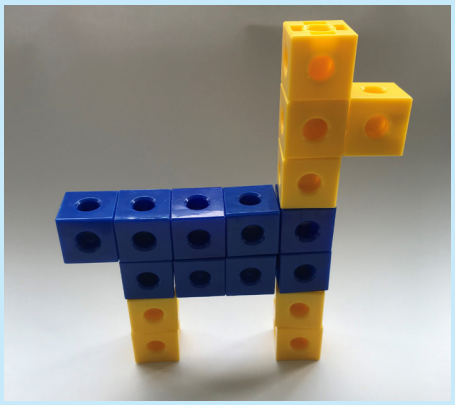
Table 1. Children created this table to show the points for the dog (depending on the value of each colour.

Yellow = 2 point	8 blocks	16 points	2 x 8
Blue = 1 points	10 blocks	9 points	1 x 9
Total	**18 blocks**	**25 points**	**16 + 9**

Table 2. Children show that the dog is worth 25 points.

Yellow = 3 point	8 blocks	24 points	3 x 8
Blue = 4 points	9 blocks	36 points	4 x 9
Total	**17 blocks**	**60 points**	**24 + 36**

Table 3. This child is working on the 3 and 4 tables.



CHALLENGE 4

Using grid paper, ask students to draw their object, (one block equals one square.)

Using markers/textas, ask students to mark the arrays on their drawing. Encourage students to find alternative ways to record the arrays (students in the upper primary could consider using order of operation to show this).

CHALLENGE 5

Using two multiplication tables that you are currently focusing on in class e.g. 3's and 4's, find the value of your object. See Table 3.

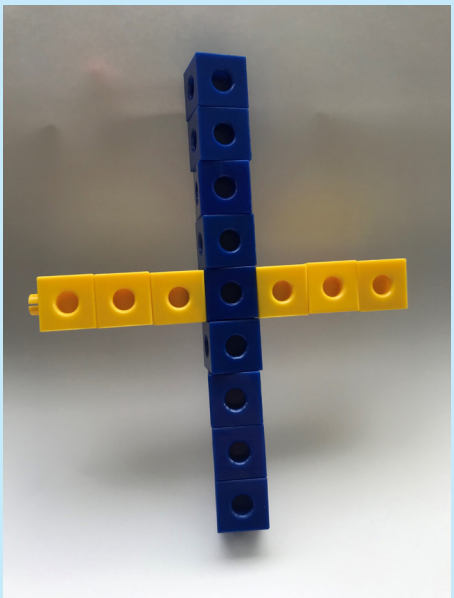
CHALLENGE 6

Give students a specific target number and find out how many of each block are needed, use the two multiplication tables students are currently working on.

For example if students are working on their 7 and 8 multiplication facts you could give them the number 148. How many blocks worth 7 and 8 will they need to reach this total? Is there another way that you could make 148 with the 7 and 8's?

FINAL CHALLENGE

Show students a new object you have made. Tell students 'My object is worth 78 points. What two multiplications have I used?'



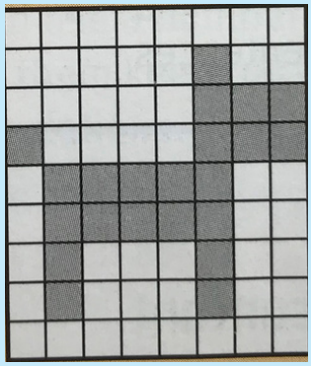
OTHER OPPORTUNITIES

Students could use more than two colours, use more than 20 blocks or the value of a block could be said in money. Using money would allow decimal multiplication to be used e.g. Yellow is worth $1.50.

Our Year 5 classes have also used this lesson as a way of teaching three dimensional drawing using isometric paper.

SUPPORTING THE CHALLENGE

Show children how to draw a 2D representation of their dog.



- Provide children with $1 and $2 coins. They use this money to 'buy' cubes so they start with cubes that total $25

ASSESSING AND APPLYING

- Children make a model dog worth 25 points.
- Children can find different model dogs worth 25 points.
- Children can use multiplication to solve the problem.

This lesson is rich, it has mathematical understanding at its heart, however, fluency, problem-solving and reasoning is also deeply embedded throughout.

REFERENCE

This activity has derived from Clarke, P. (2008). *We Can Do It, Year 2, Using and applying Maths Challenges*. BEAM.

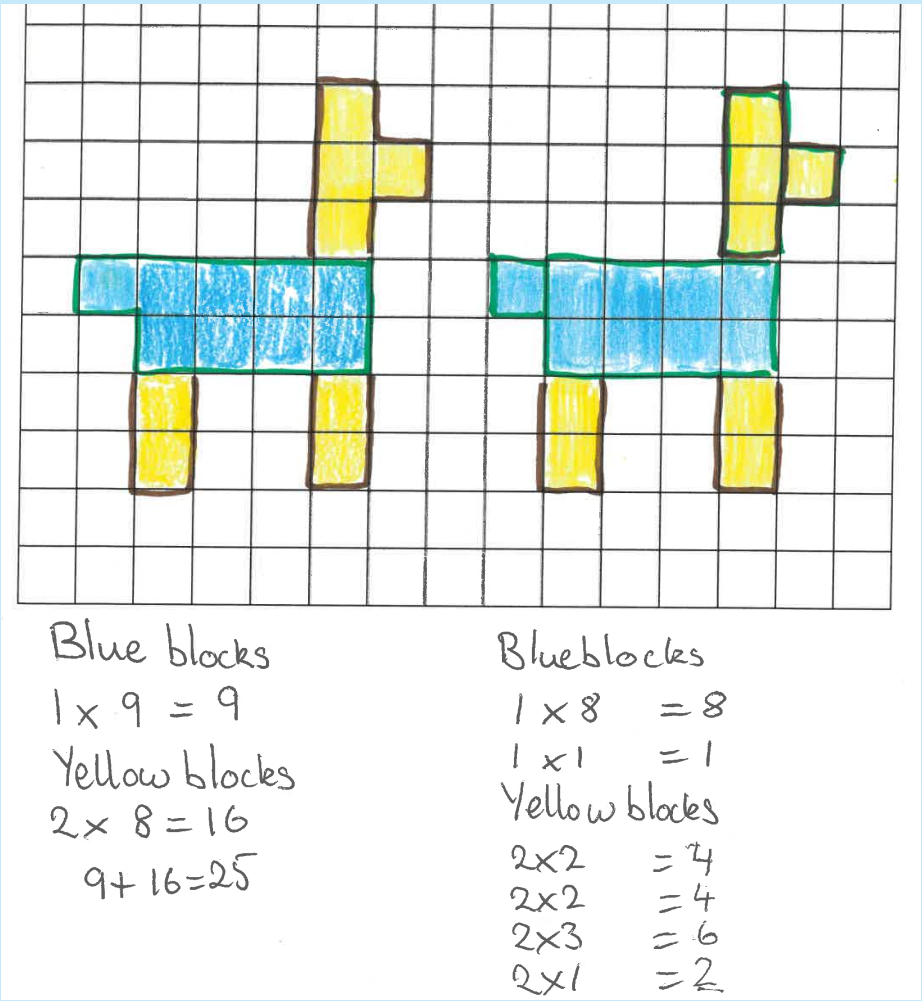


Figure 1. This is an example of a student's work of how they made 25 points. The left side multiplication shows adding all the colour and multiplying by 1 and 2. The right side shows the student finding all of one colour and multiplying.

MAKING MAGIC HAPPEN

Hayley Dureau – 2022 Master Teacher (Mathematics), Teaching Excellence Division, Victorian Academy of Teaching and Leadership

COLLABORATION IS POWERFUL

Magic happens when mathematics teachers learn from one another. I had the great pleasure of spending last year working in the Teaching Excellence Program (TEP) at the Victorian Academy of Teaching and Leadership. As the inaugural Master Teacher of Mathematics, I worked closely with 45 incredible mathematics teachers from across the state who were part of the first cohort to undertake this Australian-first program for highly skilled teachers. The 'Maths TEPers', as they were affectionately known, taught me so much about the power of collaboration. They demonstrated first-hand how impactful it can be when teachers are given the time and space to explore and build their discipline knowledge and pedagogy expertise with peers and colleagues. The collaborative approach by teachers from various contexts meant that they were exposed to new ideas and had their thinking and practice challenged. They heard about different approaches and were encouraged to trial various strategies in their classrooms. These dedicated teachers teach across Years F-12 and represented Government, Independent, and Catholic schools from all over Victoria. The group included teachers from Mildura, Cohuna, Inverloch, Allansford, Wodonga, Wangaratta, Bendigo, and Ballarat, as well many from metro and outer Melbourne.

I am grateful for the opportunity to learn from, and with, these exceptional educators. It made me appreciate the power of collaboration and shared values between teachers working in multiple contexts, teaching various levels, and from different school systems. Through the TEP, these teachers built an incredible and dynamic community of practice.

BRINGING VICTORIAN MATHS EDUCATORS TOGETHER

In 2022, 45 mathematics teachers participated in the TEP, but I know that there are so many mathematics educators across Victoria who would benefit from a professional community of practice. I'm thrilled MAV are launching a new online mathematics education community. This means that wherever you are, you'll be able to access the community 24/7 and engage in collegial sharing and learning.

MAV's new online community has been informed and designed by practitioners and is based on research undertaken in a collaborative partnership with researchers from Southern Cross University (SCU). The community is open to all mathematics educators from pre-service and early career right through to established teachers and leaders of mathematics who teach in early childhood settings as well as primary and secondary schools and universities located all across Victoria. If you haven't had a chance to join yet – here is your sign! And best of all, it is free!

Our collective experiences with hybrid and remote learning prompted many teachers to look for ways to connect with, support, and learn from colleagues. With a plethora of online resources and tools at our fingertips, we turned to our teaching friends for recommendations that would serve a particular purpose for our students in our unique contexts. Many of us built local partnerships or strengthened our work in teams within our schools. Sadly, for some, particularly our colleagues in small or regional/rural schools, challenges of isolation were exemplified during this time. Well, you spoke, and MAV listened!

MAV's online community will allow educators to share ideas and resources, raise issues, ask for help from MAV and others in the community, seek expert advice, support each other, and contribute to the broader mathematics education community.

STRONG CONNECTIONS = STRONGER IDEAS

It is my hope that all mathematics teachers in Victoria join this community. Through my TEP experience, I observed that when connections are established between teachers from wide geographic locations and from a range of teaching contexts (metro, regional, rural, early years, primary, and secondary), they help to enhance teachers' discipline-specific knowledge and expose us to new ways of thinking and doing.

In the TEP, participants engaged in collaborative extended practitioner inquiry. They worked in small groups to explore a shared problem of practice and, through the process, learned from and with one another, school colleagues, and students.

> "I strongly connect with my school maths community, but not with external teachers. I will value this online network.
>
> Anna
> Maths teacher
> Shepparton

We had Foundation teachers working with high school teachers and everything in between!

Participants shared ideas for classroom activities and resources they had created or used, reflected collaboratively on student work and teaching artefacts and were vulnerable enough to ask for help with knowledge or skills they felt less confident to teach, or pedagogies they were less familiar with. As a secondary mathematics teacher, I was overwhelmed by the insights I gained from discussing problems of practice with teachers of F-6. As I visited participants in regional and rural schools, I deeply appreciated the outstanding work done by educators across the state. Context is so important, and we can learn so much from those in vastly different contexts to our own.

JOIN UP AND JOIN IN

MAV's online community platform allows educators to ask questions, share resources, write blogs, connect with teachers and experts, and start discussions around topics of interest. Members can introduce themselves to the community by building their online profile and letting other members know what they teach and their areas of interest and expertise. The platform will include member profile spotlights and provide access to videos of professional learning and conference presentations.

The online community is waiting for you. Consider checking it out and contributing your thoughts and ideas. Joining is quick, easy and free: www.mathscommunity.com.au/mav

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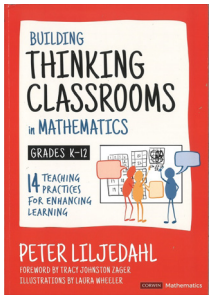
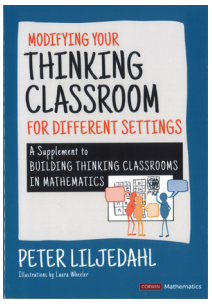


BUILDING THINKING CLASSROOMS IN MATHEMATICS

K-12

Teachers often find it difficult to implement lessons that help students go beyond rote memorisation and repetitive calculations. Sparked by observing teachers struggle to implement rich mathematics tasks to engage students in deep thinking, this book helps teachers implement optimal practices for thinking and deep mathematics learning to occur.

$56 (MEMBER)
$70 (NON MEMBER)



MODIFYING YOUR THINKING CLASSROOM FOR DIFFERENT SETTINGS

K-VCAL

In *Building Thinking Classrooms in Mathematics*, readers discovered that thinking is a precursor to learning. The book introduced practices that can increase student thinking in the classroom and can work for any teacher in any setting. But how do these practices work in a classroom with social distancing or in settings that are not always face-to-face? This follow-up supplement walks teachers through how to adapt the practices for 12 distinct settings, some of which came about as a result of the COVID-19 pandemic. This guide provides the what, why, and how to adapt each practice in face-to-face settings that require social distancing, fixed seating, or small class sizes; synchronous and asynchronous virtual and hybrid settings; independent learning; and homeschooling. It includes guidance on using thinking classroom practices to support students in unfinished learning in small groups and one-on-one teaching. This guide offers updated toolkits and a recommended order for the implementation of the practices for each of the settings.

$21.50 (MEMBER)
$26.90 (NON MEMBER)

MAV VCE 2023 STUDY DESIGN - VIRTUAL CONFERENCE (VIDEO RECORDINGS AND RESOURCES)

VCE

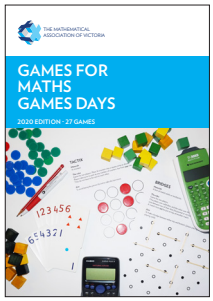
Missed the VCE 2023 Study Design Conference? You can now purchase the recordings and all accompanying resources of the day for 2023 All studies, which contains all videos and all resources from all four studies:

- Mathematical Methods
- Specialist Mathematics
- General Mathematics
- Foundation Mathematics

Each study includes sessions such as the 2023 overview, Sample Mathematical Investigations (SACs), Sample questions from the new content. Where new content has been added these resources are included, eg. logic, algorithms, networks, matrices, proof, number.

INDIVIDUAL STUDY — $120 (MEMBER) $150 (NON MEMBER)

ALL STUDIES — $400 (MEMBER) $500 (NON MEMBER)



GAMES FOR GAMES DAYS

5 – 10

The Mathematical Association of Victoria (MAV) Games Days are very popular and a great way of engaging students through competing with like-minded individuals. MAV often gets enquiries from schools either wishing to run smaller scale games days at a local or school level or requesting games days resources.

MAV has compiled a selection of favourite maths games some used in games days. Whether for games days or for general classroom use, the games are a useful tool in engaging all students.

The resource has been designed with one game per page, so teachers can print the desired page as is. Each game has the same format, listing materials required, the rules and the aim of the game.

$30 (MEMBER)
$37.50 (NON MEMBER)

THE MATHEMATICAL ASSOCIATION OF VICTORIA

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Prices are subject to change.