THE MATHEMATICAL ASSOCIATION OF VICTORIA

THE COMMON DENOMINATOR 3/18

COUNTING THE LANGUAGE OF MATHS

INSIDE

Ellen Corovic, Mathematics education consultant, MAV

Children commence school with the ability to problem solve in mathematics. They can tell which cookie is biggest, work out who is the tallest, count the members of their family, know their age, understand soon, now and tomorrow, work out who is the fastest runner - and many more mathematical ideas. If you aren't truly sure that young students can do the above, simply provide them with an unequal share of toys or treats and they will quickly let you know that 'it's not fair!'.

Early childhood settings have an enormous opportunity to expose children to the language of mathematics and to build upon their early mathematical understandings. There is great opportunity due to the nature of the program developed for early years children to explore mathematics through play. Whether it be digging in the sandpit, role-playing in the home corner, constructing buildings with blocks or exploring materials at the craft table; each of

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FROM THE PRESIDENT

Michaela Epstein

Hello! I'm so glad you've come across *Common Denominator*, one of the publications that MAV regularly publishes. Did you know that publications like this one are just a small part of the work that MAV does across the mathematics education community? It wasn't until I joined Council that I started to learn just how far-reaching the Association's operations are. To give you an insight, in this column I'm sharing three key ways that you can get the most out of what's on offer at MAV.

First, to support the work that schools do, MAV runs an array of regular events and opportunities that connect students with different ways of thinking about and experiencing mathematics. From the Maths Talent Quest, which attracts approximately 20,000 students each year, to the Made By Maths app that teachers or parents can access via a smartphone, there is something available for students of all ages.

Second, as a teacher and educator you can take part in different ways to develop and refine your professional expertise. In addition to the end-of-year extravaganza that is MAVCON, a range of opportunities exist for those who are new to the field and those with years of experience. For example, MAV primary and secondary consultants work directly with schools for short or extended periods of time on tailored programs that are designed to best suit the needs of each school. You can also get your voice out to the community. If you have stories to share of impactful practices, new programs or ideas that you're delving into, the publications *Common Denominator*, *Prime Number* and *Vinculum* are always after new writers.

Finally, the third way to benefit from MAV is via the professional networks that you can access. MAV brings together thousands of primary and secondary teachers, academics and others every year at a range of events. If you are keen to connect with like-minded individuals or people who can provide fresh perspectives and ideas, there is plenty of opportunity.

Tying the three above areas together, is goal 1 of the new strategic plan. Over the next three years, the Association will be talking to members and analysing data from our operations to ensure that all mathematics educators – no matter where in Victoria or at what level of education – gain benefit from MAV.

On a final note, I would like to welcome Kylie Slaney who is joining Council for the first time and to welcome back Max Stephens. We are grateful for the time and expertise you are giving.

MAV COUNCIL

At the AGM in May 2018, the MAV Council was appointed for the coming year. Michaela Epstein, MAV President launched the MAV's strategic plan for 2018 to 2020. You can find out more about the strategic plan on page 12.

The newly appointed Council provides a strong level of consistency with the core Executive group continuing with many of the same councillors. MAV welcomes two new councillors: Max Stephens returns to the fold. Max is a long-time supporter of MAV and life member, who has held various positions on Council previously. Kylie Slaney from Bialik College joins as a councillor, with experience in teaching mathematics and as an engineer.

Kylie's passion is encouraging students to think of the possibilities for themselves within STEM, and linking mathematics to engineering, the sciences, robotics and everyday life.

Trish Jelbart, Felicity Furey, James Gray and Terence Mills retired from Council at the conclusion of the 2017 -2018 Council year.

The 2018 to 2019 Council is: Michaela Epstein (President), Jim Spithill (Immediate Past President), Michael O'Connor (Vice President), Max Stephens (Secretary), Juan Ospina Leon (Treasurer), Daniel Cloney, Ann Downton, Allason McNamara, Thomas Moore, Claire Delaney, Peter Karakoussis and Kylie Slaney.

COUNTING THE LANGUAGE OF MATHS

Ellen Corovic, Mathematics education consultant, MAV

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these experiences leads to the capacity to further develop children's mathematical understandings.

So, what should educators be looking for and how can they build upon children's prior understandings of counting?

Many children learn to count by rote at this age. They can often recall the order of numbers increasingly to ten and then beyond. Errors often occur including missing numbers or saying the numbers in a different order (Pearn, 2018). In addition, children begin to understand the idea of one-to-one correspondence, that is one count for one item. However again errors can occur when children count at a different pace to touching/pointing to the objects, they recount items already counted or confuse the number counting sequence (Pearn, 2018).

These two ideas are critical as part of understanding the big idea of counting, however there are two more equally critical ideas (Siemon, Beswick, Clark, R, & Warren, 2015). That of cardinality and secondly the last number when counting a collection is the quantity of the group. Here is a table outlining Siemon et al., (2015) key concepts of developing counting along with tips for practise. Initially children should explore all the key ideas to five before moving to 10 and beyond (Victorian Curriculum and Assessment Authority, 2018).

Other ideas that children could be exposed to in counting at this age are:

- What comes next or after?
- What goes before?
- More and less

Counting in the early years is more than just rote counting the number naming sequence. 'The knowledge and skills that children develop in the early years are crucial to their later progress – and this is especially the case for mathematics .' (Mikakos, 2016).

Through play, exploration and modelling, children can further develop their knowledge of how counting works and therefore lay the foundation of future successful learning in mathematics.

Key concept	What does it mean	In practise
Know the number naming sequence	Do students know the names of number in order?	Provide opportunities to count through song, rhyme, and practise. Count all sorts of objects together. Incorporate counting when packing up e.g. blocks and beads.
Match the number to objects (one-to-one correspondence)	Can children match the name of the number with the quantity?	Provide opportunities to count collections moving or touching an object each time a number is said.
Cardinality	Do children recognise the number of objects in the group is the size of the group?	Provide lots of opportunities to visualise and create the numbers initially one to five. Four can look like the dots on a dice or four dots in a line. Four can be made of feathers, rocks or fingers.
The last number says the count	When counting a collection of objects, do children recognise that the last number they say is the total of the collection?	Count, count and count. Model counting with the follow question (or variations of) of 'how many items were in the collection'. In addition, count a small collection together, then rearrange the collection and again ask how many there are. Continue until students understand that rearranging does not affect the total.

Key concepts of developing counting along with tips for practise. Siemon et al., (2015).

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For support building mathematical language in your early years setting, contact Jen Bowden, jbowden@mav.vic.edu.au or phone 9380 2399.

MATHS: LET'S TALK ABOUT IT

Josh Shuttleworth, Alex Berry and Stephanie Huynh - Derrimut Primary School

LAUNCH: WHAT WAS THE PROBLEM?

'I did it in my head.' .... 'I just know it.' ....'Because.'

These responses, as well as the ever-present 'deer in the headlights' expression, are commonly observed whenever students are asked to explain their mathematical thinking. At Derrimut Primary School, we endeavoured to support our students to learn how to reason (one of the four proficiencies) so that they could deepen their mathematical understanding.

Aware that any change in the classroom can be met with resistance, we wanted to trial our new technique in one year level so we could answer some of the 'what if?' questions from our staff.

To work out what these questions might be, we decided to trial Number Talks in a place where anything and everything can go wrong - the Prep classroom. We were lucky to have the support of MAV education consultant Ellen Corovic who helped to guide through the implementation.

EXPLORE: WHAT DID WE DO? WHAT WORKED WELL? WHAT DIDN'T?

A Number Talk is a pedagogical tool. It is a student-led discussion in which students trial, articulate and learn strategies to solve a single-answer problem in a safe, collaborative space.

We found that for Prep students it was effective to sit in a circle (teacher as part of the circle) and display the problem visually on a board. We used large paper in the centre of the circle to scribe visual representations on as students explained their strategies.

We began our Number Talks by setting up the expectations with the learners around what a number talk is and how it is run:

- Students are the teachers
- The teacher is quiet
- Thumbs up once you have solved the problem
- Only one person talking at a time (person with the ball)
- Everybody has eyes and ears on the person speaking.

It was important to explicitly set up these expectations from the outset so that students knew how to participate effectively. We wanted to incorporate special signals such as thumbs up and the ball as a 'talking token' so that it felt different to other learning experiences and that students knew in this space they were in charge of the teaching.

We developed and refined a checklist for ourselves as teachers on how to effectively facilitate the Number Talk:

- Reveal problem when all students are silent and ready
- Teacher only talks to prompt or redirect conversation back using the question 'how does this make sense to you?'
- Ensure students have wait-time to unpack their thinking
- No judgement in the teacher's voice (indicating correct/ incorrect), just acknowledgement of student responses by saying 'ok' after a student contribution
- Teacher scribes visually once the student has finished explaining their thinking, e.g. Student says there are 3 on that side and 3 on that side, 3 and 3 makes 6. We would draw 3 dots and group them with a circle around them, then draw a circle around the other 3 dots to indicate the student's way of working out how many. We found it difficult to scribe while students were explaining, and on some occasions it resulted in lots of incorrect reasoning on our Number Talks anchor charts.
- Using a ball that students can roll to others who have their hand up, students only talk when they hold the ball (as we reflected on our trials we realised we sometimes needed to point to where the ball should go next so that all students were contributing).

We later introduced 'how does what [name] said make sense to you? (so that students would begin to discuss each others' strategies and build on them/prove/ disprove them).

SUMMARY

We believe that our venture into Number Talks was a successful one. We began building students' confidence in and ability to explain their thinking in a safe space. We are continuing to embed Number Talks into

our lessons so that our students become more confident in their reasoning abilities and so that we can fine-tune the Number Talks process.

For those of you who are keen to trial Number Talks in your own schools, we have developed some guidelines, but feel free to modify these to suit your own situation.

Teachers will need	Students will need
• A well-chosen problem that lends itself to using different strategies. If it's too easy, everyone will agree straight away. If it's too hard, it will stifle the conversation. • To know the mathematical vocab to connect to student-constructed strategies. For example, 'Does anyone know the name of this strategy? Mathematicians call Shaun's strategy the 'Count On' strategy'.' • Questions to ask students to guide the conversation. • A classroom where students feel safe to share their ideas. • A willingness to 'Get off the stage'. This will mean stepping back, embracing long silences, and asking questions of your students instead of jumping in to save them.	• The vocabulary to respectfully respond to another student's ideas. For example, 'I disagree with Anna because...', 'I think that Megan is trying to...' • Vocabulary to discuss their ideas. It's OK if students aren't using the technical terms, as you can introduce these terms to them as they come up in the conversation. • To know what Number Talks are and what their roles are within them. If they understand a problem, their role is to explain it to others. If they don't understand, their role is to listen to others and build their understanding. • Plenty of think time. If students see that only the fastest students' ideas are chosen, they may become disheartened and see their role as a passive observer rather than an active participant.

REFLECTIONS

Alex Berry (Prep teacher)

As we were introducing students to the structure and expectations of Number Talks we found it important to keep the problem accessible, clear and of a consistent type throughout the first five sessions we ran.

It was powerful to reflect on my own interjections as a teacher when limiting my prompts to 'how does this make sense to you?' and ensuring I have non-judgemental acknowledgement of student responses. It surprised me how articulate the students were when given adequate wait time and the full attention of their peers and just how many different ways they saw the problem and figured it out. It is an effective tool as the onus is on the students to be the 'teachers' explaining to the group how to solve the problem.

It was useful in developing students' ability and confidence in articulating their thinking. It is an effective pedagogy to address misconceptions, have students learn different strategies to solve problems and to collect assessment on students' ability to apply strategies.

Steph Huynh (Prep teacher)

As a teacher, my aspiration is for students to see themselves as excellent mathematicians, where they can make sense of a problem with creativity, persistence, logic and reason. I found it challenging to design, support and assess learning that develops the four mathematical proficiencies until I was introduced to the pedagogy of Number Talks. I was excited to share this with my team and thrilled when they were on board, ready to trial it in our learning community.

We were very fortunate that we had the time to research and gain a deep understanding of what Number Talks are and the purpose for this pedagogical tool. We had many conversations about what it might look like with Prep students, wondering if our young cohort would engage in a Number Talk and curious as to which direction our students would take the conversation.

It's important to set up positive norms from the onset, so that students understood the focus of Number Talks as breaking down the process of a problem, rather than the answer. Video analysis allowed us to observe each other facilitate Number Talks and then reflect on our practise. It was an important learning tool for me to truly understand student misconceptions and see the power in the question, 'How does this make sense to you?' As students became more familiar with Number Talks, I saw increasing confidence in their ability to take charge of the conversation, eager to share strategies and even communicate how their peers made sense of a problem.

I understand that Number Talks is one pedagogy to elicit strong mathematical characteristics and skills in our students and should not be overused, but rather for the right context and purpose. I do love that it encourages different ways to look at problems and wholeheartedly celebrates our learners as excellent mathematicians.

Josh Shuttleworth (Year 3/4 teacher)

I observed and reflected on the work that our Prep teachers did and compares it to my own work with my Year 3/4 class. The biggest difference was the willingness of students to engage in the task.

While many of the Prep students were willing to explain their thinking in front of the group, there was a smaller percentage in the middle years. My assumption is that there are more students who have developed fixed ideas about who they are as mathematicians by in the middle years. For those who don't see themselves as strong mathematicians, they may feel like their ideas aren't worth sharing.

In the short-term, I would combat this by using Number Talks as a pedagogical tool in small-group workshops with like-ability students to build confidence in their reasoning ability.

In the long-term, I would love to see Number Talks becoming a frequently used tool from Prep. This would allow all students to build their confidence in sharing their ideas so that by the time they reach Year 6, a Number Talk would be a conversation among equals, rather than an opportunity to have the 'smart kids' passing down information to everyone else.

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CASIO®

INSPIRED BY AUSTRALIAN TEACHERS FOR AUSTRALIAN STUDENTS

LOVE MATHS? LOVE SURVEYING.

Surveying and spatial sciences rely on a robust understanding and love of mathematics. It's at the core of the discipline.

The fundamentals of trigonometry and geometry are key elements when determining the height of skyscrapers. They can also help model the effect of atmospheric interference on GPS satellite signals. Looking back further, surveying was used throughout history to develop societies and their infrastructure – the ancient Egyptians applied mathematical surveying techniques when constructing the pyramids.

However, many students who find maths engaging don't really know what surveying is, or how mathematics plays a role.

WHAT DOES THIS MEAN FOR THE CLASSROOM?

There are practical ways to demonstrate the real-world power of surveying. The website alifewithoutlimits.com.au offers teachers in-depth mathematical resources that do just that. This offers maths teachers a unique opportunity to encourage students to learn about surveying – and its relation to mathematics.

These surveying activities are designed to be run with a class independently of a registered surveyor and require only basic measurement tools such as a tape measure and magnetic compass. Designed by NSW mathematics teachers with knowledge of the national curriculum, these lesson plans are suitable for Year 10.

THE FIRST STEPS

The activities included in these resources will see students taking a practical approach to learning – measuring heights using shadows, mapping a garden or the perimeter of a building, and marking a path through a minefield. With a focus on measurement and the outdoors, these activities are likely to capture the imaginations of any students with a keen interest in maths and geography.

The first lesson sees students measuring up an area – such as a basketball court or a recreation area – and tabling and mapping their findings.

They begin by sketching a rough draft of the space, marking each corner with a number. From here, students will determine the bearings and distances between each point. This will give them a set of measurements that they will put to grid paper to produce a more detailed map, using a scale of 1cm to 1m, or 1 : 100. Students are then encouraged to use this scale map to calculate the area of the region – showing their working, of course.

This is just the foundational activity of this set of maths and surveying activities. Building on this later in the lesson, students will create a map using miniCAD. This map creation software is free for school use, see http://minicad.mapsoft.com.au.

GETTING YOUR COPY

You can download this activity and many other resources – and get more information – when you visit http://alifewithoutlimits.com.au/maths-teacher-resources.

ANOTHER CHANCE TO LEARN ABOUT SURVEYING AND MATHS

To give students the opportunity to get hands-on with surveying, RMIT University is hosting free monthly Experience Surveying Days throughout 2018. Held in Fairfield at RMIT's university field station, these afternoons enable students from Year 10-12 engage with industry equipment like laser scanners, total stations and GPS systems to solve maths problems.

For further details about how to book and what the days include, head to http://alifewithoutlimits.com.au/rmit-experience-surveying-day.

TEACHERS CREATING IMPACT

The Mathematical Association of Victoria is pleased to announce the MAV18 conference keynote speakers. This year the conference will focus on best practice, new ideas and innovative approaches around how:

- sharing action research and evidence is improving practice
- technology can be used as a valuable tool to support teaching and learning
- critical and creative thinking can be embedded into the classroom
- networks and communities of practice can support excellence and improvement.

DR ALAN FINKEL AO: AUSTRALIA'S CHIEF SCIENTIST

Dr Finkel commenced as eighth Australia's Chief Scientist in January 2016. Prior to this, he was the eighth Chancellor of Monash University and the eighth President of the Australian Academy of Technology and Engineering (ATSE). As Chief Scientist, Dr Finkel has led the Review into the National Electricity Market ('Finkel Review') and the 2016 National Research Infrastructure Roadmap. He leads the STEM Industry Partnership Forum for the COAG Education Council and serves as the Deputy Chair of Innovation and Science Australia.

PROFESSOR ROBYN JORGENSEN

Robyn is a Professor of Education: Equity and Pedagogy at the University of Canberra. Her work in mathematics education has focused on equity and how practices can either contribute to, or change, the learning outcomes for students who have been traditionally marginalised or excluded from participating in mathematics. She has focused her research on low SES communities, rural/regional communities; and Indigenous communities, particularly communities in remote areas.

PROFESSOR TOM LOWRIE

Tom is a Centenary Professor, the Director of the STEM Education Research Centre (SERC) at the University of Canberra, and the current President of the Mathematics Education Research Group of Australasia (MERGA). Tom has a well-established international research profile in the discipline area of mathematics education. His concentrated and sustained body of work has focused on the extent to which primary-aged students use spatial reasoning and visual imagery to solve mathematics problems and the role and nature of graphics in mathematics assessment. More recently, his research has expanded to include students' use of digital tools and dynamic imagery to solve problems.

DR JAMES RUSSO

James is a lecturer and early career researcher at Monash University. He worked part-time as a mathematics specialist in primary schools whilst undertaking his PhD, which he completed in 2017. James is passionate about making mathematics more enjoyable to teach and learn, and in strengthening connections between research and practice. He has published prolifically in teacher practitioner journals both nationally and internationally, with over 40 contributions since 2015, and has recently become editor of the MAV journal *Prime Number*. He is committed to working at the intersection of research and practice; helping to translate academic literature into practical teaching ideas, and ensuring that mathematics education research is both informed by, and informs, classroom teacher practice.

DR TRACEY MUIR

Tracey is an Associate Professor in Mathematics Education at the University of Tasmania. Her research interests include effective teaching for numeracy, problem solving in mathematics, parental involvement in mathematics education, student engagement in mathematics, teachers' use of ICT in the teaching of mathematics, flipping the mathematics classroom and mathematical practices that promote reasoning and personalised learning. She is a co-author of two books and has presented seminars and workshops at state, national and international conferences and is particularly passionate about working with teachers to engage their students in mathematics and to enhance their classroom numeracy practices.

ROB PROFFITT-WHITE

Rob is a Principal Education Advisor for Australian Curriculum Mathematics, Queensland Department of Education and Training. His creativity and determination for bringing research informed practices to the classroom and his ability to revitalise teachers and school leaders across diverse school cultures has been recognised with two Queensland School of the Year awards and opportunities to present the work at AAMT, ACER and MERGA.

LEONIE ANSTEY

Leonie Anstey is an Educational Consultant in Instructional Leadership and Mathematics and Numeracy Education. She currently holds a Masters in Mathematics Education, based on research of the skills and knowledge for mathematics teacher coaching. Leonie was a Principal in South Gippsland for six years and has worked as a teacher/principal coach for five years. Leonie's teaching background includes senior secondary (mathematics/physics), primary and she has supported pre-schools to implement challenging learning literacy/numeracy.

NICOLA YELLAND

Nicola is the Professor of Early Childhood Studies in the College of Education, Psychology and Social Work at Flinders University in Adelaide, South Australia. Her teaching and research interests have been related to the use of new technologies in school and community contexts. She has also worked in East Asia and examined the culture and curriculum of early childhood settings. Nicola's work engages with educational issues with regard to varying social, economic and political conditions and thus requires multidisciplinary perspectives.

EDDIE WOO

Eddie is the 2018 Australian Local Hero Award recipient. His enthusiasm for mathematics education is infectious. He feels privileged every day to be working with young people to help them grow and flourish and find their place in the world. Eddie began uploading videos of his maths classes in 2012 to YouTube in an attempt to help a sick child in his class. Eddie now has over 300,000 subscribers.

Checkout his wootube
https://misterwootube.com

Visit www.mav.vic.edu.au/conference to see session details, full biographies for the keynote presenters and information on how to register.

PROBLEM SOLVING WITH RICH TASKS

Michael Nelson - Teaching and learning coordinator, Portarlington Primary School

A common refrain from many teachers of mathematics is the desire for their students to be greater problem solvers. However, the issue facing many of those teachers is how to choose appropriate problem questions for their students. A problem question is one in which the solution is not readily available (Booker et al, 2014).

Thus, in a classroom where there is a wide range of student ability, what is a problem question for one student is an exercise for another. One alternative is to provide a series of questions, targeted at all levels. A more engaging and enjoyable approach is the use of a low floor/high ceiling task.

Real life mathematical problems are full of opportunities for students to explore different aspects of mathematics. The Collatz Conjecture, otherwise known as the Hailstone Sequence due to the up and down nature of the pattern, is a rich task worth exploring with your students. Curriculum wise, students are required to demonstrate an understanding of the four operations as well as the order of the operations, as well entering into algebra for those students who are ready.

THE COLLATZ CONJECTURE

This task was given to students in Year 5/6 who had had limited exposure to problem solving and certainly never in this form. To fully engage your students in the 'unknown' aspect of problem solving, the traditional method of introducing the skill first to your students is not necessary. Rather, an example of the pattern was shown to the student, in this case the numbers 20-10-5-16-8-4-2-1 and the rule that the pattern terminates when it hits one, without any further explanation. They were then exposed to Polya's problem solving approach (Booker et al, 2014):

1. Understand the problem
2. Devise a plan
3. Carry out the plan
4. Look back

Once they knew the steps they were required to complete, they were sent off to work collaboratively. A significant amount of struggle occurred as students attempted to approach the problem using a purely abstract approach. An element of the conjecture that requires students to think

deeper than they normally would when solving simple worded problems, is that the conjecture is multi step, in that two different rules are used. This proved a difficult obstacle for students to overcome.

When students had approximately 5-10 minutes of struggle time, students were brought back to the floor to discuss their situation. A lot of them were lost for ideas on how to approach the problem other than by trying and adjusting using mental operations. In each case, one operation was used for the first number, then simply repeated for each of the following numbers.

Students were reminded of the problem solving approaches outlined by Booker:

- drawing a diagram or graph
- using materials
- making a table or list
- backtracking
- working forwards
- looking for a pattern
- thinking of a similar problem
- trying and adjusting/specialising
- acting out the problem
- using smaller numbers

This prompted students to try a more hands on approach, with the majority of students electing to create the pattern using counters. It was in this stage that the task truly differentiated and the students were able to both displayed and extend their understanding. By using the counters, students quickly realised that when the number was even, it was being halved.

However, due to the fact that in the example there was only one odd number, a difference in opinion occurred. Some students thought that it was three groups and one more whilst others argued that you simply added 11. The beauty of this example was that both of these rules will work, requiring students to use their new knowledge to disprove the others. After more struggle, starting at 22 proved to be the clincher, as by starting at 22 required students to halve the number down to 11. If students added 11, they found themselves in an infinite loops whereas the $3n + 1$ group continued until reaching one.

For the advanced students, they were challenged to be able to state the problem as efficiently as possible, for which they required algebra.

CONCLUDING REMARKS

The Collatz Conjecture can be taken in anyway a teacher desires, as simple as students discovering patterns to opening the door to explore the world of algebra. This is presented as an example of a low floor/high ceiling task and one in which a change to the traditional approach of Rule-Example-Practice is required. It is an extremely student-centered task that I hope you find useful in your classroom.

REFERENCES

Booker G, Bond D, Sparrow L, and Swan P (2014) *Teaching Primary Mathematics* [Fifth Edition] Sydney: Pearson Education Australia

MAV PROFESSIONAL DEVELOPMENT

ONLINE INTERACTIVE PROFESSIONAL LEARNING TERMS 3 & 4

The MAV is excited to launch Online Professional Learning Accessible for Rural and Regional Teachers. This program will provide mathematics teachers across the state access to professional learning opportunities not usually available to them due to their remoteness from Melbourne.

The program will include online professional learning for primary and secondary teachers. Sessions will be free to all teachers in 2018. The MAV will have DET schools in each region as Polycom hosts. Other teachers within a one hour drive from this host venue would be encouraged to attend.

THE EDUCATION STATE

VICTORIA State Government | Education and Training

For registrations and more details please go to www.mav.vic.edu.au/pd/

During Term 3 2018, a variety of presenters and MAV's own mathematics educational consultants will present workshops focussing on innovative teaching practice.
Make sure you reserve a place by booking online early, www.mav.vic.edu.au/pd.

TOPIC	DATE	YEARS	PRESENTER
Maths games to engage students	7/8/18	5-9	Helen Haralambous
Tip of the iceberg - how to find rich and challenging tasks for your teaching	13/8/18	F-6	Nadia Walker
The importance of developing children's counting skills: the move from rote to rational counting	15/8/18	F-6	Catherine Pearn
Texas Instruments workshop	28/8/18	9-VCE	David Tynan
Let's get started! Using games to promote fluency and reasoning	12/9/18	F-6	Ellen Corovic and Jen Bowden
Prepping for the best start - transition in the early years	17/9/18	K-2	Bree Collins and Jen Bowden
Algorithmic thinking across primary years	22/9/18	2-6	Martin Holt and Jen Bowden

MAV STRATEGIC PLAN 2018-2020

MAV Strategic Plan 2018 to 2020 was approved by the MAV Council in March 2018, and launched recently at the AGM. It has been developed via a process of consultation and analysis of the context in which the Association operates.

The four goals in this Strategic Plan identify key areas of focus where MAV will have a positive impact on educational outcomes in support of its members. This includes in teaching and learning in mathematics education and in support of students who are from backgrounds that typically do not access mathematics at higher levels in school and beyond.

VISION

Valuing mathematics in society

MISSION

MAV is a membership-driven association that provides a voice, leadership and professional support for mathematics education.

CONTEXT

- Education is changing, and MAV must lead the way in supporting mathematics educators to have the best impact possible.
- Preparing students for life after education is critical for both their own and Australia's future workforce and industry success.

	Value	Partnerships
Objective	**Ensure that MAV provides benefit and value for all mathematics educators, with all education segments across Victoria supported appropriately.**	**Develop and nurture high-profile partnerships that lead to improvement of the quality of mathematics education, and promote the fundamental importance of mathematics in society.**
Strategic intent	MAV will better deliver value to all members and mathematics educators across the state, in different sectors, and embed itself as the 'go to' place for all mathematics education advice and services. MAV's engagement with members should continue to evolve as the context of education changes.	Partnerships will enhance benefits for members, mathematics educators and society, and allow MAV to expand its influence and impact while delivering its programs efficiently. Working with partners aligned to MAV's vision and programs will expedite MAV's impact, with broader access to a range of resources, expertise and advice.
Strategies	• Analyse and understand members and market opportunities • Review member benefits, value and engagement • Focus on regional areas • Develop a Member Retention and Acquisition Plan to increase membership, value and impact of MAV's mission	Ensure that MAV has effective and targeted partnerships that support its vision and mission, including: • AAMT and state affiliates • Government, government authorities and statutory bodies • Other education industry partners
Performance measures	• Membership growth • Member engagement • Increase in engagement from regional educators • Member and educator participation in services • Member and educator satisfaction with services	• Increase in new partnerships • Effectiveness of partnerships and partner satisfaction • Public impact and profile of partnerships • Effectiveness of collaboration with AAMT and affiliates

THE MATHEMATICAL ASSOCIATION OF VICTORIA

- Students need to be risk takers, to challenge assumptions and think creatively in order to contribute to society and enter industry with open and inquiring minds.
- MAV must provide the teachers of young creative minds with the skills and resources required to produce high-quality, critical-thinking mathematicians.

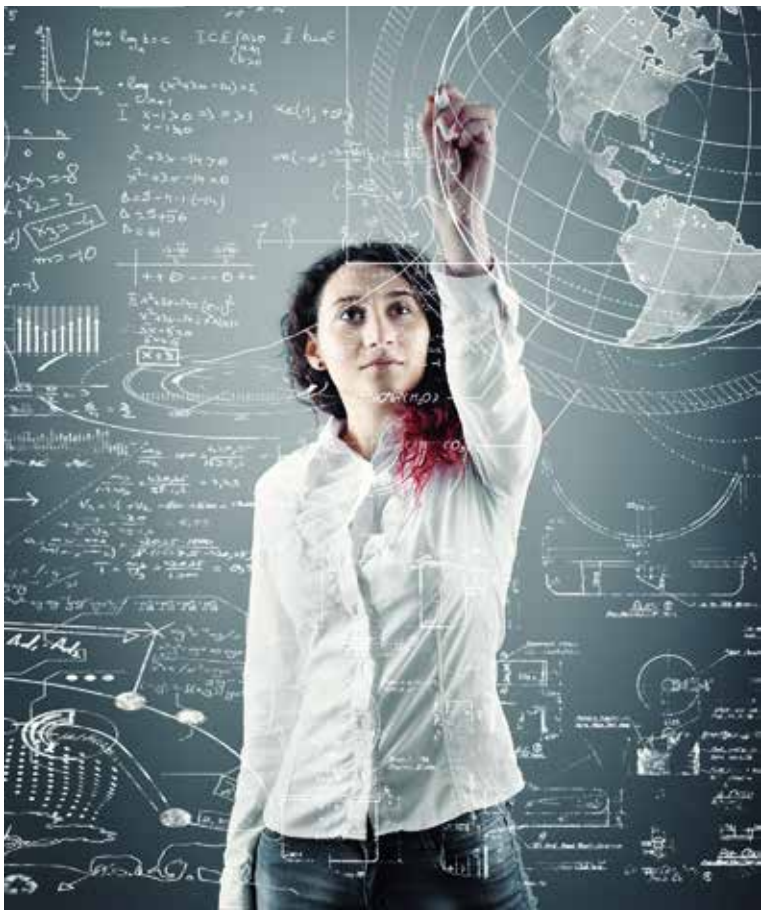
The full version of the Strategic Plan 2018 to 2020 can be found at www.mav.vic.edu.au/about-us/strategic-plan.html

	Advocacy	Operations
Objective	**Strengthen MAV's position as a key stakeholder in mathematics education through advocacy and engagement with key stakeholders.**	**Streamline and improve MAV's operations, management and governance.**
Strategic intent	MAV seeks to increase its profile in Victoria, so that it is seen as 'the voice' of mathematics education in Victoria and nationally where appropriate. MAV's views are to be sought in relation to areas of engagement and achievement of the MAV vision and mission.	MAV considers that continuous improvement in areas of MAV's operations and governance is essential, to prepare MAV for the future as a dynamic, modern and progressive organisation.
Strategies	• Develop new and strengthen existing connections with advocacy stakeholders • Proactively communicate MAV's position on current issues and engage with members and relevant stakeholders	• Strengthen and modernise governance structures and policy documents • Collaborate with AAMT and affiliates on operational areas • Ensure excellence in staffing and program delivery • Ensure best practice in office systems and processes
Performance measures	• Output of advocacy and communications material • Public impact and profile of advocacy and communications • Member and educator satisfaction with MAV representation	• Staff engagement and satisfaction • Efficiency and currency of systems and processes • Financial performance • Councillor engagement and satisfaction • Effectiveness of Council governance and communications systems

THE MATHEMATICAL ASSOCIATION OF VICTORIA

GIRLS IN **STEM**

INSPIRED BY CURIOSITY



9am	Registration
9.15am	Welcome and introduction *Felicity Furey, Machinam* Opening address *Dr Sue Barrell, Chief Scientist, Bureau of Meterology*
9.45am	Experts *Taryn James, Ford* *Sharon Lai, Reserve Bank of Australia* *Chivonne Hollis, CHT Architects* *Sarah Cirillo, Thales*
10.30am	Morning tea
11am	Experts *Kimberley Whitehead, VEC Civil Engineering* *Kirsten Pilatti, Breast Cancer Network Australia*
11.25am	Interactive panel discussion
12pm	Closing *Ford, Gold sponsor* *Felicity Furey, Machinam*
12.45pm	Close

WHO	Year 9 and 10 girls who are interested in pursuing a future in STEM careers.
WHERE AND WHEN	Friday 3 August, Ivanhoe Girls' Grammar School, 9am-12.45pm | $15 member, $20 non member This is a half day program sponsored by Ford that includes Dr Sue Barrell and six industry speakers.
BOOKINGS ESSENTIAL	Teachers must book on behalf of students, limited places are available, so reserve your place quickly. www.mav.vic.edu.au/student-activities/girls-in-stem.html
MORE INFO	For more information, contact Jacqui Diamond, jdiamond@mav.vic.edu.au or visit www.mav.vic.edu.au.

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Thales

PREPARING: FOR THE FURTHER MATHEMATICS EXAMS

Jessica Mount - Further Mathematics Assessor

REMEMBER THIS!

There are two questions you must answer.

1. Have I answered the question?
2. Is my answer reasonable?

Ask yourself these two questions after answering each question.

COMMON ERRORS STUDENTS MADE IN THE 2017 FURTHER MATHEMATICS EXAMINATIONS

1. Missing a question
2. Lack of care in reading questions
3. Incorrect rounding
4. Not showing working
5. Unreasonable answers
6. Not setting out working neatly and logically
7. Poor use of the Finance Solver
8. Including extra information that is irrelevant
9. Poor understanding of 'show that' questions

TIP 1: **Reading time = Thinking time.**

It is not time to start answering questions.

Too many students each year think they are getting ahead by using reading time to answer the first few questions.

Instead use the time to ask yourself if you understand the question and if have you read all the key words.

TIP 2: **Rounding**

Know how to round properly.

Read the question carefully to make sure you have answered the question completely and have rounded properly.

In the Recursion and Financial Modelling Core Module round to the nearest cent unless otherwise stated. Note, there are times where you will not always round down!! For example, How many months will be taken to fully repay the loan?

Answer: 34.1 months
Round up to 35 months.

After 34 months the loan will not be fully repaid.

TIP 3: **Show working**

Showing working is vital for questions worth more than 1 mark but some 1 mark questions also require working.

Example:

Use recursion to write down calculations that show the amount of money in Ken's savings account after two years, V_2, will be $16 224 1 mark

$V_0 = 15000$

$V_1 = 1.04 \times 15\,000 = 15600$

$V_2 = 1.04 \times 15\,600 = 16\,224$

therefore $V_2 = \$16\,224$

Working can also be useful for either exam when checking your work once you are finished.

TIP 4: **Unreasonable answers**

Example:

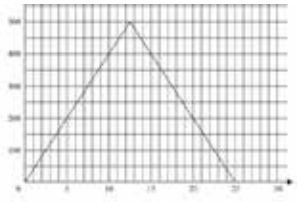
Alex sent Lily a bill of $428 for repairs to her car. Lily did not pay the bill by the due date. Lily paid the full amount of her bill four months after the due date. How much interest was Lily charged? Round your answer to the nearest cent. 1 mark

Unreasonable answers included: $454.26 and $-1,700.

Read the question again and ask if it makes sense to pay $454.26 in interest over 12 months when the bill was $428 and was only paid 4 months late. Or if it would be possible to pay negative interest?

TIP 5: **Show that questions**

Let E Edgar's distance from the shore, in metres, t minutes after the race begins. The linear relation that represents his swim out to the buoy is of the form
$E = kt$ where $0 < t \leq 12.5$



The slope of the line k is the speed at which Edgar is swimming, in metres per minute.

Show that $k = 40$.

e.g. $k = \frac{500}{12.5} = 40$

You must use the values in the question and 'show' an equation that equals 40. e.g.

It is not sufficient to substitute $k = 40$ into an equation.

$12.5 \times 40 = 500$ was not awarded any marks as the k value was substituted into the equation.

TIP 6: **Bound reference**

- For both Further Mathematics exams you are permitted to have one bound reference throughout the entire exam.
- Work on and develop this bound reference throughout the year and have it bound once you finish the course. Don't bind it the night before the exam.
- Revise, including doing Trial Exams, with your bound reference and make notes about content that you need to add in as you're doing your revision.
- A useful tip may be to include a glossary of relevant terms for the modules you are studying.
- Include templates and examples for how to answer questions about interpreting the slope, vertical intercept and percentage of variation in the data analysis module.
- Create a chart that shows which graphs can be used with different types of variables, e.g. parallel boxplots require one numerical variable and one categorical variable.

FINAL EXAM TIPS

- Revise by doing a number of Trial or past Examination papers for both Exam 1 and 2.
- During revision make sure you are timing yourself to ensure you finish during the allocated time allowance (90 minutes for each exam).
- Read through the entire paper in reading time.
- Keep track of the time during the exam.
- Do your most confident module first.
- Don't spend too long on questions – come back to them.
- Take time entering data into the calculator.

GREAT HOOKS

Thomas Moore - EngageME Mathematics and MAV consultant

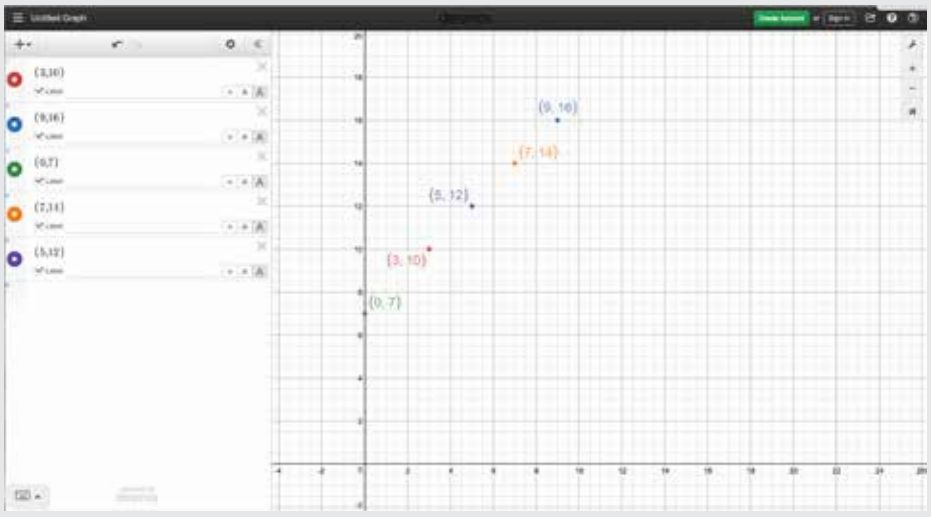
GET YOUR STUDENTS THINKING MATHEMATICALLY

During MAV's 2017 conference, I ran a workshop where I shared my favourite starters to get students tuned in to thinking and working mathematically. Throughout this article I will discuss some of the resources and activities which I use frequently within my classes and have come to love!

At university, I originally trained to become a Physical Education (PE) teacher first and foremost (maths was my second method). Being given the opportunity to teach mathematics over the past nine years, I have fallen in love with teaching the subject to the point where I now don't tell schools I teach PE to avoid being given it instead of a maths class. There is something about helping a student to grasp a mathematical concept, or make the link between various ideas in maths which I, like I'm sure all of you, find extremely rewarding.

Even though I now identify entirely as a maths teacher, there are many things which I can thank my PE degree for. As I learnt about teaching physical education and sport, the underlying principles to teaching the subject were allowing everyone the opportunity to participate in the subject and experience success. This was done through having all students participate in the same game, but modifying it somewhat (e.g. rules or giving students choice over kicking distance when practising etc.) to allow all students to feel as if they could be successful to some degree. Competitive games like dodgeball, where less able students would often be the first to be eliminated, were frowned upon. As was running laps at the beginning of the lesson to improve fitness, because really, who wants to do that?

Instead, I was taught to find ways to engage students at the beginning of the lesson that got them interacting with each other, were non-competitive yet challenging, and were open for all students to experience some degree of success. It's these very principles which I believe should be applied when looking for a great starter in a maths class to engage students and get them feeling positive about the subject from the get go. Here are some examples of great resources and activities to do just this.

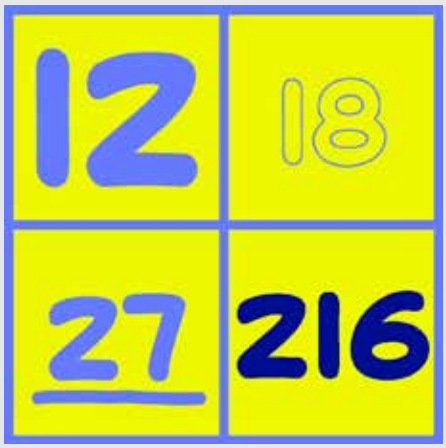


What's my rule?

GRAPHING STORIES

Are you teaching a unit on rates of change? Or could your students benefit from being able to better interpret graphs? www.graphingstories.com is an excellent resource to get your students thinking and talking about graphs. Simply give every student a set of axes which can be downloaded and printed from the website, and get them to sketch the motion graphs of any of the 21 videos provided. By playing the video through a couple of times first, then getting the students to plot their graphs and discuss the various elements which they have sketched, it is a great opportunity for students to learn from each other before then comparing their own graphs to the one which is shown at the end of the video.

WHICH ONE DOESN'T BELONG



One of these numbers (12, 18, 27 or 216) shown in the picture (left) does not belong with the other three. Can you figure out which one? Can you explain why? This activity is brilliant because all is not quite as it may initially seem. Students tend to quickly see an answer and jump to the conclusion that their response is the only correct response. Maybe you did too? In fact all four of these numbers can be the odd one out for one reason or another.

Maybe you came to your conclusion based on the colour of the font? Maybe you saw mathematics hidden within the numbers? The two key factors which make this activity great are:

- all students can participate in the activity, regardless of their ability; and
- this provides a great opportunity to encourage students to engage socially with mathematics through discussion and even light hearted debate.

Through doing this, some students may make connections between mathematical ideas which you as the teacher may not have even planned for. For many more examples of these, visit http://wodb.ca.

ESTIMATION 180

Estimation 180 (www.estimation180.com) is a great resource to get students thinking and talking mathematically. Begin at day 1 by showing students a picture of Mr Stadel and ask them to predict how tall he is. In doing so, they must write down an estimate which is too high, too low and just right.

This allows for most students to experience some level of success, as most (if not all) are able to choose two numbers, between which the final answer will lie. After some prompting by the teacher in regards to why particular students wrote down their various responses to each of the three categories (too low, too high and just right) the answer can be obtained by a simple click of a button. This is always the best part of the lesson as you hear even the most reluctant learners of mathematics celebrate when they get the exact answer or close to it.

This activity can be taken even further by getting students to record their responses in a spreadsheet and then requiring them to use formulas to compare who was the most accurate over a five day period.

WHAT'S MY RULE?

Input (x)	3	5	9	0	7
Output (y)	10	12	16	7	14

This Maths300 lesson (http://maths300.com) is a fantastic way to get students working together and looking for patterns. Simply start off with an empty table of values and a Cartesian plane (www.desmos.com/calculator is a free online tool which can be used for plotting points on a Cartesian plane).

Ask students to give you a number, for example 4. Tell them that you have a rule in your head, (e.g.. +7) and you are going to apply this same rule to every number they give you. Their challenge is to determine the rule which you have in your head. As they give you each number, enter it and the resulting number into a table of values. The relationship between the two numbers can also be highlighted by plotting these points on a Cartesian plane.

Repeat this process 4-5 times (see image on page 16) and get students to write down what they think the rule is when they think they know it. Ask a number of students to share what they have written down for their rules.

The key here is to not give anything away. Write every response on the board and then ask student to discuss the following questions: Which of their classmates responses do they like the most and why? Could these answers be improved on and how? The key is to get students to recognise an algebraic rule which describes the relationship between both x and y. By getting students to discuss this and figure it out for themselves, it will go a long way to giving them ownership of the lesson.

Whilst this can be used as an engaging starter within your classes, this lesson can also easily be turned into a rich task which could be explored over many lessons. For more information regarding this activity, see the 'What's my rule?' lesson at http://maths300.com.

PAPER CUTS

This activity is simple, all you need is some paper and some scissors and you are ready to go. First, fold the piece of paper in half, and cut three shapes out of it.

On their own piece of paper, ask the students to draw what they think it will look like when you open it up. This activity can be modified in any number of ways. This can be done by folding the paper two or more times to make it more challenging for students, whereas, making less cuts or guiding students to draw a rectangle with a dotted line where the fold would be, may make it more accessible for them.

It's always a great idea to get students to talk with their peers about what they have drawn before you unfold the paper. It's once again this discussion which can lead to further learning and engagement from students.

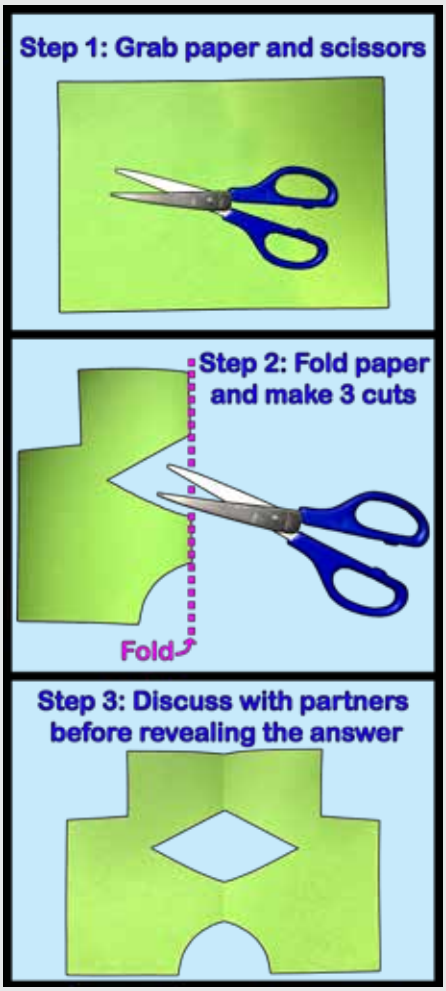
SUMMARY

A number of activities and resources have been shared in this article as being great starters for a maths lesson. From my experience, the activities which promote the greatest level of engagement are ones which have the following three elements:

Inclusive - all students regardless of their ability are able to make a start and participate to their own level.

Social - students are encouraged to discuss and/or debate the mathematics within the task. This discussion can lead to further learning within the task.

Challenge - regardless of each students' ability, there is an element of challenge within the task for every student. Each of these tasks is posed as a problem to solve.



Paper cuts.

It is these three elements - which much like a physical warm up- can lead to mentally tuning and engaging our students into maths at the beginning of every lesson.

What are your tips for keeping students engaged in a lesson? *Common Denominator* is a great platform to share ideas - if you are interested in writing an article, please contact MAV via email office@mav.vic.edu.au.

Contributions don't have to be word perfect, our editors can assist with that. You just need to bring the ideas!

HAESE MATHEMATICS

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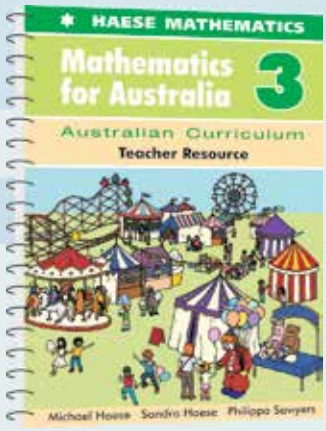
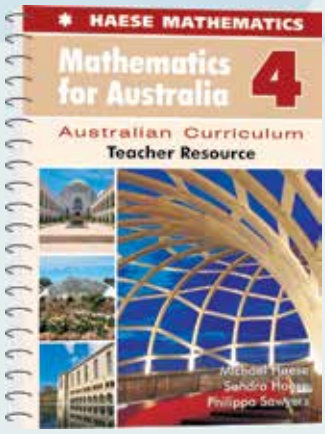
Australian Curriculum

Year 3 - 12





Support Material:

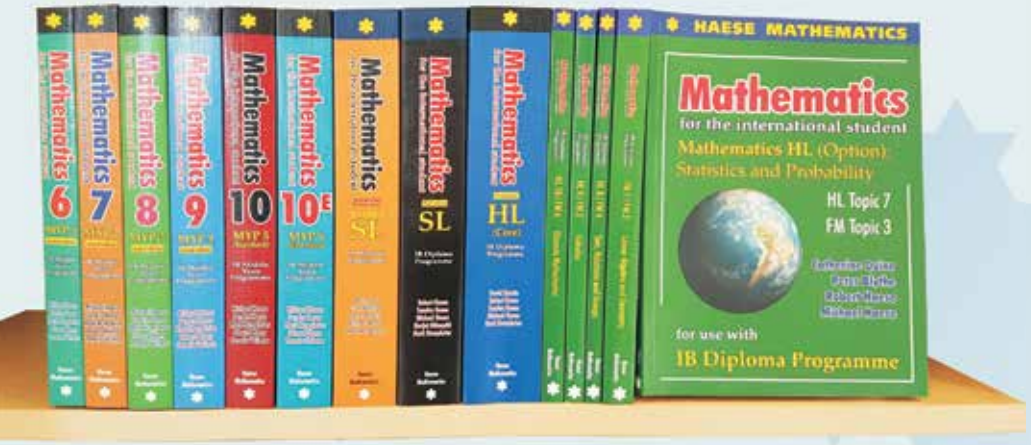
- Teacher resource (Year 3 - 4)
- Worked solutions (Year 7 - 12)
- Homework books (Year 5 - 10)

SNOWFLAKE by Haese Mathematics

All textbooks and teacher resource books include online access to the digital book and interactive content.

International Baccalaureate

MYP 1 to 5E and DP



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MATHEMATICAL MODELLING: IS IT RELEVANT TO ME?

Ross Turner - ACER and Australian Coordinator, IM2C

The International Mathematical Modelling Challenge (IM2C) takes place in Australia during Term 1 each year. National awards have been determined, and our two top teams are waiting on the results of the international judging of their team reports. Results will be known in time for the successful teams from around the world to get organised for the International IM2C Awards Event, scheduled for August and taking place in Melbourne.

Teams of up to four students from the same school worked on the problem 'The Best Hospital' over a five-day period between 13-29 March 2018. This years problem asked teams to think about what 'best hospital' might mean, and to decide what data could be collected, and how it could be used, to help users decide which hospital might be appropriate for some non-emergency hospital treatment. In this, the third year of Australian participation, a total of 163 teams registered to participate. 75 of those teams submitted their report for judging. 25 of those were deemed to be of sufficient quality to be put before the national judging panel, and 12 were identified as finalists. National awards were made to several of the finalists.

Teams were formed by students from Years 7 - 12, with most participating students (over 80%) in Years 9, 10 and 11. The Challenge attracts boys and girls in almost equal numbers. Students and teachers have been very positive about the benefits:

'We keep being told that team-work and cooperative problem solving are critical in the modern workplace. Well, the IMMC provides that opportunity in spades.'
- Team advisor, NSW

'This was the most interesting week I've had in maths, ever!'
- Year 11 student, Queensland

WHAT ARE THEY TALKING ABOUT?

Greg Breese, Head of Mathematics, Glen Waverley Secondary College, supported nine teams. Five went on to complete and submit a team report.

> We had a large number of students express an interest in participating, most of which were younger students and did not have significant experience with this sort of activity.

> We were able to get some of the students together for two lunchtime information sessions in which we went through the structure of the activity and last year's problem.
>
> Five of our teams submitted reports, with students from Years 7 to 9. The feedback students about the experience was positive, especially about the team aspect. Most were able to identify several salient variables in the problem and design a simple algorithm for selecting a hospital.
>
> Many teams were significantly challenged by the timeline for the task, having to tackle the problem and produce written reports within five days. We had a group of Year 12 students that met and developed a model but did not complete the written report as they needed to spend their time preparing for SACs.

A number of challenges were identified, including the lack of experience of students in undertaking this kind of mathematics activity and the time pressures that students face. Chiara Seidenman, Year 7, reflected:

> This year's problem was to find the 'best hospital' in a non-emergency scenario. My team and I started off by organising some meeting times so that we could study and collaborate. Every time we met up, we would discuss what each person had done and we then would collate all the work and decide what to do next. We also made sure to delegate the jobs evenly amongst our team. I learned a lot through this competition about maths and time management skills.
>
> The IMMC made me think really hard about the problem because there was no easy answer.
>
> The problems are real world problems! That means that there will always be a positive and negative effect on someone, therefore we had to think in depth and weigh up the pluses and minuses. This is why I joined. I wanted to participate in a fun, yet challenging, math competition that involved teamwork, collaboration and lots of learning all in one. The IMMC is a great competition and I recommend it to all people (whether you are really good at maths or not) who have a passion for STEM. Something that would have helped us would have been to have some learning sessions beforehand briefing so that we have an idea about the maths that we can use and how or when to use it. This way we would not only learn, but our results would be better.

Check out the information and support materials available for free on the Australian IM2C website, immchallenge.org.au. Additional resources are also available via the international site, immchallenge.org.

And don't forget to look out for information about the dates for the 2019 Challenge. Team preparation can start now!

VCAL: ON THE MOVE

Gabrielle Panozzo, Rachel Villani and Jamie Gray - Peter Lalor Vocational College

The Victorian Curriculum and Assessment Authority recognises that from an early age children learn in an 'active way', by 'exploring the world through touch, sight, sound, taste, smell and movement'. This traditionally hands-on approach to learning is also evident in the delivery of the Victorian Certificate of Applied Learning for senior secondary students, but is extended to incorporate learning that is in context and supports the development of critical skills and knowledge for their transition into life after work.

Many of the students moving to Peter Lalor Vocational College have previously struggled with numeracy, unable to see how the concepts can be linked in any way to where they envisage themselves in the future, and lacking interest in learning what they have perceived to be boring and of no use to them. The challenge for us is to rethink how we engage our students and reignite - or even develop from scratch - a spark of love in our students for learning, both for now and throughout their lives.

One of the ways in which Peter Lalor Vocational College has attempted to combat this initial apathy towards mathematical knowledge development is by an integrated curriculum model, whereby theme-based activities and projects are developed that integrate outcomes from different VCAL strands. These themes are developed in consultation with students and adapted to meet the individual needs in our increasingly heterogeneous classrooms. We have also introduced an electives component at the intermediate and senior levels, where two of the four terms have been designated a diverse range of topics, and students are able to select a subject from both the 'a' and 'b' stream to achieve pre-determined outcomes across the different strands. These elective models are still implemented and assessed in an integrated way, and have been designed to increase engagement of our students with the curriculum, their learning and their educational pathway.

There are a range of theories regarding what engagement is, how it is achieved and how can we measure it. And whether you are an advocate of Theroux (2004) who focuses on engagement being evident when students are working in collaboration, participating and learning via exploration of authentic and real life tasks (Marsh 2010) or believe as Axelson and Flick proposed in 2011 that 'Engagement may simply be the by-product of a learning environment that suits the student', most educators would agree that the old model of transmissive teaching does not meet the needs of the modern day classroom.

Preparing the ground and pouring the concrete for a bricked-in BBQ.

This article investigates some examples of how excursions have been able to increase the interest and engagement of our students, and make links between numeracy and practical applications in real life.

One of the electives offered to intermediate and senior students this term has been the trade elective. The two main numeracy learning outcomes focused upon are numeracy for practical purposes – measuring, and numeracy for practical purposes – design. In choosing these outcomes there is a natural alignment between the outcomes and the trade focus. The students are completing two major projects; the installation of a bricked-in BBQ and the construction of a new gazebo. Inherently, there is a lot of numeracy in these tasks. Drawing designs, constructing models, estimating costs, coordinating deliveries and calculating areas and volumes are some of the mathematical concepts that students have been challenged with. Engagement in these projects is strongly proportional to the ownership that is given to the students. Therefore, excursions to suppliers, attendance at trade shows and visits to worksites all add to the immersive nature of the projects. Evidence for VCAL Quality Assurance will be captured through student portfolios, photographs, responses to worksheets, drawing plans, construction of models and participation in the different aspects of the projects.

In Term 2, Foundation students focused on exploring Melbourne under the topic 'City Experience'. This integrated unit incorporates prior knowledge as well as skill-building techniques relating to multiple learning strands and outcomes including literacy, personal development skills and numeracy. The two main numeracy learning outcomes embedded in the curriculum is numeracy for personal organisation

– location, and numeracy for personal organisation – money and time.

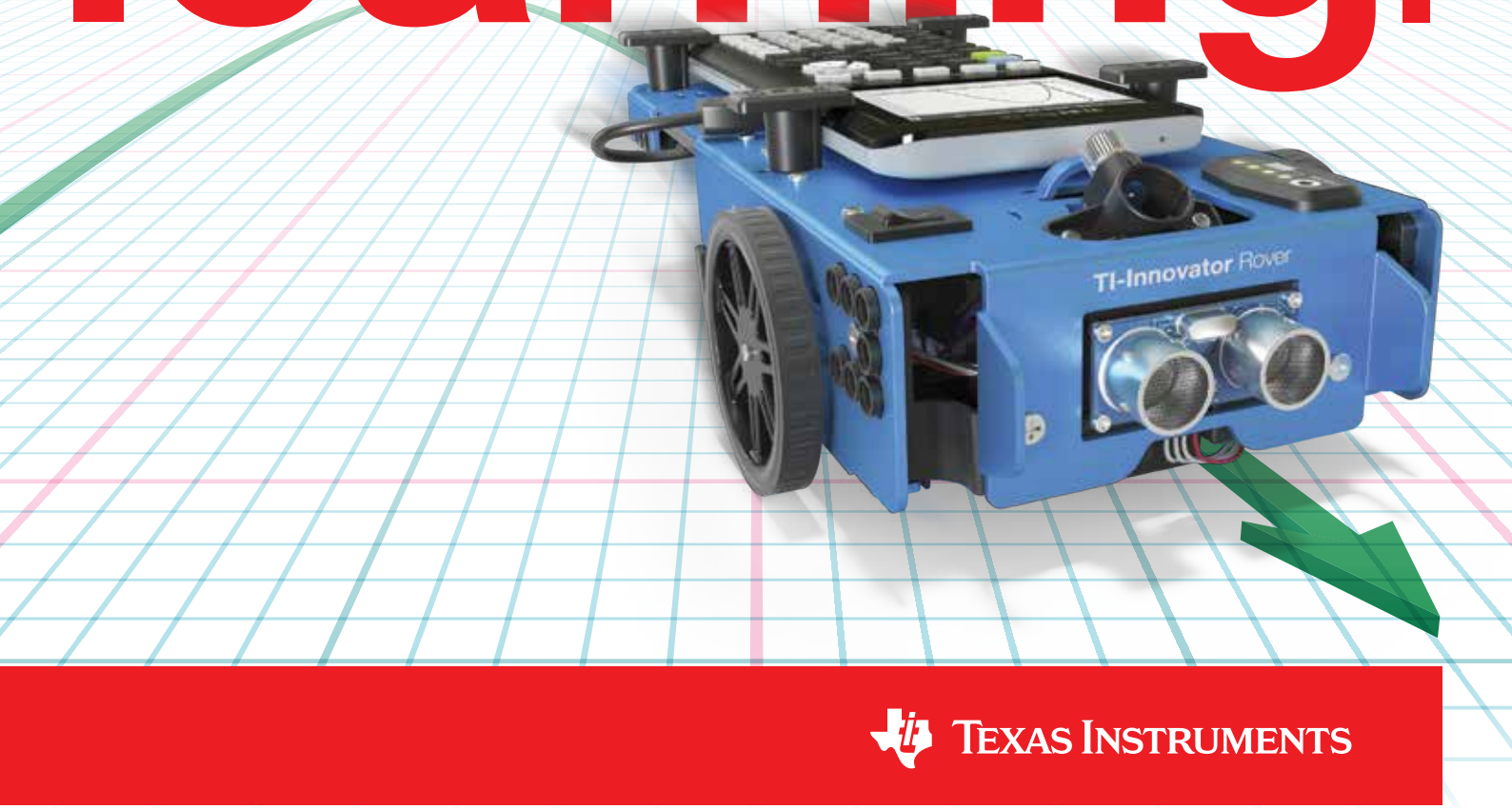
In order to get students thinking about the intricacies of Google Maps, students were first introduced to utilising the many features of the site. They explored tracking different travel routes and compared time differences when driving a car as opposed to accessing public transport. They also studied alternate locations within Hoddle's Grid such as tourist destinations, landmarks and historical sites.

Students attended a modified Hoddle's Grid navigation excursion in two teams. The aim was for students to work in groups to navigate their way around the CBD whilst learning about each significant destination they had visited. Both groups had with them a copy of the allocated roles including leader, photographer, detective and timekeeper, as well as a question sheet containing questions to answer about each site. They also had an A3 colour map of the CBD, including Hoddle's Grid and the City Loop tram network. Throughout this exercise, students were exposed to real-life applications of utilising a physical map to understand the legend and determine compass directions. They were also required to determine the best travel route to take in order to locate each site in a timely manner, whilst identifying which tram would lead them to their next destination. This excursion not only enhanced students' location and navigation skills but allowed them to access and learn about new sites. The excursion strengthened peer relationships within the groups and gave students tasks to take responsibility for.

Another 'City Experience' task that students enjoyed, was creating a travel package for an interstate couple wanting to visit Melbourne for a week-long holiday. After reviewing travel brochures, they determined the best options to include in their travel package relating to travel dates corresponding to a well-known public event, budgeting appropriate hire car options, accommodation, tours and activities. Students put together what they believed would be the ultimate getaway experience based on their own preferences and interests and what first-timers would want to experience. Students were excited to learn about the costs associated with interstate flights, sightseeing activities such as hot-air ballooning, and the difference in price between diverse accommodation preferences due to peak and off-peak seasons as well as location. A few students even exclaimed that they felt lucky to have such opportunities at their backdoor!

Students have enjoyed the life skills that they have been able to utilise, expand upon and embrace. They have been able to comprehend how simple numerical skills relate to everyday living scenarios and can appreciate why the content is being delivered. To date, 'City Experience' has been a multi-tiered topic that has exposed students to developing their knowledge and cemented particular transferable life-skills – the key underlying success component in VCAL curriculum.

When the wheels are turning, the students are learning.



TEXAS INSTRUMENTS

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PUZZLES

Michael Nelson - Teaching and learning coordinator, Portarlington Primary School

LOWER PRIMARY

My teacher asked me if I had half my book left. I said that I had read more pages than I had left. Did I have half a book left?

Recognise and describe one-half as one of two equal parts of a whole (VCMNA091)

MIDDLE PRIMARY

I bought a drink for $3.50 and paid with a $5 note. How much was my change and how many different ways can I receive my change?

Represent money values in multiple ways and count the change required for simple transactions to the nearest five cents (VCMNA137)

UPPER PRIMARY

I painted my kitchen wall in 12 hours. How many hours will it take to paint my outside wall if it is twice as long and twice as high?

Solve problems involving the comparison of lengths and areas using appropriate units (VCMMG224)

My mum was thinking of a number. She said it had a zero in the tens place, but the number had 60 tens. How can this be?

Recognise, model, represent and order numbers to at least 1000 (VCMNA104)

Group, partition and rearrange collections up to 1000 in hundreds, tens and ones to facilitate more efficient counting (VCMNA105)

I asked my friend what time it was. She can't read an analogue clock but said that the numbers the hands were pointing at added to 10. What time could it be?

Tell time to the minute and investigate the relationship between units of time (VCMMG141)

An equation was written down, but it had been smudged. The numbers were 8, 2, 3 and 7 but I couldn't see the operations. What was the equation if the answer was 40?

Explore the use of brackets and order of operations to write number sentences (VCMNA220)

Select and apply efficient mental and written strategies and appropriate digital technologies to solve problems involving all four operations with whole numbers and make estimates for these computations (VCMNA209)

Image of juice bottles courtesy of : www.freepik.com/free-vector/bottles-of-delicious-juices_1112962.htm. Designed by Freepik.

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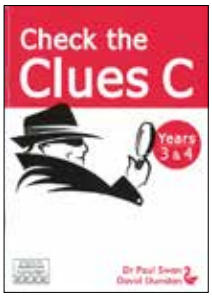

CHECK THE CLUES C

2–7

The *Check the Clues C* by Dr Paul Swan and David Dunstan offers schools a whole school approach to word problem solving using a co-operative group approach. It's designed to improve students' comprehension of mathematics word problems, and to build mathematical understanding through problem solving and reasoning. The *Check the Clues* series uses Polya's four step problem solving approach: understand the problem, devise a plan, carry out the plan and look back. Teachers are provided with AC links, language (vocabulary), notes, answers and references.

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SCHOOL FRIENDLY PLAYING CARDS

K–6

School friendly cards are just playing cards but without any of the links to gambling and come in a set of 2 packets. There are no picture cards - Just numbers 0 to 13. There are no suits, just shapes configured in standard subitising patterns and four different colours. You can play all of the traditional cards games like snap, fish and more using these simple, easy to use cards.

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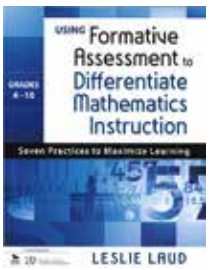
NUMERACY: TEACHING MATHS IN CONTEXT

VCAL

Numeracy: teaching maths in context describes an approach to teaching mathematics based on applied and contextual learning principles. This means that the teaching and learning of mathematics proceeds from a contextual, task-based and investigative point of view — where the mathematics involved is developed from a modelled situation or practical task. Practical investigations and projects are key vehicles for student learning in such an approach.

The approach will be helpful for teachers of students who need a practical rather than formal mathematical background for their everyday life skills and further education, training or work aspirations. The text illustrates how this approach works through contexts such as cars and driving, sport, cooking and catering, and draws together maths from the areas of number, measurement, space, data and statistics, and algebra.

$23.17 (MEMBER) $28.96 (NON MEMBER)



USING FORMATIVE ASSESSMENT TO DIFFERENTIATE MATHEMATICS INSTRUCTION

4 – VCAL

Assessment is the bridge between teaching and learning. The author lays out seven practices to maximise learning – a supportive classroom environment, clear learning targets, continuous assessment, student self-direction, flexible student groups, data-formed instruction, and differentiation of student work – and signposts these practices throughout the text. From supporting students who are low achieving to challenging students who are high achieving, the author presents strategies for creating tiered lessons, managing a multi-tasking classroom effectively, and implementing time-saving management strategies. Included are a wealth of practical examples, resources and student activities.

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