THE MATHEMATICAL ASSOCIATION OF VICTORIA

THE COMMON DENOMINATOR 3/20

LESSONS FROM REMOTE LEARNING

INSIDE

Paul Tuchtan - Primary mathematics co-ordinator, Balcombe Grammar School

When planning for 2020, no-one could have imagined how different Term 2 would have looked. Part of the Victorian Government's response to stopping the spread of COVID-19 saw almost one million students schooling from home for the majority of the term.

As a school, investigative thinking has been at the forefront of our teaching and it has been just as important to maintain this approach with remote learning. Over the past years, our internal and external professional development has also focused on the four proficiencies in mathematics: understanding, fluency, problem solving and reasoning. Throughout this time, classroom teachers have been exploring ways these proficiencies can be integrated into their teaching.

Balcombe Grammar School's transition to remote learning has been very agile.

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FROM THE PRESIDENT

Michael O'Connor

THE COMMON DENOMINATOR
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We live in interesting times. Schools have now re-opened and there has been a return to something akin to the normality of life pre-COVID-19. Several schools have written about their experiences of remote learning in this edition of the magazine and I hope that there are lessons to be learnt from each.

At the same time, what life will look like in the future has been significantly altered over the last few months. Energy giants like BP are now divesting themselves of ties to fossil fuels and are accelerating the development of renewable energies, something that a few months ago seemed improbable.

Education has changed too. We were plunged headfirst into a natural experiment and forced to adapt our practices. As is often the case in such circumstances many of the adaptations were less successful than we might have hoped. I suggest that this is not an indication that 'the old ways are the best ways'. Rather it is a sign that change is uncomfortable and successful changes need time to evolve. We have all, like BP, been given an opportunity to direct how these forms evolve.

So what should we take into consideration? What do we, as a profession, want to breed in – and out – of our practice? I make three suggestions:

- The social contract between teachers and parents
- Equitable access to educational resources, and
- Maintaining our own learning as teachers.

Firstly, it became starkly obvious that schools and teachers in modern society underwrite and enable much of business and industry. The next pandemic might be a century away. Or it could be next week. In either circumstance, providing for a smooth transition between open and locked down states needs to be planned for, locally and globally. The technology exists now, nascent though it may be.

More importantly, conversations need to be had around how to best implement these technologies and not just in a time of crisis.

While the importance of schools to the social development students should not be underestimated, there are also reports of students who improved in their outcomes while learning remotely. Finding opportunities to blend the two forms is analogous to storing water in preparation for a drought. We might not need it now, but we will need it at some stage.

This leads to the second consideration. We have seen the inequity of access to resources very clearly in recent times. This is more than just access to information. Education is, and always has been, much more than just information. In mathematics, proficiency must also be sought and achieved. Textbooks and websites hold enormous amounts of information. How do we, as teachers enhance and utilise that information to develop deep understanding, reasoning and problem solving skills? I think a lot might be gained by exploring how to achieve this in physically distanced situations that could also be applied in classroom settings.

Finally, but most importantly, we need to consider our own, ongoing professional learning. It can be all too easy to magpie information as though it were toilet paper, hoarding it but not using it. Most of us were forced into steep learning curves these last few months where we struggled to understand, to apply skills and to solve problems. We also had to do it in new ways.

With reflection, what can we learn about our learning from those experiences? What do we need to prioritise in our learning? These are open ended questions. As a way forward I would recommend two resources by Barbara Oakley. The first is a MOOC that can be found on Coursera called *Learning How to Learn*. The second is an accompanying book: *A Mind for Numbers*, published by Penguin. I suggest that there is much to be gained from both. Not just in terms of information but also from the nature and style of the two forms. Books are familiar and 'old school'. MOOCs (short for Massive Open Online Courses), a little over a decade old. One is not right and the other wrong, but a blend may well be the next evolutionary step for education.

MAV PROFESSIONAL DEVELOPMENT

During Term 3 2020, a variety of presenters and MAV's own mathematics educational consultants will present online workshops focusing on innovative teaching practice. All PD below will be delivered virtually. Most sessions are free for MAV members.
Registration is essential, www.mav.vic.edu.au/events.

TOPIC	DATE	YEARS	PRESENTER
EAL and secondary mathematics	15/7/20	7 - 12	Ruth Hibburt
Number talks and fraction talks	30/7/20	5 - 9	Helen Haralambous and Danijela Draskovic
Applying digital resources to the secondary mathematics classroom	6/8/20	7 - 10	Helen Haralambous, Danijela Draskovic and Nathan Alison
TI Navigator	TBC	9 - 12	Various
Engaging students with learning difficulties and/or maths anxiety	19/8/20	7 - 10	Ruth Hibburt
Engaging number skills through games	20/8/20	7 - 10	Andrew Lorimer-Derham
Teaching algebra through manipulatives, both concrete and virtual	27/8/20	7 - 10	Helen Haralambous and Danijela Draskovic
Exploring Mathematical Reasoning in the Middle Years	2/9/20	5 - 9	Tom Moore
MAV/ISV conference: New frontiers of learning	11/9/20	F - 10	Various

VCE REVISION PROGRAM 2020

MAV is releasing a self-paced, interactive, online VCE revision program for all three maths studies. Course videos are delivered by highly qualified, experienced teachers and current VCAA exam assessors. Students will receive detailed revision notes.

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LESSONS FROM REMOTE LEARNING

Paul Tuchtan – F-6 mathematics co-ordinator, Balcombe Grammar School

CONT. FROM PAGE 1.

We spent time on our curriculum day to upskill staff on the use of the Seesaw learning platform to deliver learning and spent time considering what mathematics should look like in this new environment. While many online learning programs made their resources more readily available for Term 2, our teachers agreed that rich learning does not come from abstract questions but through real life propositions, stories, hands on activities, trial and errors and applying the mathematical toolbox wherever possible.

Some of the challenges faced in remote learning are:

- motivating students to engage in their learning
- knowing whether students understand the instructions and
- understanding how much support students have from parents.

Using Seesaw, the teacher can talk though the task and provide additional information orally or visually that might be difficult to convey in text only. Using screen recording and uploading movies on YouTube allowed students to see how the task is to be completed at an almost 'fishbowl' level.

This is also a place where teachers can encourage those who are ready to take their learning further by differentiating a lesson. Also, we found that students regularly seeing and hearing their teacher, helped them feel comfortable and connected with the learning tasks they were assigned.

At Balcombe Grammar School, we quickly became aware that the amount of learning children complete in a normal school day is very different to what can be achieved at home. Teachers have a very special skill which they utilise to deliver and explain topics, we are trained with the latest pedagogies (such as *Teaching Primary Mathematics* et al).

A school based maths lesson would start with a game (which was repeated for the week) to develop fluency as well as allow for differentiation as the week progressed and then we moved to understanding, problem solving and reasoning.

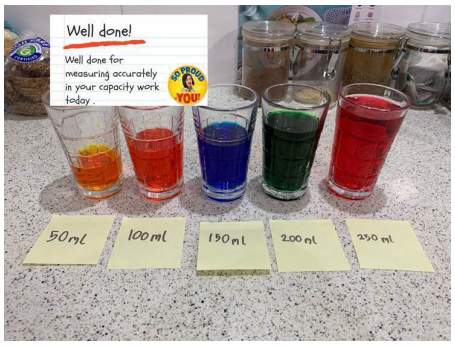
A remote learning week involved teaching for understanding by using concrete materials at home (such as grocery items in the pantry), and investigative learning (to incorporate the four proficiencies) that uses our mathematical toolbox.

Remote learning presented many opportunities for teachers at Balcombe Grammar School. It upskilled every teacher in the use of different technologies available to teachers – how to make movies, screen recordings, different uses of PowerPoint etc.

It also allowed our creative juices to flow as we devised imaginative ways for students and parents to understand what we are teaching and explore ways to teach the four processes (addition, subtraction, multiplication and division) through space and measurement activities.

Our teachers met with each student individually using Microsoft Teams for up to 20 minutes on a weekly basis. Through screen sharing, the teacher and student were able to analyse the progress made and discuss strategies for ongoing tasks.

Our Getting Ready in Numeracy (GRIN) program continued with teachers meeting with each student every week to discuss upcoming learnings. Having such regular and direct contact with families was an extremely positive aspect of remote learning as it maintained (and at times improved) student/teacher and teacher/parent relationships. It also served to give teachers insight as to how the families were navigating these unusual times.

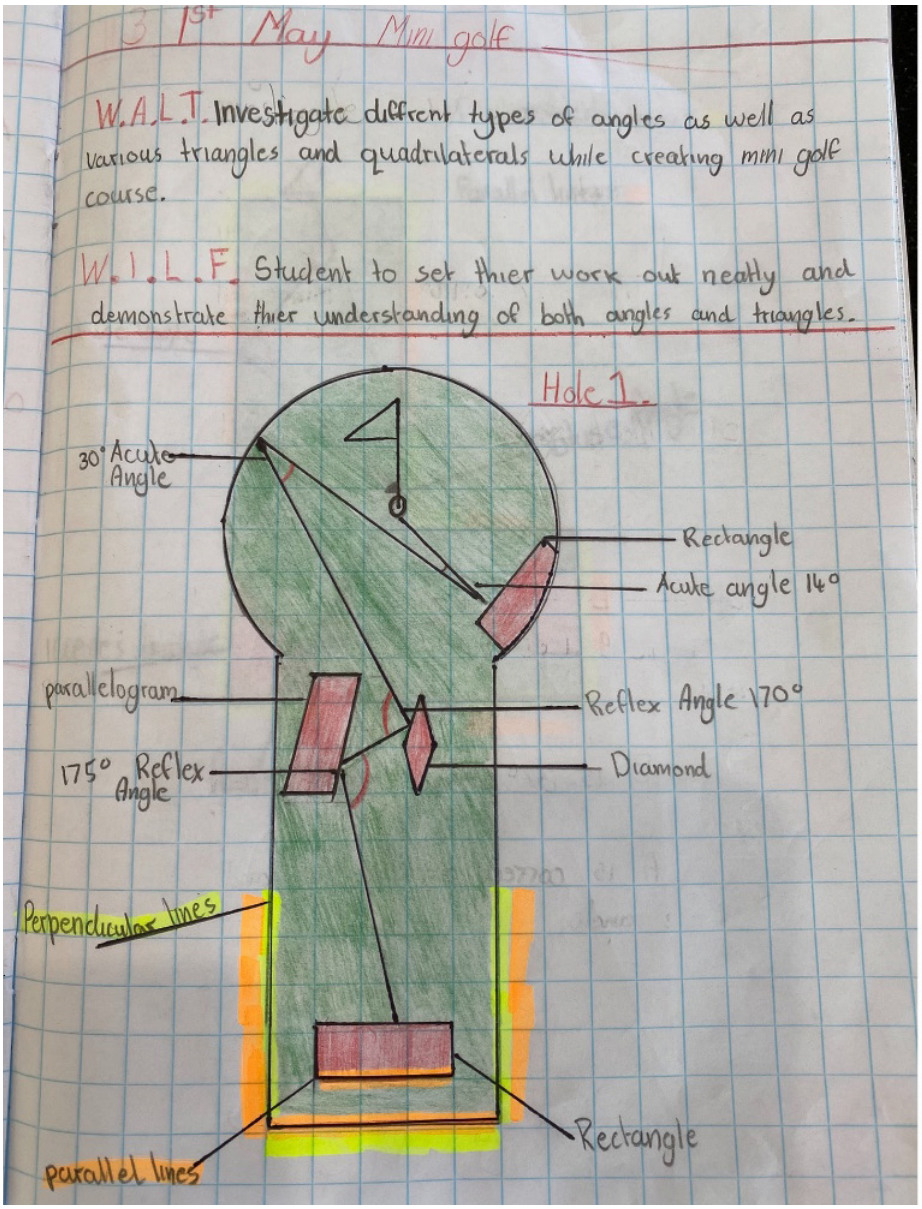


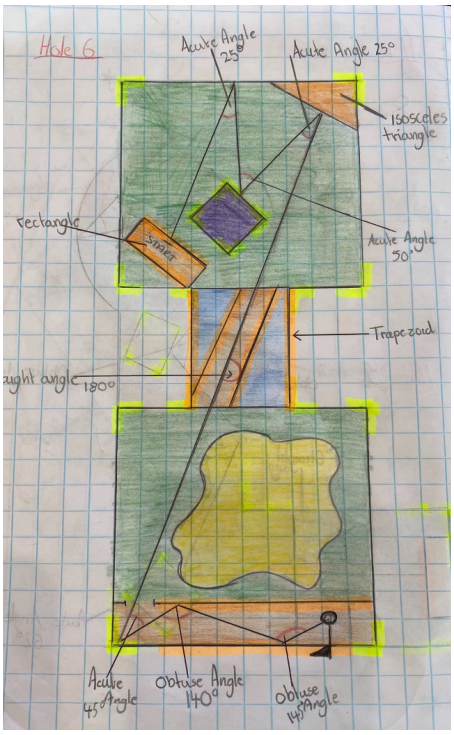
Measuring accurately requires a steady hand. In this lesson Year 3 used measuring jugs to accurately pour liquids of varying amounts. For fun students added some food colouring.

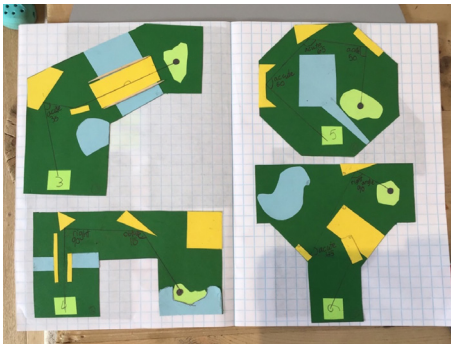
Students gathered five containers and used cups of water to determine capacity and order them from smallest to largest.

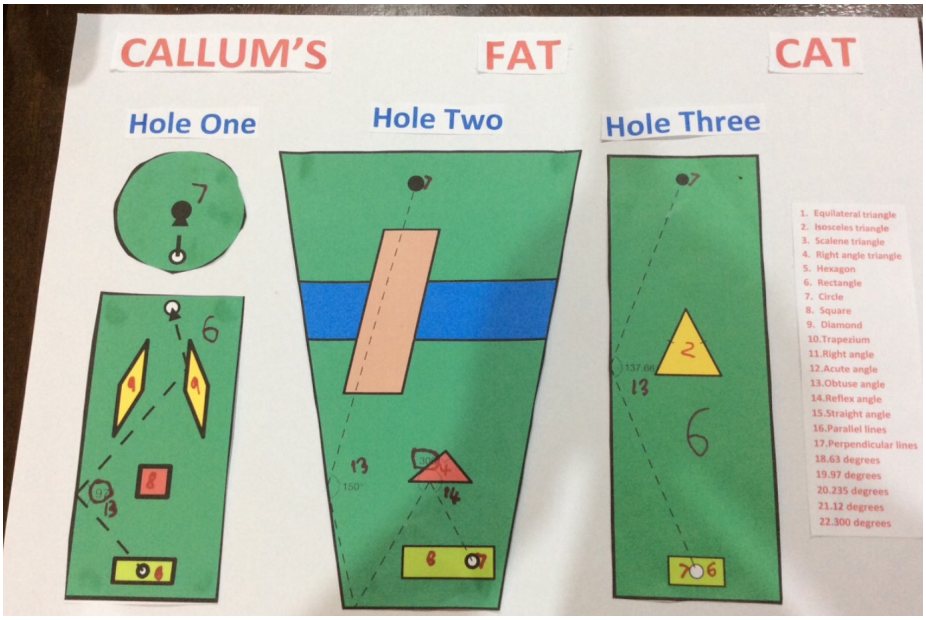
Students made medals and wrote the ordinal numbers before playing judge and presenting them to race winners in their family.

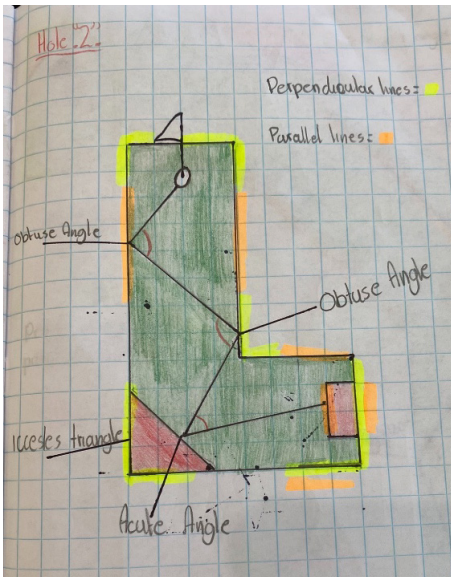
Balcombe Grammar School is a Maths Active School. To learn more about Maths Active accreditation, visit www.mav.vic.edu.au.











Teaching angles with mini-golf.

CONTINUOUS IMPROVEMENTS

Michael Uzunovski, Assistant Principal and Michelle Burke, Learning Specialist – Albanvale Primary School

Established in 1981, Albanvale Primary School is located 29km west of Melbourne, close to the suburbs of Deer Park and St Albans. The school ranks in the 26th percentile in the Index of Community Socio-Education Advantage (ICSEA) and has a highly diverse profile with over three quarters of students from families where English is an additional language and around 7% of the population accessing the Program for Students with Disabilities.

The school has a strong focus on teacher collaboration and building high levels of rigour and consistent teaching practice. Staff recognise that improving students' learning is at the core of their work and have established a shared vision which is to continuously ensure that every student is challenged and supported to meet their potential, regardless of the stage in their learning journey, based on a deep understanding of their individual learning profile and the next steps they require.

Numeracy at the school is led by both of us. Together, we have engaged staff in a process of whole-school improvement through deliberate practices designed to improve student learning in numeracy. With a clear vision set in our strategic plan to improve student numeracy outcomes across the cohort we identified three key initiatives crucial to our success which includes structured professional learning team meetings, instructional coaching for all, and collaboratively developing our guaranteed and viable curriculum. Each strategy has contributed to a culture of continuous improvement amongst our staff and has coincided with significant increase to the positive endorsement of the collective efficacy domain of the annual DET staff opinion survey.

PROFESSIONAL LEARNING TEAM MEETINGS (PLTs)

Each week, teams are supported with non face-to-face teaching team for a scheduled PLT which is lead by one of their instructional leaders. PLTs are structured to follow the FISO school improvement process ensuring teachers are engaged in data informed discussions relevant to their cohort which drives a deep inquiry into what students already know and where to next.

Leveraging the collective expertise of their colleagues, coaches and MAV consultants, teams develop deep learning experiences, developmentally appropriate to their students ensuring high levels of differentiation are catered to. The role of our MAV consultants (Ellen Corovic and Judy Gregg) has adapted with the needs of our staff. In recent years we have had an influx of early career stage teachers so our consultants have been leveraged to further build staff capacity in the developmental learning sequences of upcoming concepts ensuring teachers have a deep understanding of what to teach before exploring how to teach it.

Following these sessions, teacher feedback highlights their more positive attitude toward teaching numeracy supported by their greater understanding of the broad range of concepts in the curriculum. Further to this, by diving deeper into the developmental steps for each concept they expressed greater confidence in differentiating for their students by knowing where they are in their learning and where to next for the progression. PLT's provide teachers with protected time to collaboratively plan the upcoming learning sequence ensuring the data and professional learning they just engaged in is central to informing their planning. This transformed our way of working with one teacher stating, 'Previously we planned each subject alone, now we have shared planning with an agenda directly linked to the improvement and success of our teaching. This way we can immediately see the impact on our students are share that with other teachers.'

INSTRUCTIONAL COACHING

At Albanvale Primary School we believe that all staff are capable of continuous improvement regardless of career stage, experience, or expertise. Every teacher receives weekly, in-class instructional coaching in numeracy to support teachers in implementing the strategies determined in PLTs, applying the schools numeracy instructional model, and leveraging high impact learning strategies. Coaches engage with teachers for individualised cycles by developing an agreed goal and establishing an action plan with measurable outcomes.

Supports in meeting these goals are dependent on need but could include providing professional reading, observing lessons, modelling lessons or lesson components, arranging for the observation of a teacher colleague or supporting teachers with planning, assessing and analysing student learning. The relationship between the coaches and the staff are built on trust and a shared vision to improve student learning which has been crucial in ensuring its success. Coaching is highly valued amongst our staff, 'I know more about teaching concepts, what I was assessing and why. I have more access to other teachers and coaches.'

GUARANTEED AND VIABLE CURRICULUM

Through significant consultation with teachers and the Mathematical Association Victoria (MAV), our school has developed, and continues to refine, our guaranteed and viable curriculum in numeracy which is presented as the APS Essential Learnings. The essential learnings detail the core knowledge we expect all students to have mastered upon graduating from our school and are informed by the Victorian Curriculum and the relevant literature base.

The school has a long-standing partnership with MAV who regularly facilitate professional learning that is aligned to our PLT process and keep teachers engaged with current research to inform high quality, evidenced based teaching and learning.

The APS Essential Learnings are informed with the growth points identified in the Early Numeracy Research Project (2001) and demonstrate the developmental sequence towards mastery in priority learning areas. As teachers, we recognise that learning is not a linear process however with precise expertise on the developmental sequence in each of these areas, we are able to identify the indicators of student progress and target teaching at their point of need. Along with our essential learnings a detailed assessment schedule has been developed to ensure we are consistently and accurately measuring how students are going and adapting our teaching, learning and intervention as required.

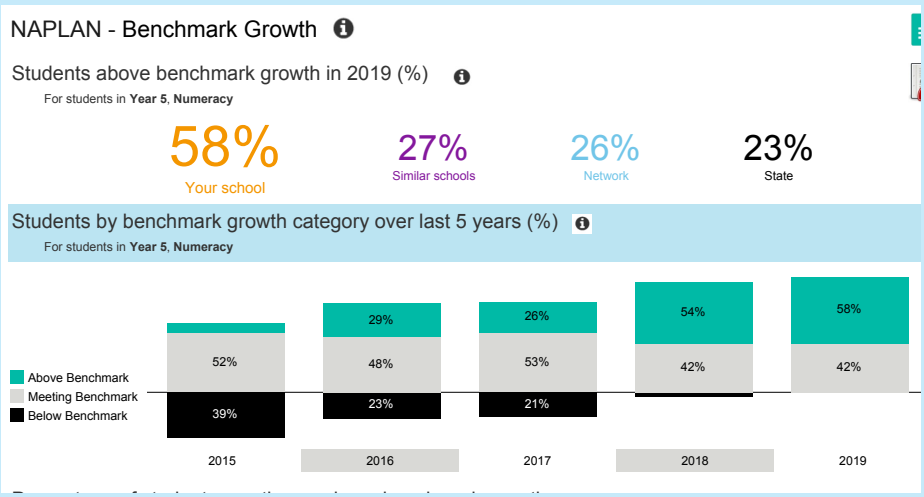
School improvement is an intricate and complex process which is difficult to capture. Numerous improvement strategies are pivotal to our success with each underpinned by the commitment, rigour, and determination obvious amongst our team. We are proud of our efforts, they have yielded positive outcomes for our students and have fostered a culture of high expectations. Recently our school improvement journey was recognised by the DET Performance Branch who published a case study. Our student results in NAPLAN have been recognised for our substantial gains in student growth and achievement by ACARA and was featured in the *Herald Sun*.

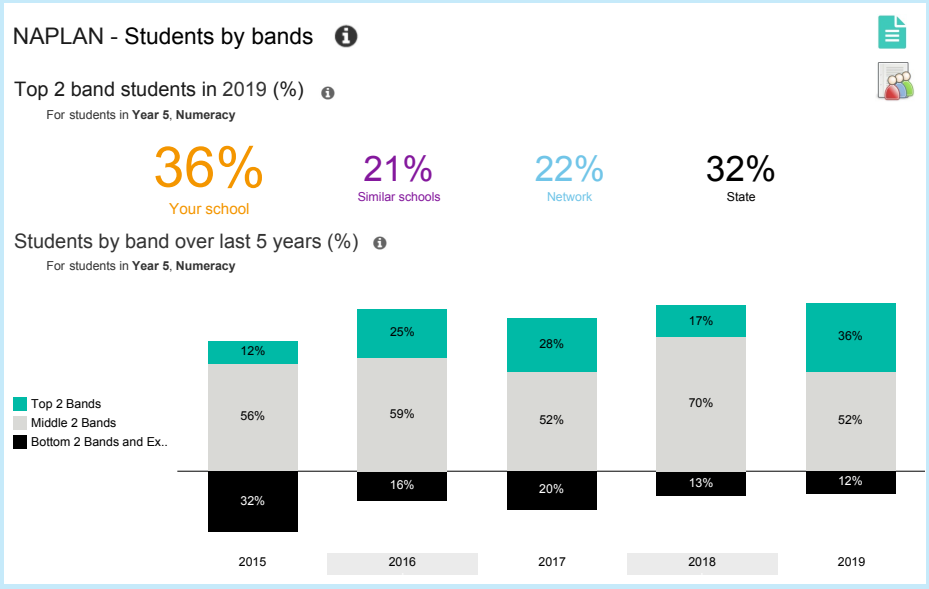
More importantly, the impact is noticeable to our students. Amelia, a Year 5 student explains 'I love working in my explicit group focusing on my learning goal. I like looking at my learning map and seeing how far I have come and then looking at what I need to learn next. Now I can see that I am good at maths.'

MATHEMATICS ACTIVE SCHOOL ACCREDITATION

In 2019, our numeracy leaders began working with our MAV consultants toward gaining Maths Active Accreditation. The guiding framework challenged us to review, evaluate and consider all components of our teaching and learning program and highlighted specific actions for improvement. Although the process focused on our practices in numeracy it sparked discussions amongst our school improvement team around refining whole school practices more broadly. Proudly, in 2020 our school gained Maths Active School Accreditation from the MAV and we look forward to celebrating this with our community. Our path to continued improvement isn't fixed, but with the Maths Active School framework available to guide our work, and the support of our MAV consultants we feel well placed to continue working in partnership to deliver a teaching and learning program to our community that makes a difference.

Could your school attain Mathematics Active School accreditation? Learn more at www.mav.vic.edu.au.





Albanvale's NAPLAN data highlighting their shift to significant growth for all students

CREATIVITY IN MATHEMATICS

Simone Saunders - Raymond House learning enrichment teacher, Lowther Hall

I am in the very privileged position that I am able to work with some very able mathematicians. They all have a skill set way beyond their year level and are able to learn and consolidate new concepts very quickly. My students thrive on being given pages of algorithms to complete and anxiously wait to see if their answers are right or wrong. Maths is very black and white to them, every question must have a set strategy or formula used to solve it and a correct answer. There is no need for mathematical reasoning or deeper understanding, as long as you get it right, you are considered good at maths.

As teachers, we know this is not the type of mathematician that is going to experience success in the future. Experience tells us that students must learn to reason and make sense of mathematics if they are going to apply their skills in meaningful ways. The focus is no longer on what a student knows, it is what they can do with this knowledge that matters. To give my students the best opportunity of future mathematical success, I had to change my teaching focus from skill development to knowledge application. I knew I had to do this, but didn't know how.

After conversations with colleagues, I began to research creativity in mathematics. Although they were two words I had never linked before, I was assured this was where my research should begin. Preliminary readings taught me that it was equally important to focus on the quality of a students' learning outcome as well as the thinking that led to this. That in mathematics, creativity encouraged a student to recombine known facts to produce something that was novel, interesting or valuable.

At this point, the mathematical problems I had written for my students were always in a framework very familiar to them (the problem involved applying an application they had just been taught). They were given a clear indication about what knowledge to apply and the problems often had one answer and no opportunity to show individual thinking and ideas. It quickly become apparent that this had to change. I had to begin to develop creative problems that allowed my students to apply their known skills in original and useful ways.

After much deliberation over what a creative maths problem looked like, I walked into my Year 6 maths class and presented them with the following problem;

How many isosceles triangles, all with different surface areas can fit inside a square with a total surface area greater than 600 cm^2?

I developed this question with the belief my students would find it quite simple. I knew they had the necessary knowledge (names of the different types of triangles, an isosceles triangle has two angles of equal value, all angles in a triangle add up to 180°, the formula for the area of a triangle was equal to $\frac{1}{2} \times b \times h$) as well as the necessary skills (how to flip, slide and rotate shapes, how to measure and draw angles, how to find the square root of a number) to solve the problem and I would be able to introduce to creative problem solving (show them how they had applied known skills in novel ways).

Much to my disbelief, the lesson was a complete disaster. My students sat there for 30 minutes and did not put pen to paper. They repeatedly asked for the formula or to be shown a strategy, told me that this was not the type of questions other teachers gave them and as a group decided it was too hard and would not attempt it. One student (who was working at an extremely high level) burst into tears as she could not cope with the lack of direct instruction. All of a sudden, right before my eyes, my very able group of mathematicians were showing me a huge gap in their learning. The scary thing was that I did not realise the extent to which it existed and I was not confident that I knew how to close it.

Not to be defeated, I began to research if it was possible to teach creativity and if so how. I learnt that it was possible and that there were many strategies that teachers could implement to support its development. I then identified three strategies that I thought would best work for my students; classroom collaboration and team building, brainstorming and the encouragement of risk taking. The next week we readdressed the problem as a group.

We set a common goal and looked at it from different perspectives, students were given the opportunity to voice their opinions and ideas in a safe environment and we all became very familiar with failure. In the process, the classroom became more about guided instruction rather than dictation. We built upon the ideas of others and learnt that not every question has one right answer.

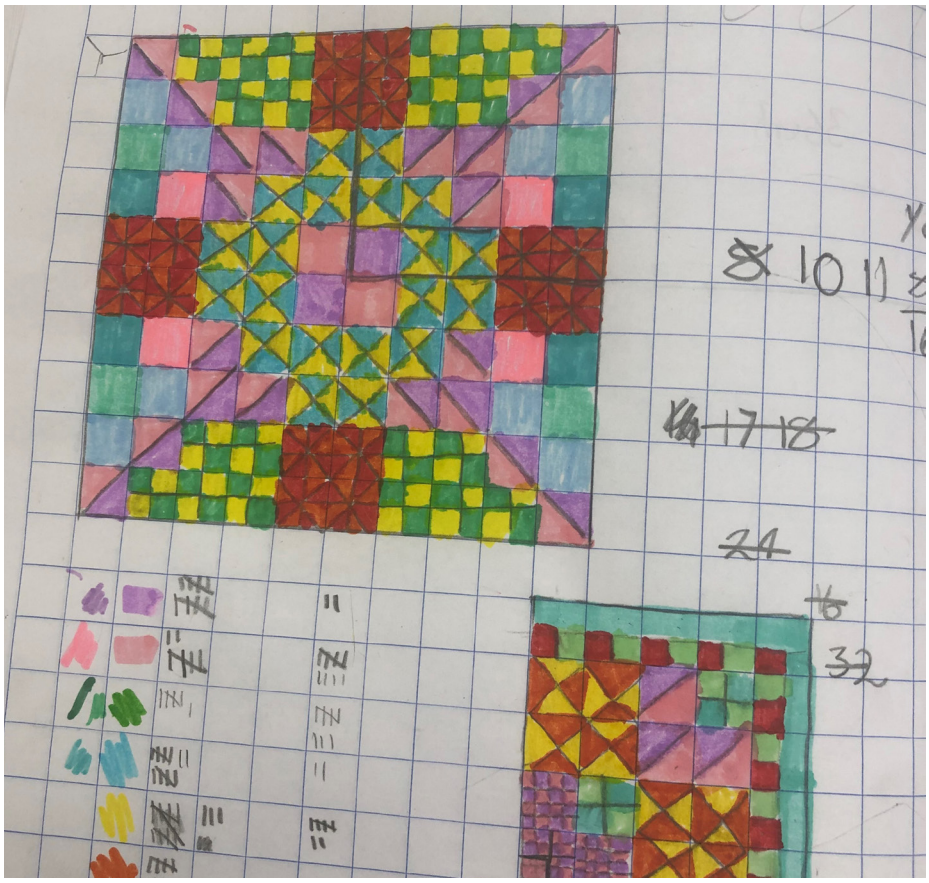
Despite all of this support, many students were still unable to create something that would be considered correct. Some creations included equilateral triangles, triangles of the same surface area and their squares were not greater than 600cm^2. However, these lessons were not about the answer, they were about developing a learning environment that valued and celebrated creativity. They were about giving girls the confidence to willingly try this again...and again.

Despite our initial challenges, we stuck at it and tackled many more creative problems pushing us all outside of our comfort zones. It took time and patience, but eventually the feelings of dread and despair disappeared. I became more comfortable in my role as a supporter rather than a leader and my students thrived on the enjoyment, challenge – and sometimes frustration – of the application of knowledge and skill creatively as compared to direct instruction.

Learning is a life long journey and one that is best shared. Although we were at very different stages of our journeys, the path of my students and myself met at a crossroad. We are now at the beginning of a new path together and I am truly excited about where we will end up.

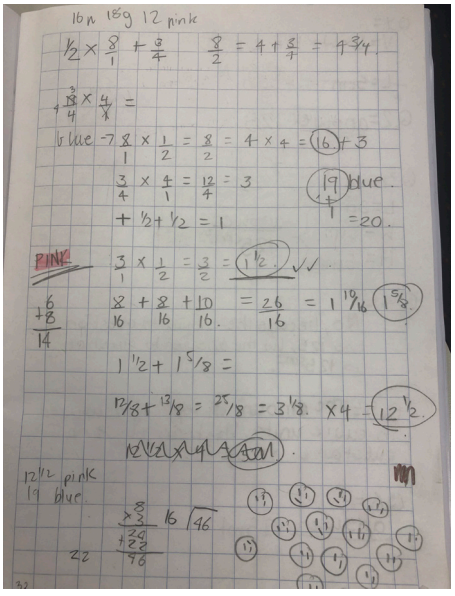
Other problems we tackled included:

Creating a grid-based artwork consisting of 12 whole shapes and 12 whole shapes broken into fractions with at least 6 different denominators.



Quilt design is an engaging activity that explores shape, pattern and proportion.

Using only one letter of the alphabet, create an oriental carpet with a central block, border pattern and field pattern.



Design one quarter of a quilt by creating a pattern that can be flipped, slid or rotated to create one larger pattern. Your pattern must include 8 colours and each colour must represent a different fraction of the quilt.

HOW MANY JELLYBEANS?

Alicia Clarke –School maths leader, St. Mary's Primary School

How Many Jellybeans? A Giant Book of Numbers! is just that – a giant picture storybook filled with numbers within the context of lots of jellybeans. The generously-sized picture storybook is uniquely illustrated by Yancey Labat, with black and white pictures which serve to highlight the different numbers of brightly coloured jellybeans on each page.

Although this picture story book is written with a specific mathematics focus in mind, it has an engaging storyline: two children, Emma and Aiden, are asked how many jellybeans they would like. The number they choose continuously increases as they realise that one child has more than the other. *How Many Jellybeans?* can be used with children from pre-school age well into the middle primary years. It begins with 10 jellybeans, which means that the first page alone would be a wonderful springboard for partitioning 10. The number of jelly beans quickly increases, from 10, to 20, to 100, to 100,000 and eventually to one million jellybeans.

The last page of the story is a huge fold out page, covered in jellybeans – presumably one million of them. Such an utterly engaging way to introduce children to the quantity of one million! This one of a kind picture storybook has infinite applications within the mathematics classroom. I've outlined two possible mathematics sessions that could be undertaken using *How Many Jellybeans?* as a springboard.

YEAR 4 SESSION

Focus: Partitioning large numbers

Victorian Curriculum Link: Level 4
Apply place value to partition, rearrange and regroup numbers to at least tens of thousands to assist calculations and solve problems.

This session was implemented with a group of highly capable Year 4 students. There were eight students in the group.

We read the story and the students enjoyed seeing the increasingly large quantities. Before turning each page, we predicted how many jellybeans would be requested on the next page, with students writing their predictions on whiteboards. This provided an excellent opportunity for students to have experience reading and writing very large numbers.

When the story gets up to one hundred thousand jelly beans, the character Aiden shows how many of each flavour he would have. He requests 5,000 blueberry, 10,000 watermelon, 2,000 cherry, 25,000 orange, 3,000 lime, 50,000 grape, 4,999 strawberry and 1 lemon jellybean.

The first task presented to the students was to prove that Aiden had one hundred thousand jellybeans in total.

Students were given a large piece of paper to show their working out to prove that the numbers given did, in fact, add to make 100,000. As we were in a relatively small group, this was a great chance to share addition strategies, discuss ways to show working out and check each others' work.

It also provided me with an insight into the different addition strategies that students were confident using.

The next part of the task was to decide which flavours you would like if you had 100,000 jellybeans and how many of each flavour you would have. To make the task even more challenging, students had to have a minimum of 5 different flavours.

This task required students to partition the number 100,000 using both their knowledge of place value as well as their addition, and perhaps even subtraction skills. Students paired to discuss their flavour choices, with the challenge to prove to your partner that you have 100,000 jellybeans.

This encouraged reasoning and the use of mathematical vocabulary. Once they had proven their calculations to a partner, students shared their work with the group. Sharing with a partner first is less daunting than sharing with the group. We discussed how there are so many different ways to partition the number 100,000. One student even verbalised that the higher the number, the more ways it can be partitioned!

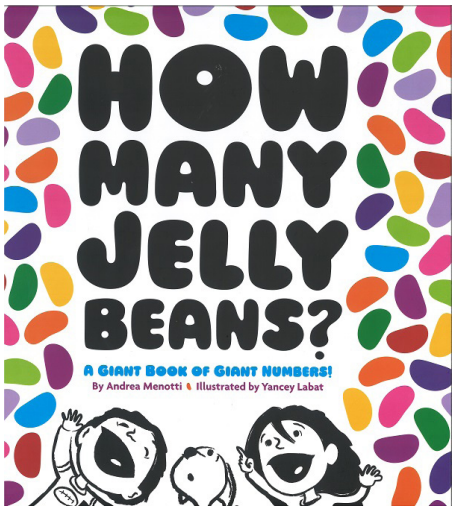
YEAR 1 SESSION

Focus: Measuring with informal units.

Victorian Curriculum Link: Level 1 Measure and compare the lengths, masses and capacities of pairs of objects using uniform informal units.

This session was implemented with Year 1 students, within a unit focused on measuring length using uniform informal units. We read the story as a class, and students were amazed to see the large quantities of jellybeans – these Year 1 children would have spent hours staring at and talking about the huge page covered in *one million* teeny tiny jellybeans!

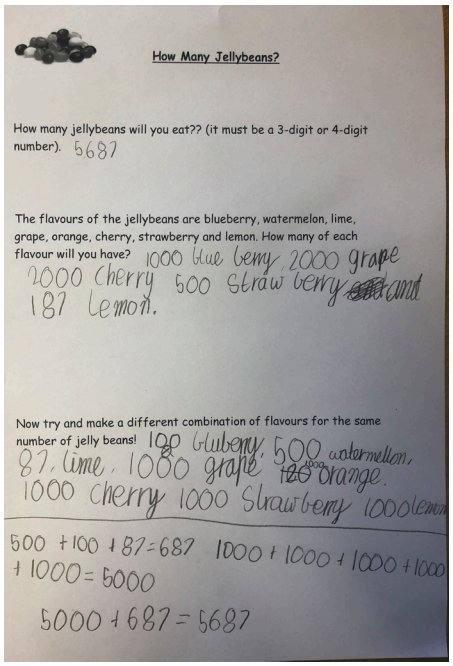
Towards the middle of the story, Emma states 'I could eat five thousand jelly beans in a year!' She then said 'If I stacked up five thousand jelly beans, they'd be as tall as this building!' This is a great springboard into measurement. Imagine if we had a building as tall as five thousand jelly beans! Do you think it would be as tall as out classroom or taller? Students began discussing how



tall five thousand jelly beans would be, and this led them to use lots of mathematical language. Students were told that they could make their own building out of playdough. After completing this, as a class we looked at each students' building and compared them to others. Sentences such as 'Sienna's building is taller than Matthew's!' and 'Dylan's building is much smaller than Oliver's but it is taller than Violette's!' led to some amazing mathematical discussion.

Students were given some real jelly beans to measure their playdough buildings. After modelling how to measure with informal units (a revision of previous lessons) students were able to take some jelly beans back to their table and measure their buildings. This could also easily be used as an assessment piece as it was quite clear which students could effectively measure with informal units. Lastly, students wrote a sentence about how tall their buildings were: 'My building was ___ jellybeans tall.'

The above lessons are only two of so many possibly learning experiences from this book. It also lends itself beautifully to an exploration of division – students could be given a number of jelly beans and asked to share them among some friends – and the best thing is it could be six jellybeans for Foundation or 458 jelly beans for Year 3 students, and many more for senior students. *How Many Jellybeans?* is so adaptable to different year levels and different concepts, it is simply a must-have book for any mathematics teacher.


How Many Jellybeans?

How many jellybeans will you eat?? (it must be a 3-digit or 4-digit number). 5687

The flavours of the jellybeans are blueberry, watermelon, lime, grape, orange, cherry, strawberry and lemon. How many of each flavour will you have? 1000 blue berry, 2000 grape 2000 cherry 500 straw berry and 187 lemon.

Now try and make a different combination of flavours for the same number of jelly beans! 100 blueberry, 500 watermelon, 87 lime, 1000 grape, 120 orange, 1000 cherry 1000 Strawberry 1000 lemon

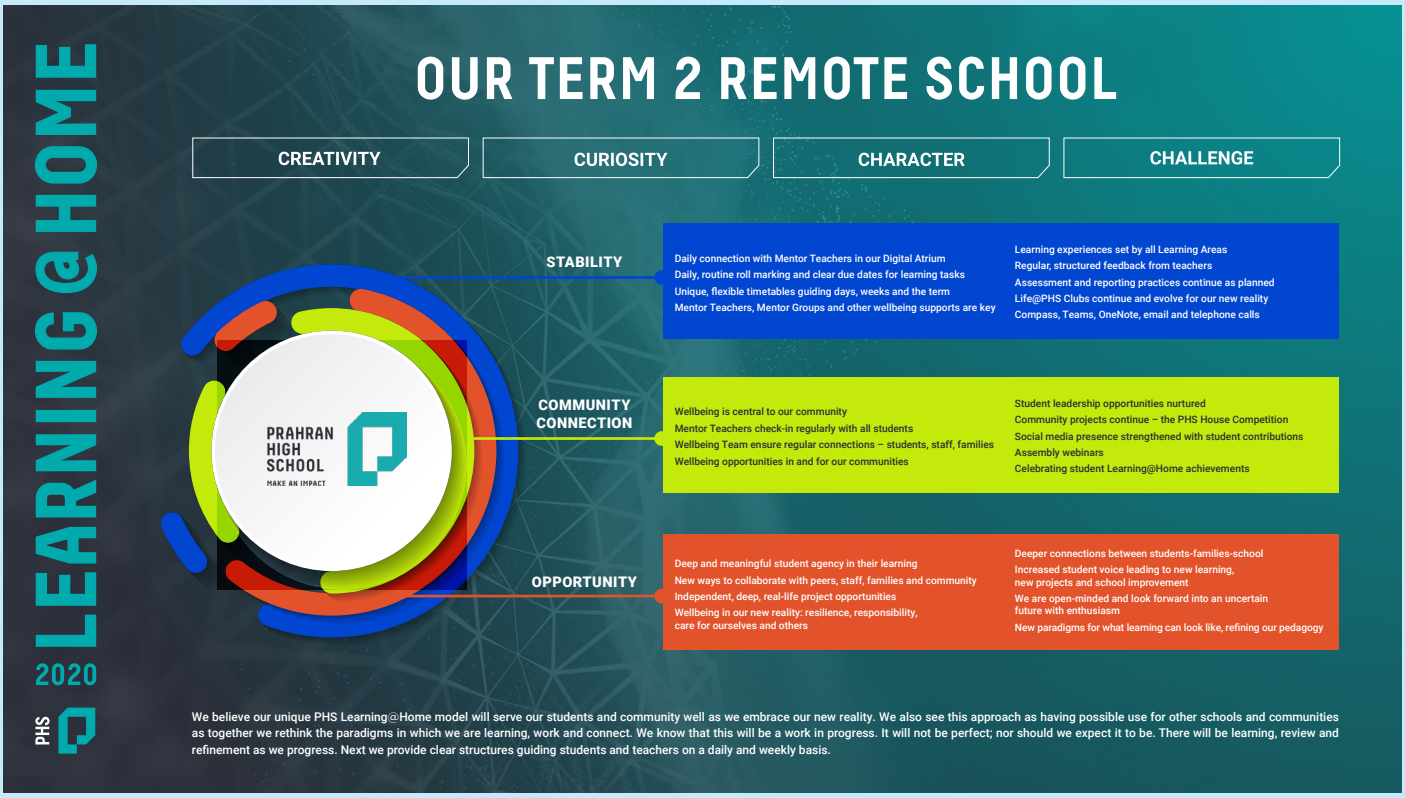
500 + 100 + 87 = 687 1000 + 1000 + 1000 + 1000 + 1000 = 5000

5000 + 687 = 5687

How Many Jellybeans is available from MAV's online shop, www.mav.vic.edu.au/mav-shop

RISING TO THE CHALLENGE

Steven Goldberg, Sara Niglia, Madeleine Graham, Thomas Savage – Mathematics team, and Nathan Chisholm – Principal, Prahran High School



The staff at Prahran High School are supported to embrace change, be flexible and rise to a challenge. With just two years combined teaching experience, in 2019 our foundation mathematics teaching team developed our curriculum and pedagogical approach. Aligning with our overall *PHS Vision of Learning*, we left textbooks behind, challenged ourselves to create a context-specific, evidence-based curriculum that could serve a new demographic of students, in a totally new learning environment. When the email dropped, and online learning was confirmed, we were eager to see what tools and strategies we could develop during these unprecedented times. We thought, 'we've got this!'

A strong vision has enabled our school to progress rapidly since opening in 2019. It was also the cornerstone of our response to online learning. The development of our Learning@Home model esteems our foundation principles by refining the conventional and striving to be inspirational. Our Principal was clear that the times required an approach that rose above business as usual, to embrace this as an opportunity for growth and be open to real-time learning about learning.

Our Learning@Home model is underpinned by the core drivers of stability, opportunity and community connection. While the overall approach values flexibility and independence, we know that stability is also important. This is nurtured through teachers' commitment to reaching 'every student, every day' not only during an 8:40am video check-in, but with proactive support, feedback and extension in all learning areas.

Rather than mimicking the regular timetable, PHS boldly rebuilt our approach. Research, contextual knowledge and instinct underpin our bespoke model of learning, connecting each day of the week to one of our school values. On Make an Impact Mondays and Curiosity Tuesdays, students participated in one 45 minute Inspiration session for each learning area. These sessions set students up for success by establishing their weekly learning goals and guiding them through the technological minefield of task submission. As teachers of mathematics, we used this time to fascinate our students with the beautiful ways the mathematics reveals itself in their physical world. For example, with the help of Numberphile, we explored the mathematically optimal way to cut a cake as we introduced a geometry unit.

On Character Wednesdays, Creative Thursdays and Challenge Fridays, teachers responded to students' individual needs using Microsoft Teams instant messaging and video conferencing, alongside a rigorous physical and mental wellbeing program. Our school is clear that numeracy and literacy remain priorities and specific time is carved out each Wednesday, Thursday and Friday morning directing student focus to their mathematics and English weekly learning tasks. Afternoons offer structured time for independent learning, linked to concepts covered in the inspiration sessions.

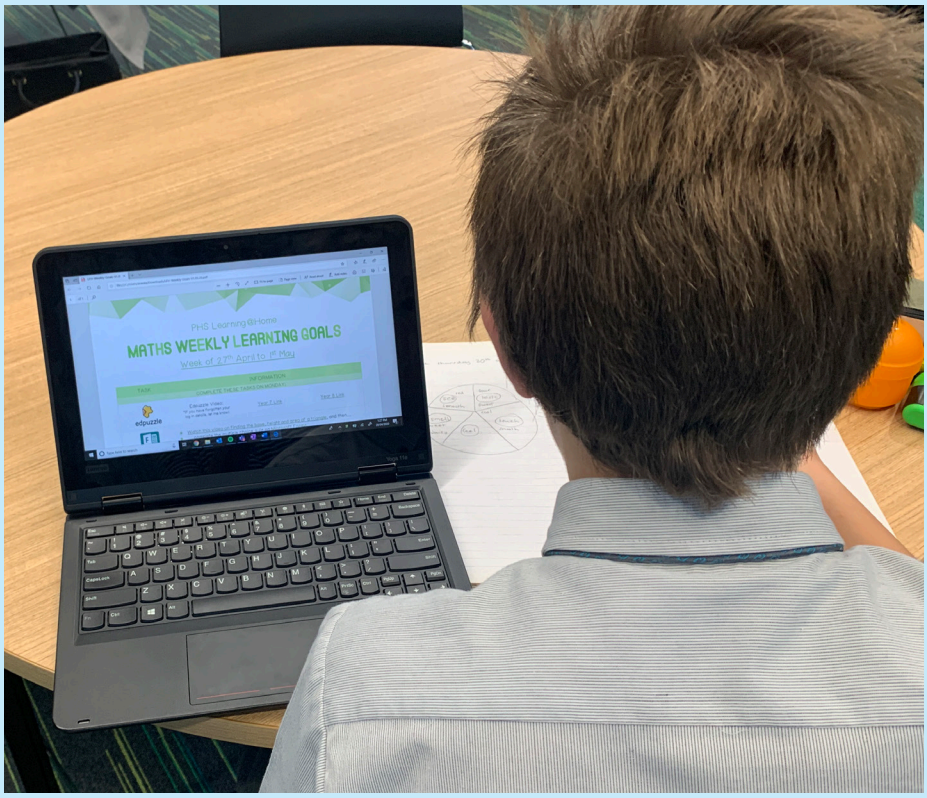
The maths team understands exactly where our students are at with their learning. Using a collaborative spreadsheet, we track every student, noting which tasks are assigned, attempted and completed. We ensure this spreadsheet is accurate at the end of each day, providing data that allows us to assign extension tasks and take note of students requiring targeted support. We offer this support by setting up a personal meeting space using the calendar function in Teams.

We have been astounded at how well most students quickly adapted to managing their own time, with us by their side. The mathematics team, were available at the same time each day, setting a routine for students that mornings are for mathematics. We didn't just wait for students to contact us; we proactively and reached out to them. Our afternoons were spent providing feedback, filming YouTube videos and designing engaging self-directed projects.

All students are expected to complete a minimum standard and amount of learning, which reflected the challenging situation of learning at home. Our team encouraged all students to embrace extension work and proactively seek it. This gave us freedom to explore new opportunities, such as entering students into a global mathematics puzzle competition.

Effective use of technology facilitates direct and efficient communication with individual students. We easily transitioned from helping Student A find the area of a triangle to prompt Student B with a video that helped them find the rule for a quadratic sequence to define the number of playing cards needed to create towers of increasing height. At Prahran High School, our students use Khan Academy to complement their in-class learning. Having pre-established routines around digital learning in mathematics did set us up well for the transition. For the students, this sort of stability was reassuring. We observed significant (>90%) task completion on Khan Academy, including many students working through extension tasks.

To enrich the procedural learning of Khan Academy we designed unique problem based learning tasks specific to the isolation context. For example, all students began the term with a task scaffolding them through the creation, analysis and review of a personalised Learning@Home timetable. This was uploaded to Teams as an editable document and delivered through the assignments function. During test runs, this process ran smoothly, but bandwidth issues, Windows illiteracy (i.e. the iPad effect), and varying technical glitches made the process with students more cumbersome. Indeed, trying to establish new technological routines has proved challenging. What did our team learn from this? We are resolute



that as a mathematics team we must also embrace the teaching of digital literacy and prepare our students to be efficient and effective users of technology.

Over Term 2, teachers at Prahran High School used digital whiteboards, online polls, collaborative documents and more to inspire students. However, there were inherent constraints with digital platforms that have, at times, reduced the vibrancy of a humming classroom. Some of the typical tools at teachers' disposal are blunted and students' intrinsic motivations and eagerness to learn are coming to the fore.

Online learning presented a juxtaposition between the challenges of providing differentiated explicit instruction in a digital classroom and the variety of professionally produced instructional videos at students' fingertips. Using Edpuzzle, we imported videos from YouTube and produced a set of accompanying questions that check for understanding at predetermined intervals throughout the video. Teachers can monitor whether, and for how long, students watched the video and assess responses via a user-friendly interface. We used our personal meeting spaces on Teams to invite students to share their screens with us to provide real-time, direct support and instruction. It became clear that some students thrived in this environment, accelerating their learning with innate curiosity and isolation. As a team we delight at the opportunity to 'take the lid off' with these students whilst we connect and motivate those who may be less enthused.

When our team is working at school, we are dynamic, collaborating daily to create targeted groups specific to the learning goal of each mathematics lesson. COVID-19 asked us to rise to a new challenge to continue our mission to see students thrive online. The process of the transition made us rethink how we meet the individual needs of our students. The return to the comfort of our classroom will see us armed with this advanced toolkit. As a team are more connected, enabling us to meet anytime, from anywhere. We have additional, concrete data of student learning progression to make more informed decisions on groupings. We have new routines around digital submission, transforming the way we do homework and preparing this generation of digital natives to be digital innovators.

EIGHTY, NINETY, TENTY, ELEVENTY...

James Tanton – Mathematician in residence at the Mathematical Association of America

Have you ever noticed how strange and fickle our English language is with regard to speaking mathematics? We'll happily say 'ninety' for nine tens, using the little *ty* as short for tens, but most people consider saying 'eleventy' for eleven tens, the number 110, as simply absurd. (Yet, curiously, we'll happily say 'eleven hundred' or 'eleven thousand.')

Even within the range of acceptable 'groups of ten,' matters are still strange. For example, 'four-ty' must be written forty, even though the pronunciation is the same. We change 'three-ty' to thirty, 'two-ty' to twenty, and no one in their right mind would dare say 'one-ty' for ten.

Of course, there are solid historical reasons for the curious—if not confounding—twists and turns of our English language. (Old English allowed terms that express eleventy and twelvety thinking, and, of course, J.R.R. Tolkien popularised such terms in his *Lord of the Rings* trilogy.)

But freeing ourselves from societal conventions and quirks might actually aid mathematics teaching and learning. For example, imagine presenting the standard addition algorithm from left to right, just as students are expected to read in every other (English-speaking) class.

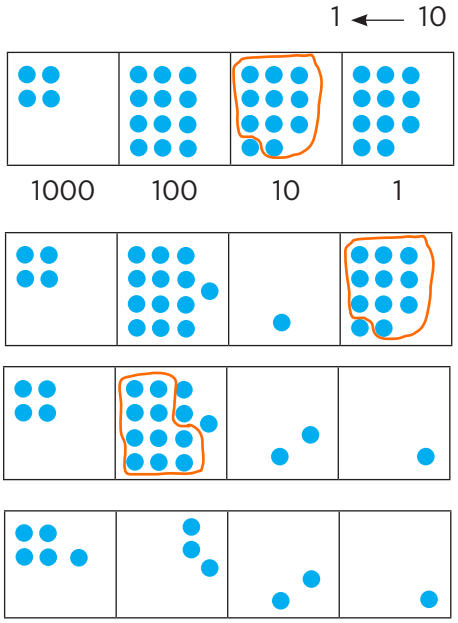
	3	5	6	2
+	1	7	5	9
	4	12	11	11

Long addition without regard to societal expectations

In the example, the answer *four-thousand, twelve-hundred, eleventy, eleven* sounds odd, and perhaps outright wrong, to our societal ears. But it is a mathematical fact nonetheless that six tens and five tens together make eleven tens, and so on. The final answer of 4|12|11|11 is rock solid and mathematically valid.

So, our challenge now is to 'fix up' this answer for society's sake, not for mathematics' sake, but society's sake. How might we do that?

If you play with a mathematical device as simple as an abacus or a row of boxes in the story of *Exploding Dots* it is clear what to do: if society expects a number less than ten in each decimal place, then just 'explode away' any undesirable extra groups of ten. That is, turn ten ones into one ten, ten tens into one hundred, and so on.



Ten dots 'explode' away to be replaced by one dot, one place to their left. Many curricula use the language of regrouping or carrying.
to be replaced by one dot, one place to their left.

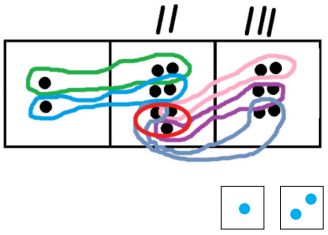
Of course, this is identical in mechanics to the traditional algorithm which starts from right to left and conducts all the 'explosions' as one goes along. But maybe now the mysteries of that algorithm are, well, no longer mysterious?

In fact, this visual of exploding dots (or beads on rods, or beans in cups) lays bare the workings of all the standard arithmetic algorithms. And this, in turn, makes much of typical high-school algebra somewhat trivial.

Curriculum mathematics is a beautiful story that connects kindergarten maths to primary school maths, to high school maths, and beyond, as one stunning whole. And we teachers are all in this together, presenting, unraveling and revealing this profound human enterprise with our fabulous students.

Primary school

$276 \div 12$
$= 23$



High school

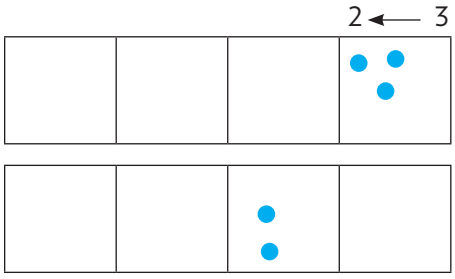
$(2x^2 + 7x + 6) \div (x + 2)$
$= 2x + 3$

Seeing long division visually.

And to give a taste of the 'beyond,' let's be quirky with our place-value representations!

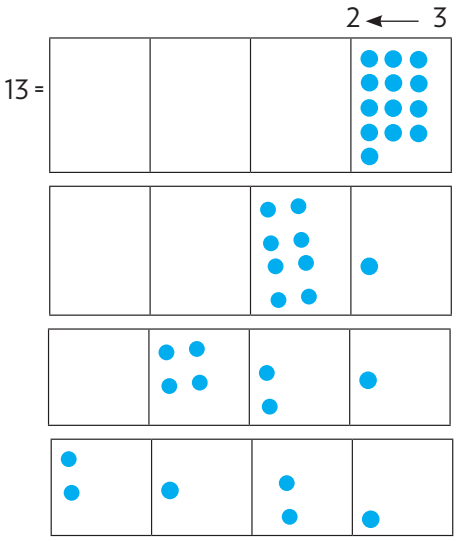
Instead of ten dots exploding away to be replaced by one dot, one place to their left, suppose we set just two dots to explode away, or three, or four? That will lead us to discover binary, ternary, and base four arithmetic in turn.

But let's be quirkier still. Suppose three dots explode away to be replaced by two dots, one place to their left?



In this 'machine', three dots in any box explode away, to be replaced by two dots, one place to their left.

Placing three dots into the rightmost box gives the code 0020 for the number three. (Let's ignore leading zeros and just write 20.) Placing six dots into the rightmost box gives the code 210 for the number six. The number seven has code 211, and thirteen has code 2121.



Thirteen has code 2121.

But here's the curious thing. Even if we don't know what these codes mean, we can still do correct mathematics in this system! In ordinary (base ten) arithmetic, 6 + 7 = 13. And in our quirky arithmetic, 210 + 211 is indeed 2121.

$$\begin{array}{rr} & 6 \\ + & 7 \\ \hline = & 1 \mid 3 \end{array}$$

$$\begin{array}{rr} & 2\ 1\ 0 \\ + & 2\ 1\ 1 \\ \hline = & 4 \mid 2 \mid 1 \quad = \quad 2 \mid 1 \mid 2 \mid 1 \end{array}$$

Ordinary arithmetic versus strange arithmetic.

Let me give it away by saying, 'Welcome to base one-and-a-half!'

The extent to which one can play with this *Exploding Dots* approach seems endless. And doing so has become a world-wide mathematics phenomenon: over 6 million students, teachers, and maths enthusiasts from over 150 countries have played with, taught with, and explored the magic of this dots-and-boxes imagery.

There is no such thing as 'elementary' mathematics. All mathematics, if thought deeply about, lingered on, mulled on, and deeply enjoyed unfurls into its own gateway to universal delight, awe, mystery and wonder.

We might have personal, and societal, quirks to contend with. But that is okay. Just remember that all good and correct mathematics is – lo and behold – good and correct. All thinking serves as a portal to joy. So ... enjoy!

REFERENCES

www.explodingdots.org

James Tanton will present at MAV's 2020 annual conference, he'll speak on Exploding Dots during his keynote and will run two workshops: Pattens and Pencil Pushing. Register for the conference at www.mav.vic.edu.au.

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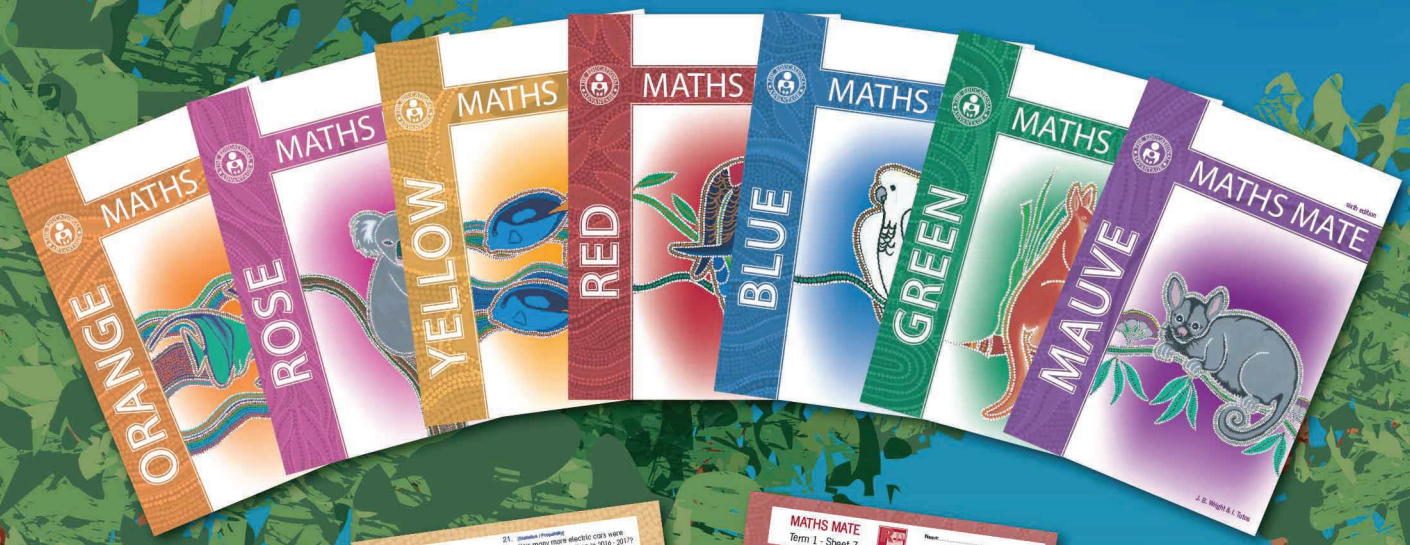

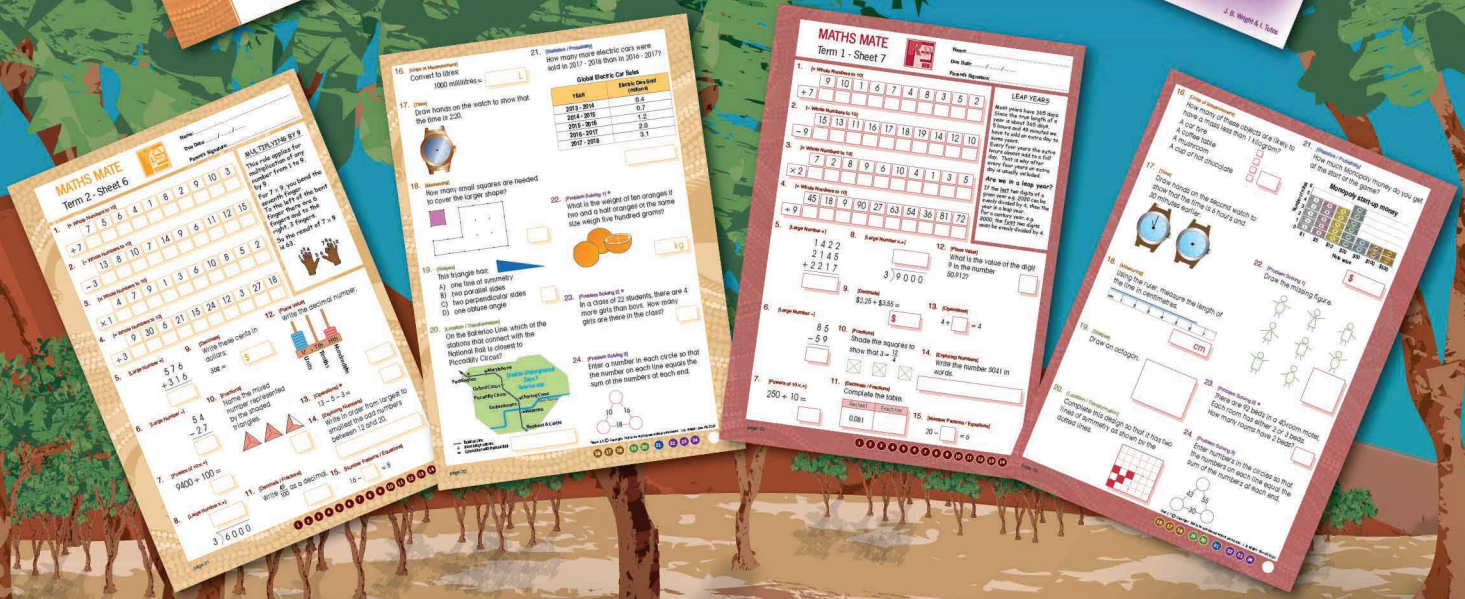

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REMOTE LEARNING JOURNEY

Robyn Twyford – Assistant principal, Templestowe Park Primary School

Remote learning has been a learning journey for everyone involved – students, parents, support staff, teachers and leadership. It has not been a process of 'one size fits all' and whilst there may have been comparisons between some schools, everybody worked hard to try their best to accommodate the needs and constraints for their individual school communities.

CONSISTENCY

At Templestowe Park Primary School, remote learning was an evolving and carefully planned procedure. A number of our staff are the parents of school age children themselves, so we were able to apply the lens of a parent juggling things at home in every part of our planning. Right from the beginning, our school was determined to have consistency across all levels with our communication and delivery of the curriculum, which we take pride in during normal operations.

Our principal team created a *Staff working from home handbook* that laid out all of our considerations (including OHS and child safe requirements), decisions, communication protocols and our stages of implementation. The document was updated regularly as the situation evolved and more stages of our program were rolled out to the community. It ensured all staff were on the same page.

OUR PROGRAM

The Learning at Home program was created with the mindset that at the beginning of Term 2, we had no idea how 'the system' was going to handle so many students and people working from home across Victoria accessing the internet.

We definitely did not want to rely fully on an internet-based program, in case the system went down. Neither did we believe that students should sit in front of a screen for hours. Therefore, we planned written lessons that could be read, printed (if families chose to do this), and followed by students working in an exercise book. We needed to ensure all families had access to devices too.

We set out to utilise the systems we already have in place and extend them, for example, our Year 3-6 student have a BYOD iPad. Compass is our school management system, so it was obvious to keep all of our communication via that platform.

Although our message has been to 'log on to Compass regularly' for a number of years, it became vitally important that all parents take heed of this advice. Stage 1 saw us preparing the school community and ensuring each student was able to digitally access the learning. Students in Year 4-6 downloaded the Compass app onto their own devices. They became responsible for developing independence in accessing the daily program through their app. Many 'how to…' documents were produced which gave staff professional learning in using parts of the system that was new to them, as well as helping students to navigate remotely.

Year 3-6 students already have school accounts with our Google Suite for Education, where they regularly use Google Classroom and their Google Portfolios. Using their Gmail account attached to this was useful in communicating directly with their teacher.

For the Prep to Year 3 students, a new Weebly website was built with password protection. This meant only our school community could access the site. Each day, a year level specific program was uploaded using a consistent layout. Teachers planned together during the day via Google Meet, another aspect of the Google Suite.

By referring to the Department guidelines, we tried to mimic our core business areas of reading, writing, spelling and mathematics, always with the message to families of 'do as much or as little as you can'. Templates were made to ensure consistency across year levels. This was important in supporting parents to navigate the daily program.

Lessons were written with the expectation that Year Prep-3 would have an adult providing some assistance (not teaching), while Year 4-6 were written with the expectation that the students would work more independently. Activities were not worksheet driven, rather we kept our lesson format of outlining a learning intention and success criteria, followed by a task that required students to 'make or do'.

The remote learning resources produced by MAV were excellent in supporting simple, manageable maths tasks at home. Wherever possible, we tried to incorporate items students could easily access at home – Lego bricks, pasta or a deck of cards.

We viewed our specialist areas of STEM, visual arts, performing arts, Mandarin and physical education as playing a major part in students' well-being, by getting them up, moving and being creative. In the first three days of Term 2, each specialist area uploaded a short 10-15 minute activity, which moved to one task per week, per specialist as the term progressed. We had very positive feedback about this from students and their parents.

HITTING OUR STRIDES

Once we were confident our students were able to access their daily programs on both the Compass and Weebly platforms, we then moved to Stage 2. This included making short 1-3 minute videos for each year level. This began with a daily welcome video from the teacher, who outlined what they had planned for the students that day, happy birthday messages and words of encouragement. The videos (hosted by Vimeo) resulted in great feedback from the community, particularly from the younger grades – kids loved seeing and hearing from their teacher.

We embarked on making more demonstration and instructional videos for some of our activities, but the trick was to keep them short and sharp. Statistics gathered from viewing our videos showed that anything longer than five minutes, was not engaging enough for students to keep watching. Short demonstration videos also allowed students to go back and watch them multiple times for clarification, if needed.

Our Stage 3 roll out was to get all of our Prep-Year 2 students on board with their school Google Suite accounts, which would not normally be used by these year levels. The students, with help from parents, used Gmail accounts to have a purpose for writing to their teacher and sending photos of some of their work, whether it be of the amazing patterns they had made for maths or their writing from the day. By using our Gmail accounts, we did not fill up our Edumail accounts with big files either!

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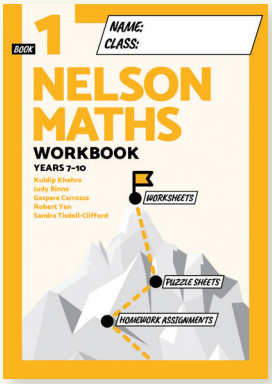

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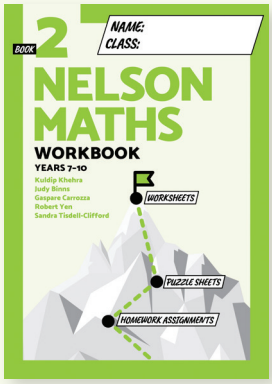
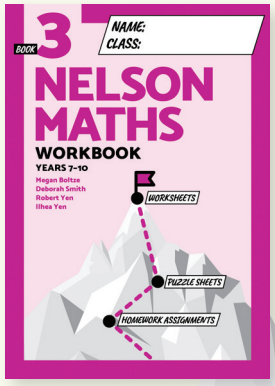


Available Term 4 2020



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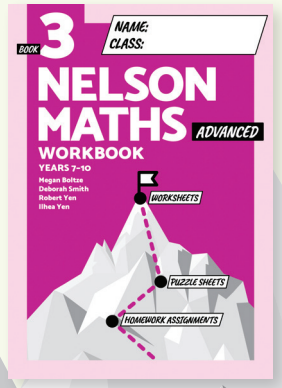

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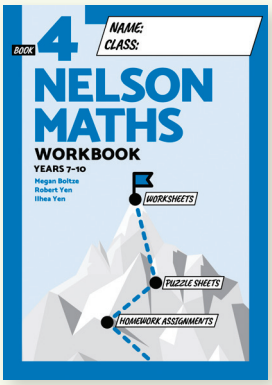

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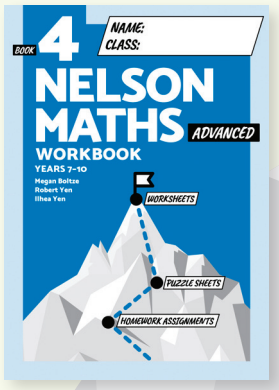

Available Term 2 2021

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As the weeks went on, learning tasks were set, rubrics created and students submitted work digitally and teachers gave constructive feedback.

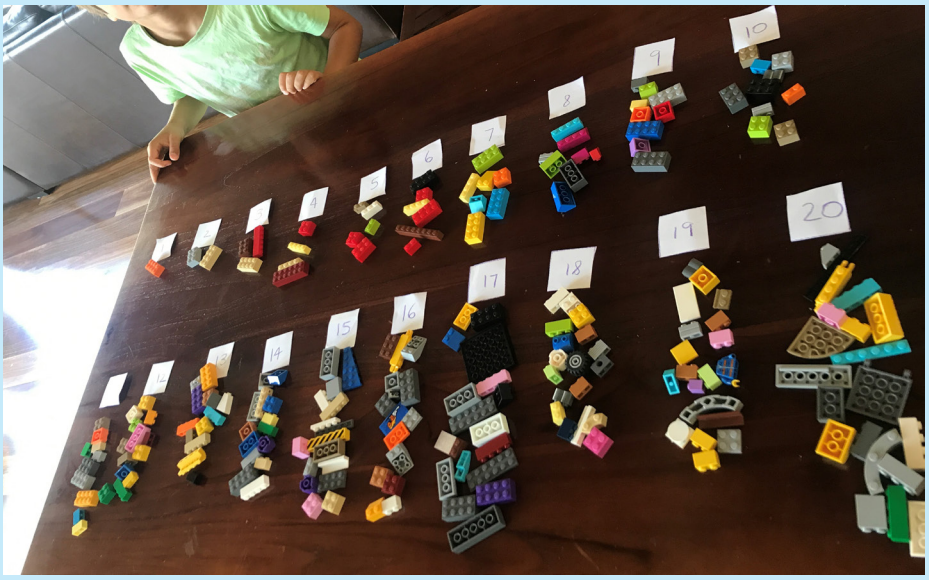
VIDEO CONFERENCING

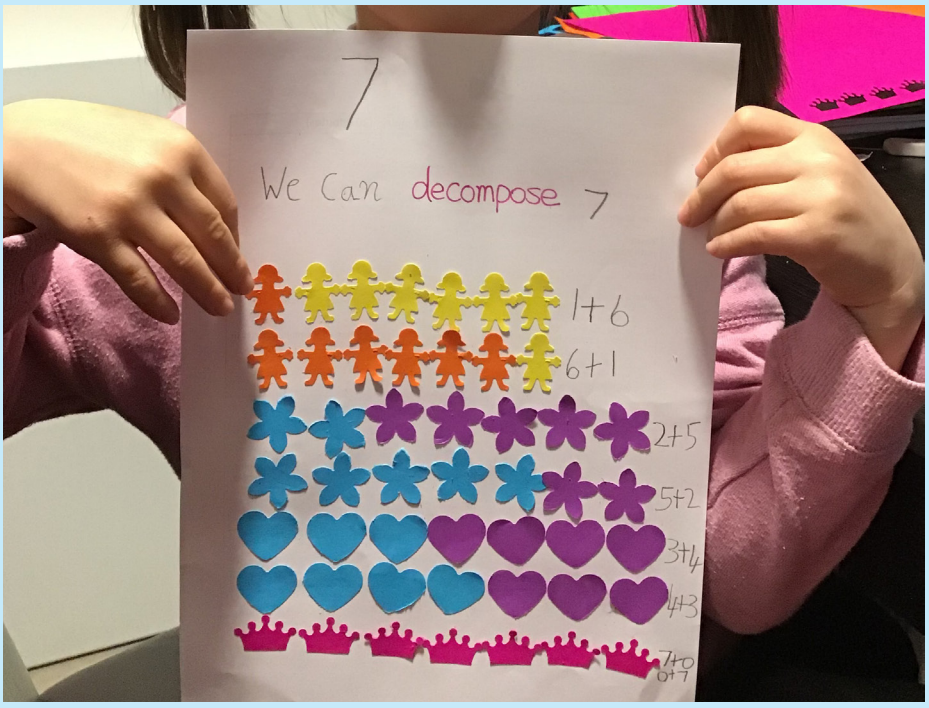
Our school is an eSmart accredited school and we are conscious of students following our acceptable use agreement when using digital devices. Parents were keen for the teachers to use video conferencing quickly, we felt strongly about our responsibility in making this a safe, secure and purposeful way of interacting. Protocols for staff and students were created and students were expected to engage in lessons that required them to know 'the rules' before they began. This helped to minimise potential mayhem of everyone talking at once, with the conferences having direction from the teacher. We used video conferencing as a way of checking in and connecting with the kids, not as a replacement for 'teaching' from the classroom. This was highly effective.

OUR LEARNINGS

It is difficult to please everybody. The feedback from the majority of families was overwhelmingly positive. For some, there was too much work, for others, not enough. This was largely dependent on their personal situation. Many were juggling working from home themselves, which meant they had the challenging task of trying to instruct and keep primary age children and younger siblings engaged.

The positives were the rapid learning that all of our teachers undertook with the digital aspect of the program. We were forced to learn and to sometimes do things a bit outside our comfort zone. Virtual meetings kept teachers and staff connected. Moving forward, We will definitely incorporate several learnings, such as the use of Google Classroom and demonstration videos. We intend to continue to develop more areas of Compass, in particular the possible use of learning tasks as part of our reporting process. One thing is for sure – our teachers are more appreciated. Parents saw first hand a snippet of what it was like to guide a child's learning in a more formalised way and some of them still can't believe we do it every day, multiplied by 20+ kids!





Samples of student work in the remote learning period.

Templestowe Park Primary School is a Maths Active School. To learn more about Maths Active accreditation, visit www.mav.vic.edu.au.

INVESTIGATION: NEAT AND TIDY

Bree Collins – Windsor Primary School and Danijela Draskovic – MAV's Mathematics education consultant

These open-ended tasks have been developed using the playful, quirky and eye-catching book, *The Art of Clean Up Life Made Neat and Tidy*.

The author, Ursus Wehrli, artfully captures everyday life materials and objects such as cars, food, maps, people, clothes and creatively organises, categorises and arranges them into tidy rows, leaving the reader amazed and amused.

There are multiple benefits for incorporating children's literature into mathematics lessons. Literature provides a meaningful context for children, it assists with concept and language development and supports students' development of the mathematical proficiencies of understanding, fluency, problem solving and reasoning (Schiro 1997). Seeing the astounding effect this picture book had on the students across my school at many different year levels, it was only natural to go searching for the mathematical tasks this book would lend itself to. Each page displays a messy, unorganised photograph coupled with a cleaned-up version of the image. A mathematical concept is evident on every page, providing a wonderful resource to create a sequence of open-ended engaging tasks.

THE TASK

Drawn by the vibrant array of colours on the washing lines, I selected pages 8 and 9 (pictured right) as the stimulus for my maths task. I introduced this task to a class of Foundation students at the end of Term 1. I was supporting a graduate teacher for the day and asked if I could take a risk and try this maths task, with a warning it could be a complete disaster! With her enthusiasm and open mind, we enlisted a few older students who were happy to assist for 10 minutes during recess to string up some washing lines using wool and twine between classroom chairs. I already had a decent size bag of small baby clothes, previously my daughters, in the office along with pegs.

The lesson began with a shared viewing of the book and for each page I chose a student to explain what the author had done to make the picture 'neat and tidy', with many of the pages providing brilliant opportunity for estimation.

The beauty of this book is you can add theatrics by leaving the kids in suspense for some of the 'wow' pages such as the fish fingers and playcentre ball pool.

I opened to the washing line page and explained this would be the image we would be focussing on for our maths lesson.

We spent time discussing the details of the image, estimating how many washing lines, approximating how many pegs and clothes on each line, determining colour categories and exploring the change in shadows on the ground. Next, I introduced the open-ended task and in small groups students eagerly dispersed to their washing lines to explore the activity. After adequate hands-on time, we reassembled, and I modelled how I expected the students to record their findings.

Students needed to draw and record as many possibilities as they could and write the total number of clothing items at the end of the washing line. At the Foundation level, I found it easier for most students to choose one item of clothing to draw to save time. The Year 1 students were capable of drawing a variety of clothing. Both year levels had access to manipulatives on their tables to support them with the task

Posing the problem

I counted the pegs on the washing line and there were 10 pegs, how many pieces of washing did I hang?

Enabling prompt

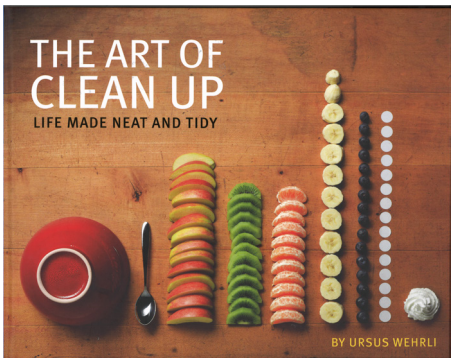
I counted the pegs on the washing line and there were 5 pegs, how many pieces of washing did I hang?

Extending prompt

I counted the pegs on the washing line and there were 16 pegs, how many pieces of washing did I hang?

CONCLUDING THOUGHTS

Although a few Foundation students struggled to draw simple washing items and accurately record their thinking, with the recording of numbers a particular challenge (as expected), all students gave it a good go and demonstrated some level of success. For many, the exploration play phrase of pegging the washing on the line in small teams was a rich learning experience.



Page 8

Page 9

The mathematical language used included: rows, groups of, pairs, how many, skip counting. This itself was a purposeful outcome.

Students were reminded constantly to check they had drawn 10 pegs before drawing the washing. Additionally, I wanted them to explore different representations with the pegs whether it be by ones, twos, patterns or odd/even combinations. The second part of the task demonstrated my expectation as a maths teacher that students must have a go at recording their problem solving. In the words of Rob Vingerhoets, in maths we always 'record, record, record'.

The second time I did this task in my Year 1 class, I was prepared with a few laminated

photocopies of the washing line page as students appreciated being able to examine and marvel at the image at their own tables and it sparked rich conversations.

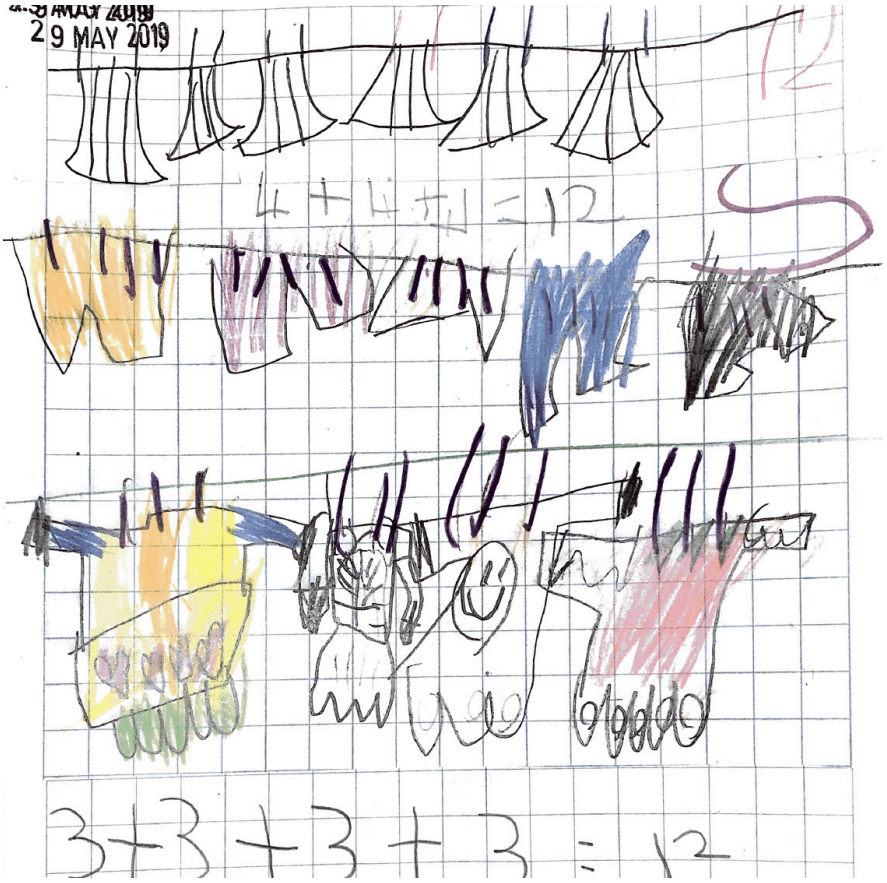
The number of pegs in the question was extended and varied from 12 to then 15, 18 and 24. During this lesson, I encouraged students to think and trial different ways of grouping their pegs while hanging on the line. Students began to use factors of 12 while hanging, which led to informal conversations about turn-around-facts which provided more solutions.

Many were confident to write the repeated addition number sentence and a few extension students recorded multiplication.

Revisiting the book, I asked the Year 1 students, 'Thinking like a mathematician, what questions could you pose about the washing line photograph?' Following some brainstorming time in pairs these are examples of what students shared:

- Can you order the washing biggest to smallest?
- How many pieces of washing could you fit on the line?
- Can you sort the clothes into colour groups?
- Guess how many clothes there are altogether
- What is the least number of pegs you could use for 20 pieces of washing?
- The shadows on the ground have changed, how long did it take for your washing to dry?

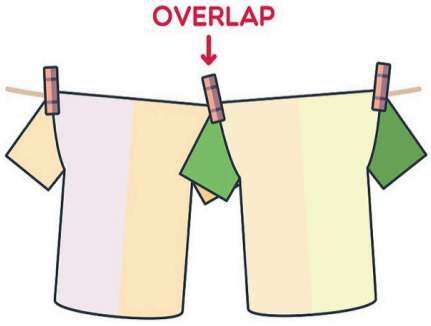
I was impressed with students' responses to this question. It demonstrated their capability to ask clever questions and think like mathematicians. Furthermore, it fosters a wonderful opportunity to provide students time to investigate their own questions and articulate their mathematical ability. I set them the challenge over the weekend to find anything around the house or garden that they could make neat and tidy then challenge a family member to explain the maths in the arrangement!



A Year 1 student arranges his pegs using factors of 12 recording using repeated addition.

EXTENDING INTO SECONDARY LEVEL ALGEBRA

You hang t-shirts and pants so that you have an overlap and save pegs like this:



You hang socks in pairs like this:

How many pegs would you need if you had:

- 2 t-shirts and 2 socks?
- 9 t-shirts and 6 socks?
- 10 t-shirts and 7 socks?
- x t-shirts and y socks?

Developing rules for n clothes

- what if there were only t-shirts (how many variables?)
- what if there were t-shirts and socks (how many variables?)
- what if there were t-shirts, socks and towels (how many variables?)
- what if there was a limit to how many items you could put on one clothes line?

REFERENCE

Schiro, M. S. (1997). *Integrating children's literature and mathematics in the classroom: Children as meaning makers, problem solvers, and literary critics.* New York: Teachers College Press.

INVESTIGATIONS

Ellen Corovic, Jennifer Bowden, Helen Haralambous and Danijela Draskovic – MAV's Mathematics education consultants

FOUNDATION - YEAR 2

PREDICTING TIME

Using the image to predict the following. Record by drawing or writing your answers.

What might have happened....

- 1 minute before?
- 1 minute after?
- 1 hour before?
- 1 hour after?

YEAR 3 - YEAR 6

TIME FOR A BATH

It takes 1 hour to fill a 100 litre bathtub with water, how long would it take to fill two 10 litre buckets from the same tap?

Explain your working out with drawings, numbers, equations and/or words.

Enabling support: what if it took 60 minutes to fill a 100 litre bathtub, how long would it then take to fill up 2 twenty five litre buckets of water?

Extending prompt: If it takes 1 hour and 15 minutes to fill up a 100 litre bathtub, how long would it take to collect enough water to fill four 5 litre water bottles?

YEAR 7 - YEAR 9

AUSTRALIAN TIME ZONES

Victoria, South Australia and Western Australia do not agree what time 6am is.

Investigate Australian time zones and complete this table to indicate comparable time with each of the other states and territories during non-daylight savings time. i.e. if it is 6am in Victoria, what time is it in South Australia?

Further support: www.worldtimezone.com/time-australia.htm

Watch https://education.abc.net.au/home#!/media/1950553/how-many-time-zones-are-there-in-australia

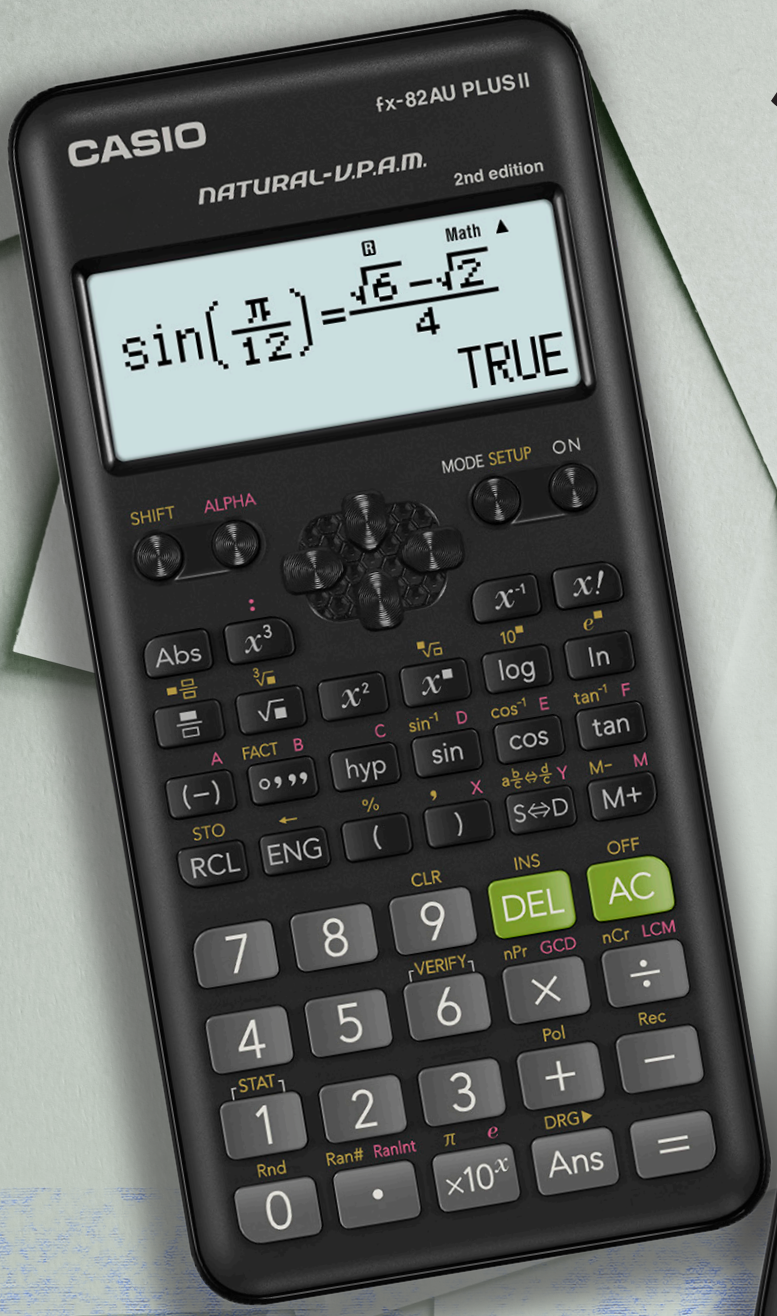
What are some of the challenges with Australia's current time zones?

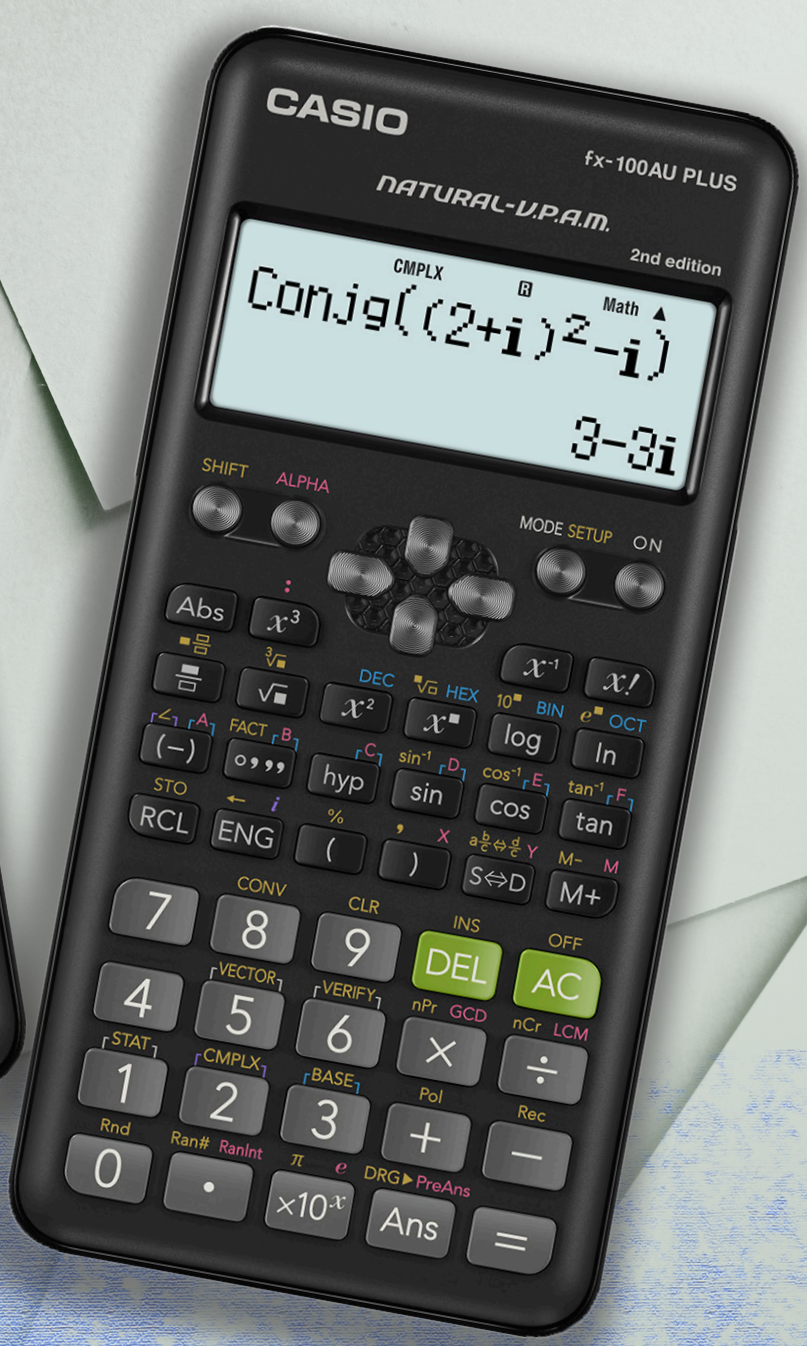
VIC	NSW	QLD	TAS	NT	SA	WA
6am						

Images from Pixabay, Gundula Vogel (bubbles), Alexas_Fotos (tap).

CASIO
CALCULATORS

Just landed.





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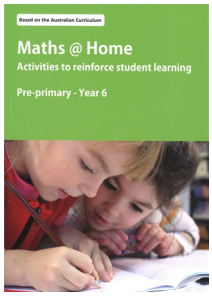


MATHS @ HOME

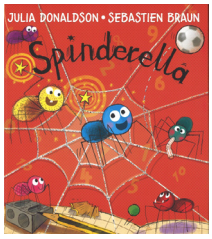
F–6

Parents often go to great lengths to help their children succeed in their education. Unfortunately many parents believe that helping their children with mathematics is beyond their abilities. For some, learning mathematics was a dull and uninspiring experience that they are not keen to revisit. For others, the mention of mathematics is associated with a profound sense of fear or anxiety.

Fortunately a rapidly growing body of scientific research has led educators to question much of what they thought they knew about the teaching and learning of mathematics. Teachers and parents now have a shared responsibility to ensure that in future students can learn mathematics with confidence and understanding.

This Parent Guide was developed by the Mathematical Association of Western Australia. It is designed to assist parents who wish to ensure that their children are capable and confident users of mathematics.

$16.70 (MEMBER)
$20.88 (NON MEMBER)



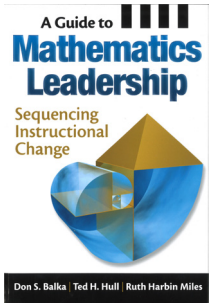
SPINDERELLA

F–4

A fantastic new picture book all about a football-playing spider, written by Julia Donaldson, author of *The Gruffalo*, with glorious full colour illustrations from the talented Sebastien Braun and a sparkling, glittery foiled cover.

Spinderella the spider has a passion for football! She tries to play a match with her brothers and sisters but she doesn't know how many spiders should be on each team. Even worse, she can't count the goals! Luckily for Spinderella, her Hairy Godmother has a plan... Julia Donaldson does it again in this hugely engaging and funny story all about football, spiders and counting - what's not to love! The perfect picture book for children of all ages.

$19.42 (MEMBER)
$24.28 (NON MEMBER)



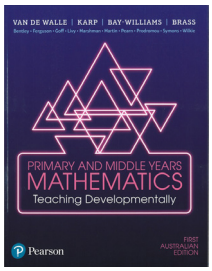
A GUIDE TO MATHEMATICS LEADERSHIP

K–VCE

This book helps mathematics leaders build a high-quality instructional programme based upon the five principles identified by the National Council of Teachers of Mathematics (NCTM, 2000)

- equity
- curriculum
- teaching, and
- learning, and assessment.

$43.09 (MEMBER)
$53.86 (NON-MEMBER)



PRIMARY AND MIDDLE YEARS MATHEMATICS: TEACHING DEVELOPMENTALLY

F–9

This text is targeted towards teaching primary and middle years mathematics units in the Bachelor of Education degree.It illustrates how children learn mathematics, and then shows pre-service teachers the most effective methods of teaching mathematics through hands-on, problem-based activities.

The book serves as a go-to reference for the mathematics content suggested for Foundation to Year 9 as recommended in the Australian Curriculum: Mathematics (ACARA, 2016), and for the research-based strategies that illustrate how students best learn this content. This text presents a practical resource of robust, problem-based activities and tasks that can engage students in the use of significant mathematical concepts and skills. It reports on technology that makes teaching mathematics in a problem-based approach more visible, including access to ready-to-use activity pages and references to quality websites.

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