THE MATHEMATICAL ASSOCIATION OF VICTORIA

THE COMMON DENOMINATOR 2/22

SHOOT AND SCORE!

INSIDE

Leah French - Primary school teacher and mathematics education consultant

The Huddle, in partnership with the National Basketball League (NBL) has collaborated with the Mathematical Association of Victoria to create six STEM lessons that will be free for educators across Victoria to access in 2022.

The project, collectively known as 'GOAL!', features lessons that have been created by teachers for teachers. GOAL! leverages the power of sport to strengthen STEM knowledge and aims to increase engagement levels among all learners and improve student confidence in solving real world problems.

There a six basketball-themed lessons aimed at Years 3-6: A day in the life, final minute to win it, NBL trophy challenge, rookie card, shot challenge and travel choices.

Continued on page 4

THE COMMON DENOMINATOR
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FROM THE PRESIDENT

Michael O'Connor

Hope. It seems appropriate after two years of turbulence and disruption to discuss this as we begin Term 2. A semblance of routine has developed during the beginning of the year allowing the hope of more to come to seem likely. This in turn allows teachers the opportunity to plan schedules and build rapport with students. Student learning, the core of our work, is rooted firmly in support from teachers.

In this edition you'll find a very interesting article by Kerryn Sandford, Principal of Heathmont Secondary College (page 6). This article includes a fascinating letter that was sent to Peter Saffin, MAV's CEO by a parent about their daughters Year 7 mathematics experience. The article is worth a thorough read, as it illustrates the need for schools to consider carefully their structures and approaches to supporting students.

Happily, the story ends well. But there is no doubt that there are many other students in similar situations who have been equally disadvantaged, and were not provided the opportunity for experiencing mathematics positively, and the future pathways that a positive experience opens up. The article provides links to some new monographs from the Victorian Department of Education and Training. I was very pleased to see the monographs translate evidence of what works (and what does not!) into practical advice for schools.

I advise all secondary school mathematics teachers and leaders to consider these monographs. They can be the basis for maths faculty discussion around current practice and future improvement strategies. There are many lessons to learn and likely changes to be implemented in many schools in relation to the evidence provided. Such changes take time and perseverance in order for results to be noticeable.

Like a new exercise routine, a commitment of weeks or months may well be needed. I encourage teachers to implement the evidence based strategies, record observations and reflect on the results.

MAV AGM 2022

More than an AGM, we welcome members to join us for life member presentations, and barefoot bowls. Come along and reconnect with your peers, the MAV board and staff, and enjoy an evening of socialising in the great outdoors. **All members welcome!** Notice is hereby given that the Annual General Meeting for The Mathematical Association of Victoria will take place at 6pm, Tuesday 24 May at the City of Melbourne Bowls Club: Flagstaff Gardens. Nominations for the MAV Board are also open until Tuesday 26 April.

For more information visit www.mav.vic.edu.au/About-Us/MAV-AGM

MAV CONSULTANCY

MAV's mathematical education consultants are ready to work with you. Our team can create a customised professional learning plan on a range of topics:

- Content, curriculum and pedagogy to improve learning outcomes
- Improving assessment reporting and data
- Building mathematics teaching and leadership capacity
- Whole school improvement.

MAV has flexible modes of delivery:

- Coaching, mentoring and individualised support
- Supporting professional learning teams with planning and implementation
- Modelled mathematics teaching
- Whole staff professional learning curriculum days
- Developing mathematics leaders and leadership capacity, and
- Working with clusters of schools within a region.

MAV can customise a plan aligned to the goals of your school.

To learn more, contact Jen Bowden, jbowden@mav.vic.edu.au.

UPCOMING MAV EVENTS

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

EVENT	DATE	YEARS	PRESENTERS
Connecting Learning With Work Project	4/5/22 Virtual	7–10	Helen Haralambous and Jess Mount
SHOOT and SCORE: Engaging students through sport and STEM	4/5/22 25/5/22 Virtual	3–6	Em O'Halloran and Nick Devereux
FLIP: Financial Literacy in Practice through the MTQ	5/5/22 12/5/22 Virtual	7–12 F–6	Carly Sawatzki
Learnership series: Introduction to Learnership (free intro to the series)	17/5/22 Virtual	4–10	James Anderson and Jess Mount
VCE Maths and CAS technology TI-Nspire	18/5/22 Virtual	VCE	James Mott
SHOOT and SCORE: Engaging students through sport and STEM	25/5/22 Virtual	3–6	Em O'Halloran and Nick Devereux
Learnership series: Growth Mindset (session 1 of 6)	31/5/22 Virtual	4–10	James Anderson and Jess Mount
Coding Challenges for extending students	1/6/22 8/6/22 Virtual	7–10 5–6	Danijela Draskovic and Nathan Alison
MAV + MGSE Primary Conference: Quality Teaching	9/6/22 and 10/6/22	F–6	Various
Learnership series: Challenges and Mistakes (session 2 of 6)	14/6/22	4–10	James Anderson and Jess Mount

2022 MAV CONFERENCE

Valuing mathematics in a changing world

The focus of MAV22 is on valuing mathematics across our education system and society.

Mathematics plays a crucial role in our personal, professional and civic lives. Mathematics is the foundation for responding to and managing societal issues, such as pandemics, environmental and social problems. At work, mathematics is used every day to communicate, plan, visualise, monitor, evaluate systems and processes, interrogate data and information, and predict outcomes in an increasingly information rich and technologically advanced society.

At a personal level, mathematics is used in context and underpins our ability to make informed decisions about personal finance or health, and recreation where numeracy is required for daily life. Algorithmic thinking, often out of sight and out of mind from our day-to-day activities, underpins the new technology we see advancing around us.

As educators we want our students, parents and carers, and community to value and connect with mathematics in our fast-paced and changing world. We need to actively engage students and equip them to be problem solvers, and critical and creative users of mathematics now and in the future. This requires educators who are adaptable, innovative and flexible in their pedagogical practices.

We invite you to share your experiences of valuing mathematics at MAV22, to enrich and enhance our mathematics community's knowledge and practice.

The conference call for options is open, visit www.mav.vic.edu.au/Conference/Annual-Conference

SHOOT AND SCORE!

Leah French - Primary school teacher and mathematics education consultant

CONT. FROM PAGE 1.

GOAL! lessons are primarily STEM based, incorporating science, technology, engineering and mathematics and promote physical literacy by encouraging active learning in classrooms. All lessons are aligned to the Victorian Curriculum, with lessons linked to STEM subject areas, as well as the Capabilities framework.

The lessons have been designed with differentiation in mind, with open-ended tasks that follow the 5E Instructional Model. Each 5E section clearly outlines instructions within 'Student Does' and 'Teacher Does' components. Teachers can easily implement the lesson plans, regardless of their level of experience or knowledge. All six basketball themed activities come fully equipped with lesson plans, supporting materials and assessment opportunities. In addition to this, the lessons boast exclusive access to content in the form of videos and images of NBL players giving insights into their daily lives - which will be a hit amongst students!

In this current climate, it has never been more important for a teacher to support students to connect with their peers as they return to face-to-face learning. Collaboration is at the heart of the GOAL! lessons and the activities are highly engaging and motivating for students. Even if basketball is not the first choice of sport for students, they will find the activities in the GOAL! lessons appealing, allowing them to use their creativity as well as critical thinking skills. Each lesson has the right balance of support and challenge, and although designed as a standalone activities, there are ample opportunities for teachers to extend and integrate GOAL! lessons into existing learning sequences.

As a part of the initial trials, several Victorian schools piloted GOAL! lessons in their classrooms in 2021, with feedback received from teachers being overwhelmingly positive. According to various educators, the best aspects of the GOAL! lessons were teamwork, engagement, collaboration, accessibility, hands-on, involvement from all students and ease to implement and adapt.

Teachers have also admired the inclusion of the Teacher Does/Student Does feature, as well as the opportunity to collect real student data within lessons. Teachers also reported observing their students using mathematical language, comparing and deciphering peer decisions, justifying decisions, demonstrating leadership skills, and not being afraid to make mistakes.

Students completely absorbed during a GOAL! lesson.

With such positive feedback from educators, GOAL! offers an exciting prospect of implementing highly engaging and student driven lessons in the classroom that encourages student cooperation. The lesson plans are free!

The Huddle plans to build upon these six lessons. There is a strong push towards creating a space for educators to share their experiences of the lessons that presents a genuine opportunity for teachers to collaborate and share successes. The Huddle is keen to get feedback from teachers to ensure that future activities remain relevant and meaningful. Email education@thehuddle.org.au.

Schools can register expressions of interest to access GOAL! resources at thehuddle.secure.force.com/r/goal

GOAL! IN THE CLASSROOM: A TEACHERS PERSPECTIVE

So many of our students were disconnected from friendships and school during the pandemic. I had concerns for their well-being and how I could re-engage them when they returned to school. The GOAL! program is brilliant. The lessons are fun, active and promoted the connectiveness we had greatly missed. The lesson plans are detailed and easy to use. I didn't have to do any extra planning, just a quick look prior to the lesson. Students can engage with the lessons at their point of need, detailed instructions on how to cater for different abilities is clear and easy to implement. It felt like it was learning by stealth, a strength of the program is that revealed to my students that STEM is all around them, they were so caught up in the fun it was only after we had our discussions that they realised they were learning STEM concepts. The lessons are rich in content, they can be run in a single session or used as a starting point for longer investigations.

- Ben Eretz, Windsor Primary School

MATH HOOPS

Thomas O'Halloran - Year 5/6 teacher, Moreland Primary School

MY EXPERIENCE PILOTING NBA MATH HOOPS

As a sports fan and maths buff, I immediately recognised the power of a board game that leverages basketball to engage students in mathematics. After completing the teacher training (thankfully, a painless, super-informative online 90 minute workshop), I was impressed by the game's potential to shift the mindset of students who consider themselves to be 'bad at maths'.

While initially excited, it wasn't until I received the class set that I was blown away by the high quality of the board game. The game was fun, colourful, and the player cards were attention-grabbing. (I recently found out that Hasbro, the creators of Monopoly, are also the creators of NBA Math Hoops.) The NBA Math Hoops game formula is simple.

Teams collaborate, communicate, think critically and creatively (use the 4Cs) to win. The in-school NBA Math Hoops draft was pure chaotic bliss.

Students were scrambling to review player cards, deciphering statistics, using multiplicative thinking, debating player selection with peers, and justifying their decisions. It is always wonderful to watch students practising the skills that will equip them to navigate and thrive in our ever-changing world.

I love how the game establishes intrinsic motivation in students to build upon and use their mathematical knowledge. The associated lesson plans effectively scaffold students to practice the relevant mathematical skill while gradually layering the rules. This approach significantly reduces the pressure on teachers to be 'game' experts. I liked that I could adapt and differentiate the rules to support or challenge every student in my class.

My experience piloting NBA Math Hoops was a series of wonderful surprises.

While compiling the 2021 end-of-year reports, I was surprised by how many students referenced NBA Math Hoops in their reflective comments, many describing the game as a fun way to learn maths.

NBA Math Hoops is stealth learning! (Like sneaking vegetables into a pasta sauce). I would highly recommend the board game and accompanying resources to any educator looking for tools to engage students in maths.

Attend teacher training to receive a free class set of NBA Math Hoops board games for your school in 2022. Use the QR code or registration link to sign up. Limited spots are available.

https://thehuddle.force.com/r/mathshoops

CREATING SUCCESS FOR STUDENTS

Kerryn Sandford - Principal, Heathmont Secondary College and MAV Board member

CREATING SUCCESS FOR ALL STUDENTS IN MATHEMATICS: THE GOOD, THE BAD AND THE UGLY

In late 2021, the MAV CEO received an email from a parent in response to seeing an article about mathematics standards in Victoria. It prompted this parent (let's call her Mary) to write to MAV, and explain her experience. Mary saw her child unfairly disadvantaged due to a school's process and structures for streaming students. This issue reduced her daughter's opportunity for success in mathematics. Luckily, the outcome, in this instance, was positive.

> 'I wanted to share a personal story of outstanding maths teaching that has quite literally changed my daughter's life. It's a lovely story, and one that I think is worth sharing with other teachers as a model of 'how to teach maths right'!'

This story provides a stark message: that we need to get our students' education right, or we cut off opportunities for all students to experience mathematics positively. We also risk missing the opportunity to provide open and fair pathways for all students to do the highest mathematics they are capable of, without unfair discrimination or judgement of ability too early in secondary school.

We will come back to Mary's story soon to unpack some of the approaches that both failed and supported her child.

SO MANY KEY ISSUES IN MATHS EDUCATION…

It is important to recognise there is no quick fix in maths education. There is much current discussion in the media on improving mathematics education and what constitutes quality teaching – the response to PISA, NAPLAN and other testing regimes, false dichotomies between 'instructivist' vs 'constructivist' teaching, ITE (Initial Teacher Education), unqualified (out of field) mathematics teachers in secondary schools, the shortage of qualified mathematics educators entering the workforce, formative vs summative assessment, ability grouping/streaming, learning loss due to COVID-19, the new Australian Curriculum and what is or is not being taught, and more recently new VCE curriculum's in Victoria, the ATAR debate, and more….

Most of these issues are important, most of them are possible to fix given enough time and funding, but none of it is the sole answer to the question of what do schools do…..what follows are some suggestions and ideas to consider.

FOCUSING IN ON PROFICIENCIES FOR ALL STUDENTS' SAKE

The reality is that there is no simple solution to how we solve the 'problem' of our declining PISA rankings and other national measurements of numeracy attainment.

It is also important to recognise the range of opinion that exist as to whether this is as much of a 'problem' as it is made out to be and what the nature of the problem actually is. According to some leading academics and practitioners, such as Mike Askew and others, much of what leads to achievement or attainment on assessments such as PISA, is not knowledge of curriculum or procedural fluency but, rather, the ability for mathematical reasoning and application.

Reasoning, conceptual understanding and problem solving are three of the four mathematics proficiencies that are highlighted in both the Australian and Victorian Mathematics curricula and yet, much of the discussion outlined above about how to 'save' mathematics teaching and learning seems to focus very heavily on procedural fluency which does very little to support students to answer the higher level questions in PISA style assessments.

For more information on the proficiencies and resources to support incorporating these into instruction, check out this package developed by EdPartnerships for the Victorian Department of Education and Training, https://fuse.education.vic.gov.au/Pages/Proficiencies.

DEALING WITH DECLINING ENGAGEMENT AND ACHIEVEMENT

Even before COVID, schools have been grappling with declining engagement and achievement in traditional mathematics instruction and we have seen an ongoing decline in students choosing to study mathematics at higher levels, particularly for certain cohorts such as females (for further information regarding gender and mathematics, read the monograph by Helen Forgasz and Gilah Leder, www.education.vic.gov.au/school/teachers/teachingresources/discipline/maths/pages/evidence-and-research.aspx#link3).

In his presentation to the Area Principal Forums in Term 4 of 2021, Emeritus Professor Peter Sullivan outlined approaches that schools could look to use to support students making greater learning progress in mathematics and to support those students who have not, perhaps, made as much progress during periods of remote learning.

The strategies that Peter Sullivan suggested work across primary and secondary boundaries and include:

- Focus on key ideas in the curriculum. Use 'I can…' statements to support students to understand what they are learning and to use as success criteria for formative assessment purposes.
- Take a balanced approach to pedagogy. Incorporate many different pedagogical practices that do draw from all four proficiencies.
- Focus on High Impact Teaching strategies (www.education.vic.gov.au/school/teachers/teachingresources/practice/improve/Pages/hits.aspx) incorporate all of them into teaching repertoire, not just the 'explicit teaching' one.
- Prioritise and support collaborative planning time for teachers.

As a current school leader and someone who has taught mathematics in secondary schools for over 20 years, I can't help but agree with Peter Sullivan's suggestions. Sure they don't provide a specific answer, there is no worksheet or program that will provide what is needed but then a simple answer could not possibly respect the complexity and intricacy in how students learn mathematics (and how teachers teach it). Peter Sullivan is, absolutely, spot on with emphasising the need for a 'balanced' approach to pedagogy.

Supporting teachers to experiment with a range of pedagogies can be challenging but there are many supports available that can help with this, including external providers

who can offer expertise, staff professional learning, coaching and so forth.

I recommend checking out MAV's resources and professional learning opportunities as an example, visit www.mav.vic.edu.au.

There are also many free resources that you can draw on that are available now through the Victorian Department of Education and Training in the Mathematics Teaching Toolkit, and there are further resources coming in 2022 (refer, for example, to the resource listed above on the proficiencies). Resources currently available include the Mathematics Curriculum Companion which provides detailed support for all areas of the curriculum from Levels A – 10A (https://fuse.education.vic.gov.au/MCC).

Finding the time for teacher collaboration is a challenge but it is one that school leaders must meet, for all teachers. COVID had a significant impact on the well-being and confidence of our teachers and never has there been a greater need for educators to be able to rely on each other for support and collaboration. Too often teachers are working individually, recreating wheels that have already been created in other classrooms time and time again. The way to get teachers to collaborate is to provide more time explicitly for this. This enables teachers to better design, collect and use formative assessment, which is essential to identify where each individual student is 'at' in their learning and to ensure that they make significant growth across the year.

CONSIDERING ABILITY GROUPING/STREAMING

As we go back to our story from Mary, The email that contained the opening statement then goes on to describe the parent's own, personal experience of what current mathematics teaching is like, using their daughter as the example. It is a mother's story of her child's experience of mathematics teaching across two very different schools....

> 'My daughter is in year 10 at [a local government secondary college]. She's thriving there. She loves maths, regularly scores high distinctions and has chosen to do Math Methods in Year 11. She has come a long way from Year 7, when she truly hated and feared maths, believed she had no maths ability and, also had me convinced that she had a possible learning disorder...'

Sounds like a positive story, and it is, but it hints as something else. The question that immediately springs to mind is, 'what happened in Year 7?'.

The mother goes on to elaborate....

> 'She began high school at a different school. The culture at the first school (name withheld) was very academic and pressured. Within four weeks of starting Year 7, the school decided she needed to move to a 'support' maths class where she would only be taught 80% of the curriculum and streamed away from mainstream maths.
>
> The culture of the school was so judgemental and ingrained in the student body that one day, when we bumped into one of her friends at a shopping centre, the friend greeted me with 'Do you know how dumb *xxx* is at fractions?!'.
>
> The school 'strongly recommended' we have our daughter assessed by an educational

CREATING SUCCESS FOR STUDENTS

Kerryn Sandford - Principal, Heathmont Secondary College and MAV Board member

> psychologist. We did this, and she was found to fall in the 82nd percentile for numeracy - her natural ability was actually well above average. The psychologist then disclosed that she'd had three appointments that week with high school students being ever-so-gently steered away from their elite schools.... The damage this school did was long lasting and deep.
>
> Our daughter truly believed maths was of no use and something she would never be able to do. Many nights ended in tears as I would try to help her with homework, especially the week of NAPLAN when this same high achieving school sent home a practise test to do every night.'

Interestingly, none of the issues that are brought up by this passage seem to have a high profile in the current discourse playing out in the media and in boardrooms about how to 'fix' the mathematics teaching problem.

A major practice that is raised in the example painted above is that of 'streaming' or 'ability grouping'. This is a contentious practice, but the research and evidence on it is quite clear that streaming or ability grouping causes many deleterious effects related to student agency, equitable access to opportunity, and dispositions towards mathematics, while at the same time producing no significant benefit in student mathematical ability or achievement. The evidence shows that:

- Ability grouping *between* classes (i.e., streaming/regrouping) produces inequities in students' opportunity to learn.
- Ability grouping *between* classes is not associated with improved mathematics learning outcomes for students.
- However, there is evidence that the longer students remain in ability groups, the greater the achievement gap between lower and higher attaining students becomes.
- The tendency to allocate less qualified mathematics teachers to 'low' ability groups can have a debilitating impact on students' opportunity to learn, their motivation and attitudes towards mathematics, and as a result, their future life choices and chances.
- The opportunity to learn mathematics in mixed-ability classes leads to better cognitive and social outcomes than learning mathematics in classes grouped by ability (i.e., streamed or tracked classes).

Given this research, it is amazing to see how prevalent streaming in mathematics is in the system. If schools subscribe or claim to follow 'evidence based' practices when it comes to teaching and learning, streaming practice should no longer exist. If yours is a school that engages in this practice, it might be time to consider other approaches, especially with the impact of COVID widening the gap between those with positive and negative attitudes and confidence regarding the learning of mathematics.

For a comprehensive summary of the issue outlining the evidence against 'ability grouping' strategies, please see Professor Di Siemon's monograph at www.education.vic.gov.au/school/teachers/teachingresources/discipline/maths/Pages/evidence-and-research.aspx#link3.

REDUCING IMPACTS ON STUDENT DISPOSITION AND ATTITUDE

Those of us who have worked in mathematics classrooms know all too well how matters of disposition and attitude impact on student motivation and achievement, particularly in mathematics. As the ability grouping monograph indicates some practices negatively effect student attitudes towards learning and using maths in future:

> 'The experience of ability grouping together with fixed personal and societal views of ability can affect student's self-esteem and confidence and have a long-lasting, negative impact on learner identity and agency.'

We saw this play out clearly in Mary's story. Mathematics is like no other subject in the degree to which it is socially acceptable to denounce any interest, ability or aptitude in the field. When schools and teachers go on to treat mathematics like it is an elite sport by withholding opportunities or filtering pathways, we exacerbate the problem. It is essential that we, as a society, identify and accept that *all* students are capable of learning mathematics and there is no such thing as a 'maths person'.

Until we address the dispositional aspect of the discipline, we will continue to see students, such as the one described in our story, pushed out of the field and this is clearly at the detriment of all society (and certainly, that particular student).

Dispositions is a slightly trickier thing to tackle than merely not knowing the curriculum, or not being fluent in particular skills and whilst the Australian and Victorian mathematics curricular do refer to the importance of it, the curriculum itself does not offer much explicit advice as to how to tackle this issue.

Resources have been developed recently though to support schools wanting to address matters of disposition in mathematics. The Mathematics Teaching Toolkit, for example, contains a monograph on *Mathematics Anxiety* written by Sarah Buckley (www.education.vic.gov.au/school/teachers/teachingresources/discipline/maths/Pages/evidence-and-research.aspx#link3) and EdPartnerships have also developed a resource for schools on *Exploring Learner Mindsets and Dispositions in Mathematics* (https://fuse.education.vic.gov.au/?XG9CHY).

These resources are designed for schools to work through in their own way, either in collaborative teams or whole faculties. They are good resources for mathematics leaders of all levels to have in their toolbox. I used the maths anxiety monograph with my whole staff (secondary context) as a way to introduce a whole school approach to developing student numeracy skills and it was well received as so many of the staff involved found they could relate to what it contained. The conversations that it stimulated really highlighted the depth of the issue.

CONCLUDING OUR STORY

Our story continues as Mary outlines how her daughter was treated as an individual based on her needs, leading to improvements in confidence and ability, and a reduction in maths anxiety. Mary says:

> 'Thankfully we were eventually able to move our daughter to a government Secondary College, which has been exceptional. The teachers there have gently encouraged her, and supported her without judgement or comparison to her peers.

One night during remote learning, her teacher gave her 1:1 lesson over Teams to make sure she understood a concept. Slowly she regained her confidence and she began to enjoy maths. Without making a big deal of assessment, her grades also started to improve.

At her last parent-teacher interview I thanked her teacher for literally changing the course of her life. Because of the gentle, non-pressured culture of this secondary school, our daughter is now keen to pursue Maths Methods through to VCE and is interested in studying a science-based degree at university.

Had she stayed at her previous school, she would have been put in a stream that would have closed this option to her and stigmatised her to the point of not doing maths at all.'

And as Mary's email concludes....

'The moral of the story is to teach maths in a non-judgemental way, without an overt focus on grades. Not to stream students and certainly not after only 4 weeks into Year 7.

And to create a school culture that respects all students and not just those who are naturally high-achievers.

By removing the stress of the pressured classrooms of the first school and replacing it with the non-judgemental, caring teaching of the second school (government), our daughter now believes (knows!) that she *can* do maths. This is a gift for which I will be forever grateful.'

I don't think I can offer any better advice...

AUTHOR

Kerryn Sandford is the Principal of Heathmont College and taught mathematics and science across Years 7-12 since 1997. Kerryn completed a Masters in Education and a Professional Certificate in Mentoring from The University of Melbourne. She has previously held positions in school leadership in the North West Region of Melbourne ranging from working as a Numeracy Coach for a large metropolitan secondary school to Assistant Principal at another.

Throughout her career, Kerryn has maintained a strong focus on improving the mathematics and numeracy development of staff and students. Prior to taking on the role of Principal in 2020, Kerryn held a position in the Learning Teaching and Pathways Division of DET as Manager of Numeracy and Mathematics. Through this role, Kerry was involved in the development and delivery of a number of key projects to further professional knowledge and practice of the teaching of mathematics and numeracy and oversaw the development of tools and resources for the Mathematics Teaching Toolkit including the Mathematics Curriculum Companion, Middle Years Mathematics Challenges, and the Mathematics Monographs series, amongst others.

FINDING THE MATHS IN SPORT

Jess Mount - Mathematics education consultant, MAV

At first glance mathematics and sport may seem to have little in common. To a lot of students, it may be taking a subject that is hugely popular and blending it with something that doesn't quite have the same fan base however, in my first few years of teaching I found using sport in mathematics to be extremely helpful. It made the mathematics relatable and showed students that their everyday heroes used mathematics in a variety of ways. From analysing data, launching the ball at the perfect angle to reach the basket, or kicking the ball at the right speed to make the distance our sportsmen and women use mathematics every day.

Every mathematics teacher has been asked 'Why do I need to learn this? Where will I ever use this after school?'. As a young teacher when I would be asked this I would try and come up with a great list of careers and real-life experiences to drum up their enthusiasm and show them why mathematics was so important. No wonder I was often met with students who didn't seem convinced as I rattled off ideas that didn't relate to the students or listed careers that some had probably no idea what they were! My intentions were good but telling a Year 7 student that mathematics will be important when you're meeting with your tax accountant or budgeting for a holiday doesn't really get their excitement going.

During the school holidays, I was reflecting on how I could engage my mathematics classes for the coming term. As teachers we can often have grand ideas about how this term will be brilliant, and all my students will be engaged, and as we often know, the term rolls on, we struggle to just get through the curriculum let alone any extra activities. I knew that I had to move away from whiteboard and textbook teaching and help my students discover mathematics. I wanted to help them answer their own questions and uncover where mathematics was in their everyday life - even in Year 7.

I had read an article about exploring maths in sport, so that's where I started. At the start of the term I asked my Year 9 class to think about where maths was used in sport. All my students do inter-school sport so I knew that even those students who don't consider themselves 'sporty' would have ideas to contribute. What I thought would be a quick 5–10 minute brainstorm became the whole lesson. Students were debating why certain mathematics topics could be used in sport.

Students began offering ideas about kicking speeds in soccer, shooting angles in netball, release angles in basketball, data analysis performed by coaches and players, probability of teams winning and losing, amount of ball spin in tennis, using geometry for the best field placement in football and the list continued. As different suggestions were offered, the ideas became more complex. Students were able to understand how mathematics and sport intersect. Some students found me later in the day to offer more ideas and I could see that the topic was getting a few of them really thinking.

I decided to run with the sport theme and explore mathematics in basketball. The students were doing basketball in PE, so I figured it was a good curriculum cross over and lots of students had access to basketball hoops at home, school and at local parks.

The students worked in groups, and I posed the question 'How is maths found in basketball?'. I gave them the lesson to brainstorm and come up with a question they would like to explore as a group. My plan was to use one of my five lessons each week to allow the students to work on this investigation (and the other four lessons to continue with the current measurement topic).

The groups each picked something to investigate. I allowed groups the freedom to choose whatever idea they liked. Different research ideas looked at shooting angles, free throw technique or how to determine the best shooter. It was new for the students to have so much freedom in mathematics so some groups changed their investigation until they found something they felt they could use maths to solve.

Over the next eight weeks of term as students continued their investigations, it was encouraging to see how students used their knowledge to refine and work out how to answer their research question. The original plan was not to spend this long on the project, but the students were enjoying their research and as we were only spending one period a week on the group work, I allowed the rest of the term to complete their investigation.

There are so many great ways to engage students with mathematics via sport. Sport is great for getting students outside, being hands-on with maths and letting them see how their research questions couldn't be answered without mathematics.

There were many different research ideas that the students were exploring:

- Is there a best spot on the court to shoot from?
- How can we determine the best shooter in Year 9?
- Why are three pointers hard to get in?
- What angle do you have to throw a free throw at to hit the back board in the middle?
- How hard should you throw the ball at the back board to get the shot in?

Across the groups I saw decimals, fractions, percentages, angles, speed, graphs, data analysis, algebra, probability and measurement being used in their projects. I was also surprised to see how much better their data analysis was compared to usual. I assumed this was because they had set their own research question, collected all the data, performed their own mathematics, and therefore could analyse the data more effectively.

This type of investigation then become a staple across Years 7-10 classes. Inviting students to investigate mathematics in sport has been a success in helping students engage and relate to mathematics. Over the years, the projects have changed and at times students have researched any sport they wish, or all groups have worked on the same research question and have compared their findings at the end. The core element is to allow students the freedom to investigate. Not guiding them with how to perform the maths or which maths to use. Not guiding them with how to perform their data collection nor telling them if their data collection could be improved. Not guiding them with their data analysis even if they are missing something obvious.

When time has permitted, the groups have presented their findings to the class. During this time, I can pose questions to each group and if they have missed something obvious in their analysis or I can see that an extraneous variable has affected their results I can question them about this. It's always rewarding to see students reflect on these questions and come up with ways their mathematics or data collection could have been improved. At times groups report back that they couldn't answer their question because they didn't know how to measure or collect that data. Getting students comfortable with this has been a big learning curve and helping them see how much learning has still taken place takes time for them to appreciate.

This type of investigation has been extremely important for introducing students to open ended investigations now found in VCE courses. Students who have participated in these projects over Years 7-10 have had more success in their assessment tasks during VCE. They are used to seeing a research question, devising a plan to solve the question, and refining the plan if needed.

We need to continue to make maths relatable for our students as well as getting through the general curriculum. It won't always be possible to using hands on lessons and open-ended investigations to teach our content, but where possible we need to embrace trying something new. The learning can seem chaotic and useless at times when groups are stuck and can't get their research going. Helping students through this frustration with prompting open ended questions such as 'What information do you need to get started?, What information do you already have?, What could you try first?' can help groups to feel heard whilst still leaving the research and planning up to them. Getting out of the student's way and not offering any guidance or input was hard for me at first when I was keen to help groups get started!

Sport is a great place to start to help our students discover how mathematics relates to something in their life. Younger students can use sport to practice their counting and number skills when totalling scores, older students can compare team performance by using data analysis and VCE students can use algebra to model ball trajectories.

There are thousands of ways to relate mathematics and sport over a student's time at school. Investigating sport using mathematics allows students to see how mathematics is not just useful but necessary. All aspects of life will require students to gather information, consider alternatives, and select the best outcome following analysis. It is our job to help them to discover how mathematics will assist them on this journey.

A great way to apply mathematics in the real world is through MAV's Maths Talent Quest.

For more information visit www.mav.vic.edu.au/Student-activities/Maths-Talent-Quest.

STIMULATING THINKING

Education consultants, The Mathematical Association of Victoria

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

EARLY YEARS - YEAR 2

- Using the same sized basketball in the image, estimate how many basketballs would fill the court.
- Name three or more 2D shapes you can see in the image.
- Go on a walk to your closest basketball court. Using your step length as a measurement, estimate how many steps long the basketball court is. Estimate how many steps wide it is. Check by walking around the court.
- The difference between the points scored in the first and second half of a basketball match was 3. What might the scores have been?
- The combined total of the end result was 100, what could each team's final score have been?
- How many lines of symmetry does this image have? How can you prove your answer?
- One basketball team has 20 players in total. How many girl and boy players could be in the team?
- There are 20 basketballs scattered all over the court. How could you arrange the basketballs to make it easier for someone to count? Draw your thinking.
- Create and draw a repetitive pattern using basketball skills. Record your pattern with either drawings or letters. Example, dribble, pass, shoot, dribble, pass, shoot.
- The price on a basketball cap at the shop was $5. What coins and notes can I use to pay for it?
- How many times in 1 minute can you:
    - Bounce a basketball
    - Shoot a basket
    - Run a lap of the basketball court.

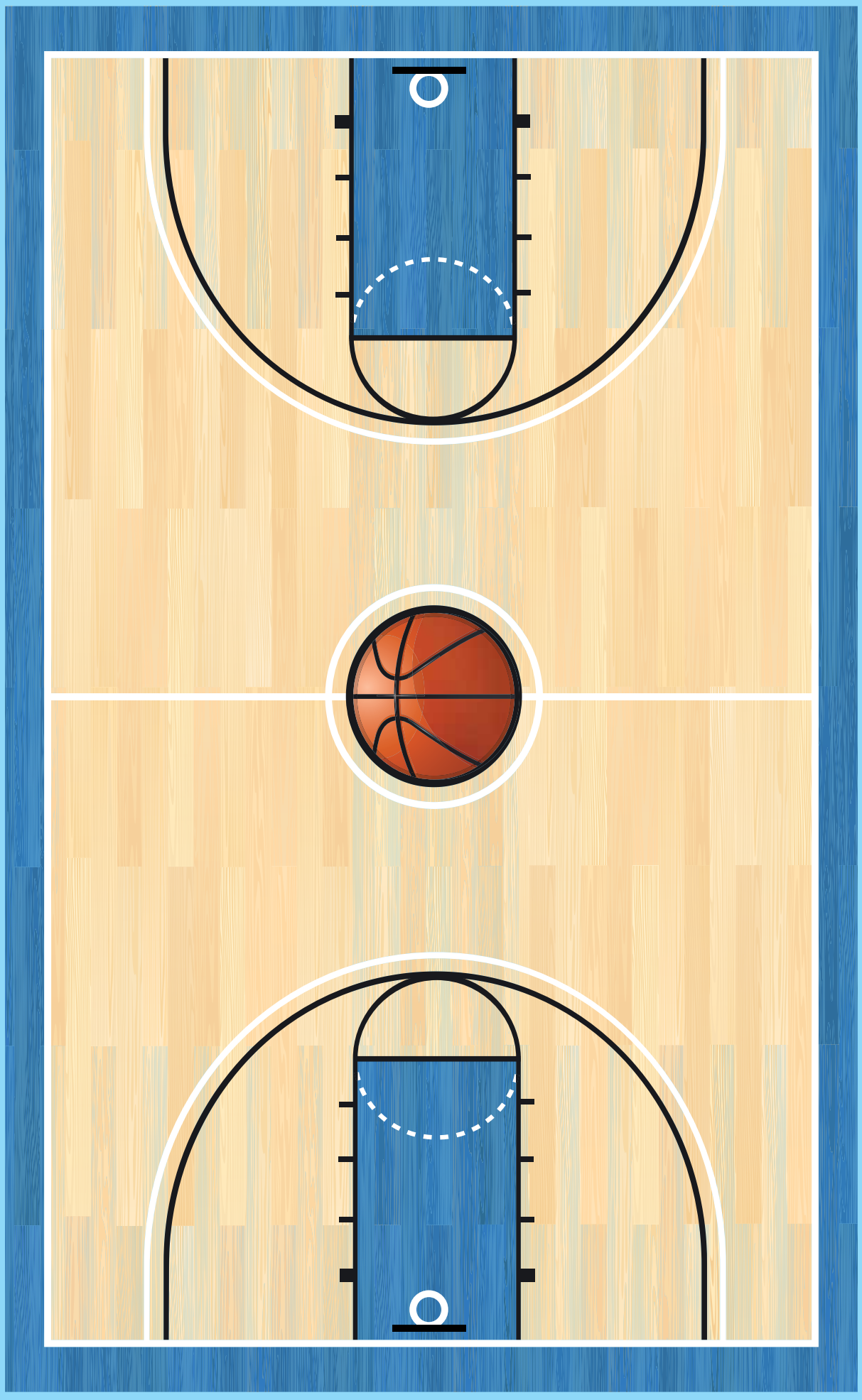
YEARS 3 AND 4

- How many people (of your size) could lie down and fill a basketball court without overlapping?
- A basketball court is normally 28 metres long and 15 metres wide. What is its area? What is its perimetre?
- The basketball court is 28 metres long. How many laps up and down could a player run in 1 minute?
- 300 people are coming to watch a game of basketball around this court. You have access to tiered seating. Draw a diagram to explain how you could seat them so everyone has a good view of the game.
- This is a bird's eye view map of a basketball court. Choose another ball sport and draw a bird's eye view map of the court, field or oval. Make sure your map is to scale.
- How many basketballs do you think you could fit in your classroom? Explain your thinking.
- The end total of combined scores for the game was 144, what could the final score for each team have been and how many 2 and 3 pointers could have been scored?
- All the players on a basketball team have odd numbers on their singlets. If you add 3 odd numbers together, will your answer be an odd number, or an even number? Is that always the case? Explain why and show 3 examples.
- There are 4 quarters in a basketball game. Player number 8 played 3 full quarters of the game. Show as fraction what percentage they played of the game.

YEARS 5 AND BEYOND

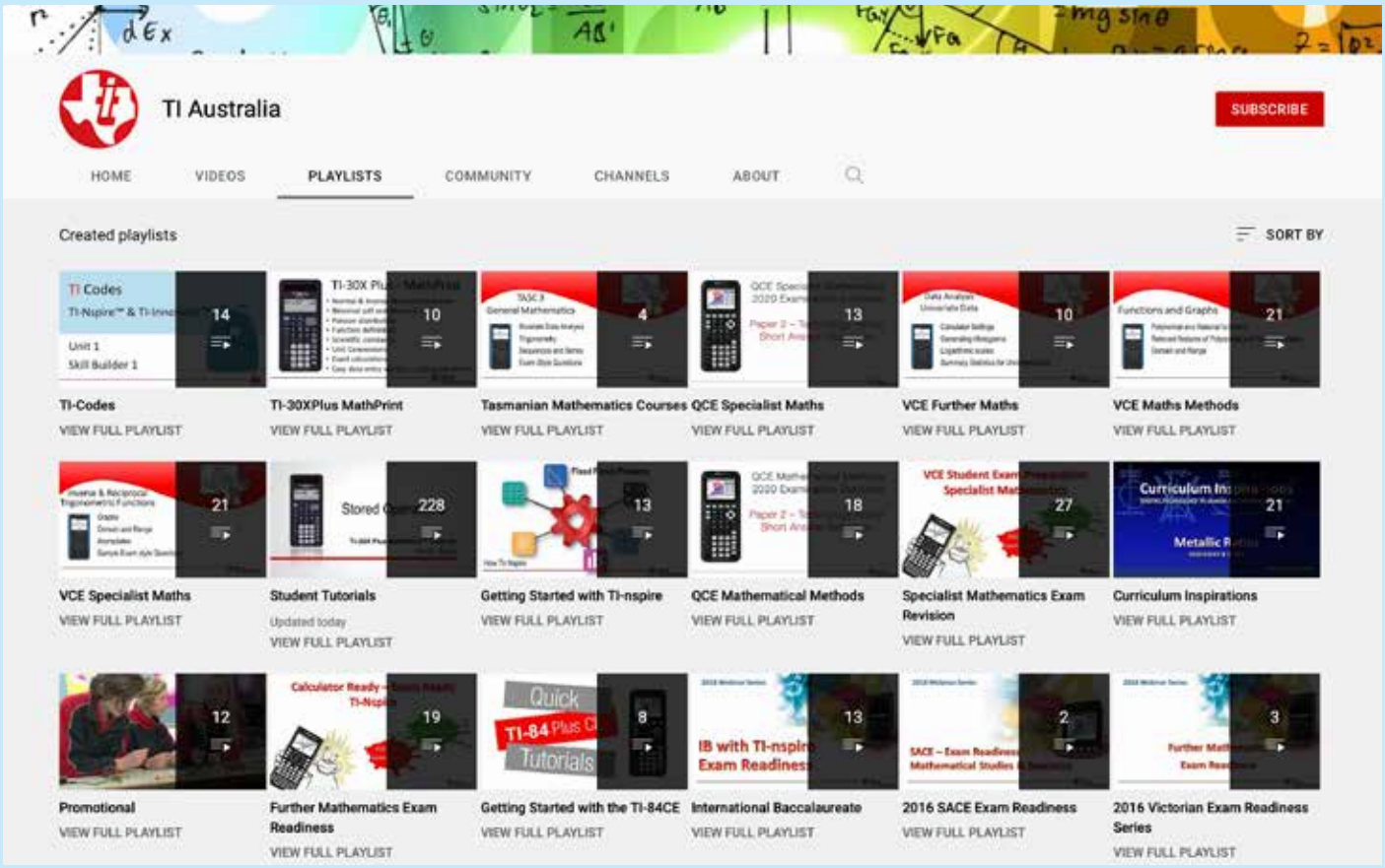
- If the baseline (the width of the court) is 15 metres, estimate the length of all of the internal lines on the basketball court. Check your estimates with a real basketball court.
- The free throw line and part of the baseline create a semicircle, estimate what percentage of the court is covered by that semi circle.
- Estimate what percentage of the court is blue.
- The diametre of the centre circle is 3.6 metres. What is the area and perimetre of the centre circle?
- 2,700 people are coming to watch a game of basketball around this court. You have access to tiered seating. Draw a diagram to explain how you could seat them so everyone has a good view of the game?
- The average number of points scored over 5 matches was 85. What might the scores have been? Provide more than one answer.
- At the final siren the total of the combined end scores was 140. If one team scored around two thirds of the points, what could the end scores have been? Can you find at least 5 answers?
- Draw an x on the court to indicate where a basketball player could take a 3 point shot from a 45° angle. What other angles could you mark on the court?

MAV education consultants can come to you and create a professional learning plan to build the capacity of teachers at your school.



VCE MATHS AND CAS TECHNOLOGY

James Mott - Head of Maths, Southern Cross Grammar and TI trainer



TI Australia's YouTube channel, https://www.youtube.com/user/TIAustralia/playlists

FOCUS: TI-NSPIRE CAS

The use of technology is incorporated in all VCE mathematics courses. It is embedded within the curriculum and there is a expectation that VCE students are competent users of CAS technology to both enhance their coursework and respond to exam questions more efficiently.

Within a VCE mathematics class or cohort, students can possess a broad range of proficiencies when it comes to using CAS technology, which is often the case when they commence their VCE studies.

For teachers who teach at a senior campus or who have new students enrolled into the school, the variation in CAS proficiency may be greater since the VCE teachers may not be involved in the development of students' CAS skills prior to them beginning senior mathematics. Students' confidence in using CAS technology is heavily influenced by their experiences in the years leading up to VCE.

Over and over, teachers are asked 'how to' types of questions when it comes to using CAS: 'how do I sketch a graph?', 'how do I solve?', 'how do I type in...?'.

This article focuses on the TI-Nspire and shows both examples and provides resources to assist students and teachers make better use of the technology.

TI Australia have created a free online course (TI-Nspire CX II CAS – The Fundamentals) to help students learn the essential CAS skills for VCE Mathematics. 'The Fundamentals' course is a beginner's course which is aimed at students who are new to the TI-Nspire CX II CAS.

The course contains targeted videos for each Application. The videos can also be accessed via YouTube on the TI Australia YouTube page. For example, within the Calculator Application section there are videos to teach students how to define, store and manage variables, how to use commands within the algebra menu, how to use commands within the calculus menu, and how to use the finance solver.

Teachers can use or direct their students to the videos that are most relevant to the subject of interest. For example, students studying Mathematical Methods may benefit more from the videos relating to the Calculator and Graphs Applications, whereas students enrolled in General Mathematics or Further Mathematics may appreciate the guided demonstrations within the Data and Statistics Application section of the online course. Teachers can decide how to use the course to best suit their students' needs.

In addition to the videos, students can take an online quiz to check their own understanding of how to use their TI-Nspire CX II CAS. This short multiple choice quiz is a great way for teachers to identify gaps in students' knowledge or skill set, and ascertain whether their students are 'CAS-ready' for VCE Mathematics.

As a beginner's course, 'The Fundamentals' course can also be utilised by teachers and students in Years 7-10 to support their learning of how to use the TI-Nspire CX II CAS.

Teachers who are unfamiliar with using the TI-Nspire CX II CAS would also benefit from the guided demonstrations within each video.

With no pre-requisites or sign-ups required, this online course is a great resource to support your students' development of CAS skills in both the lead up to and study of VCE mathematics.

In addition to the online course to help beginners, TI Australia have produced a series of videos for each VCE Mathematics course that targets key concepts and skills within each area of study. The videos are a mix of how-to/concept instruction using the TI-Nspire CX II CAS, and using the technology to effectively tackle examination style questions.

These videos are freely available on the TI Australia YouTube channel, and are also accessible via the TI Australia website. All teachers, regardless of experience, would benefit from utilising these resources as part of their classroom teaching, whether it be as support for students who may need more visual explanations, to aid students who are working ahead of the class, or to demonstrate to students how to efficiently use their CAS technology in an assessment.

For example, some videos relating to Further Mathematics include data analysis, amortisation, using the financial solver for loans and investments, performing matrix operations such as working with transition matrices using the TI-Nspire CX II CAS. For Methods, there are videos that explore how to efficiently use the TI-Nspire CX II CAS for tangent lines and stationary points, probability distributions, and exam 2 style questions. For Specialist Maths, there are videos that explain concepts and look at how to efficiently use the TI-Nspire CX II CAS for vectors, complex numbers, differential equations, vectors calculus, and mechanics to just name a few.

Any teacher who is taking a VCE mathematics subject for the first time would benefit from the pedagogical content knowledge and technological knowledge demonstrated in these videos.

These resources and the online Fundamentals course, were created by experienced secondary school teachers.

Join James Mott to find out more about how you can use your TI CAS more efficiently in your VCE Maths class.

On Wednesday 18 May, James will present a one hour virtual workshop, which will focus on the fundamentals as well as providing examples in Methods, Further and Specialist. There will also be an opportunity to ask questions.

For further information go to www.mav.vic.edu.au/Events

WHOLE SCHOOL AFL INVESTIGATIONS

Andrea O'Connor - Leader of Pedagogy, Catholic Education Sandhurst

As the 2021 AFL season loomed in Term 1 and cricket balls were swapped for footballs, both oval and round on the playground the idea of developing a whole school maths investigation based around the AFL football season was born. As a school, we have focused on providing our students with authentic, rich, open-ended maths investigations which provide a 'real life' context to enhance student engagement and motivation, however we had never undertaken a whole school approach.

We also believed this learning experience would provide an opportunity to share with our parents how mathematics investigations evolve in complexity through each year level. We have integrated Jo Boaler's *Mindset Mathematics* resources and ReSolve investigations into our maths program which highlight the importance of teaching learning tasks which support inquiry, allow students to make connections between maths concepts, provide a high ceiling and low floor and facilitate student collaboration.

The investigations ran over Terms 2 and 3 which resulted in the first investigation *What's the chance* being taught at school and the second investigation *Zach Touhy's Kick* being taught both remotely and at school.

INVESTIGATION 1: WHAT'S THE CHANCE?

The first investigation focused on the mathematical concepts connected to statistics and probability. The investigation was based around students collecting, sorting, presenting and interpreting data using both pen and paper and technology.

The students were presented with a slide show relating to events that were related to the AFL season and needed to decide the likelihood of the event happening. The students were able to connect to the context which helped to engage the students, especially when asked the likelihood of our Principal Mr Corrigan winning the Brownlow Medal.

The students created a question to ask the whole class and record the responses on a tally, which would indicate the most popular team. The students then presented their tally as a simple bar graph.

Foundation level

- The children collected, sorted and represented simple data related to AFL football jumpers. The students looked at colour, logos and patterns to create categories and organise the football jumpers. Students were provided opportunities to discuss and justify how and why they sorted the data.

Level 1/2

- This investigation provided the students with learning opportunities to collect, sort and represent simple data related to the most popular AFL teams.
- Students made judgements of event outcomes relating to past experiences or beliefs.

The 3/4 and 5/6 students investigated the probability associated with the umpire coin toss. The students modelled the toss from a 1 metre height. The students could either collect data on a spreadsheet directly or use pen and paper. Providing students with the choice of using technology supports the development of 'operationalisation', which is the process when a student becomes proficient in using technology and can determine when best to use. Questioning would the data collection be more accurate using a spreadsheet and would it support the data analysis later in the investigation.

To differentiate the tasks, students working at 5/6 level were required to compare the probability of tossing a head or tail using a 10 or 50 cent coin. The students presented their data on a table and produced graphs to visually represent the data. The students discussed how modelling is used, how sample size affects accuracy of data and represented the probability of the coin toss as a decimal, percentage and fraction.

Level 3/4 and 5/6

- These investigations examined the probability involved with the umpire's coin toss. The students explored the probability of the coin toss, by planning and conducting a coin toss experiment.
- Students looked at sample size and the variables which may act upon the outcomes.
- The students collected, sorted and represented data related to the coin toss using digital technology.
- The students formed conclusions based on their findings.

INVESTIGATION 2: ZACH TUOHY'S KICK!!

The second investigation was motivated by Geelong's Zack Tuohy's 75 metre kick. This investigation connected the mathematical concepts involved in number, measurement and statistics as students measured, ordered, compared and represented their own kicks against Zach's.

Foundation - Level 2

- Students measured their kicks using cones, the students recorded their kicks on a whole class graph on the SMART board.
- To differentiate students converted the cone distance to metres to then order the classes kicking distance.

Level 3-6

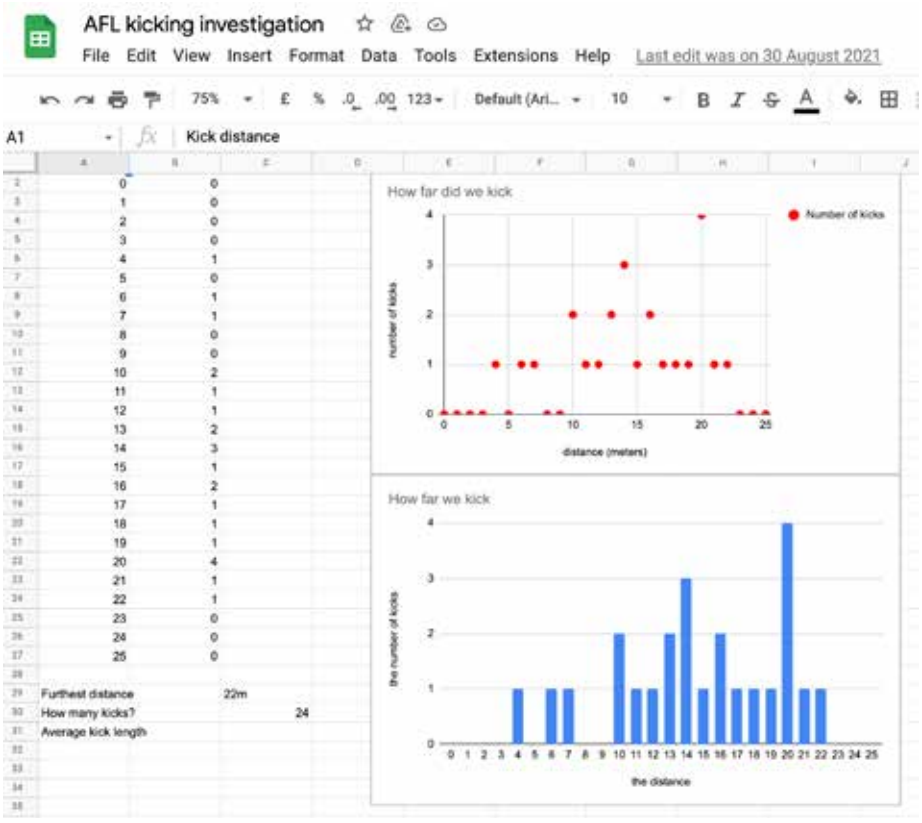
- Students planned an experiment to measure, compare and order kicking distance. Students used both pen and paper and spreadsheets to record, present, analyse and evaluate data.
- To differentiate the investigations students compared and represented their own kicking distance against Zach Touhy's using fractions.

DIFFERENTIATION AND ASSESSMENT

These investigations were collaborative and differentiated to ensure all learners were engaged in their learning through use of tiered scaffolding. The teachers were provided with a checklist of 'look

fors' to; assess formatively the children's understanding of mathematical concepts; ability to work collaboratively; form mathematical generalisations; reason and justify their mathematical thinking.

The original intention for sharing the whole school AFL Investigation was to hold a maths expo inviting parents into the school to see their children's learning and demonstrate how mathematical learning develops through the year levels. However, due to COVID restrictions this was unable to take place and the investigations were shared on our school website and Facebook page. This was a positive learning experience for the teachers and students due to the shared focus and the opportunity to collaborate vertically through our whole school.



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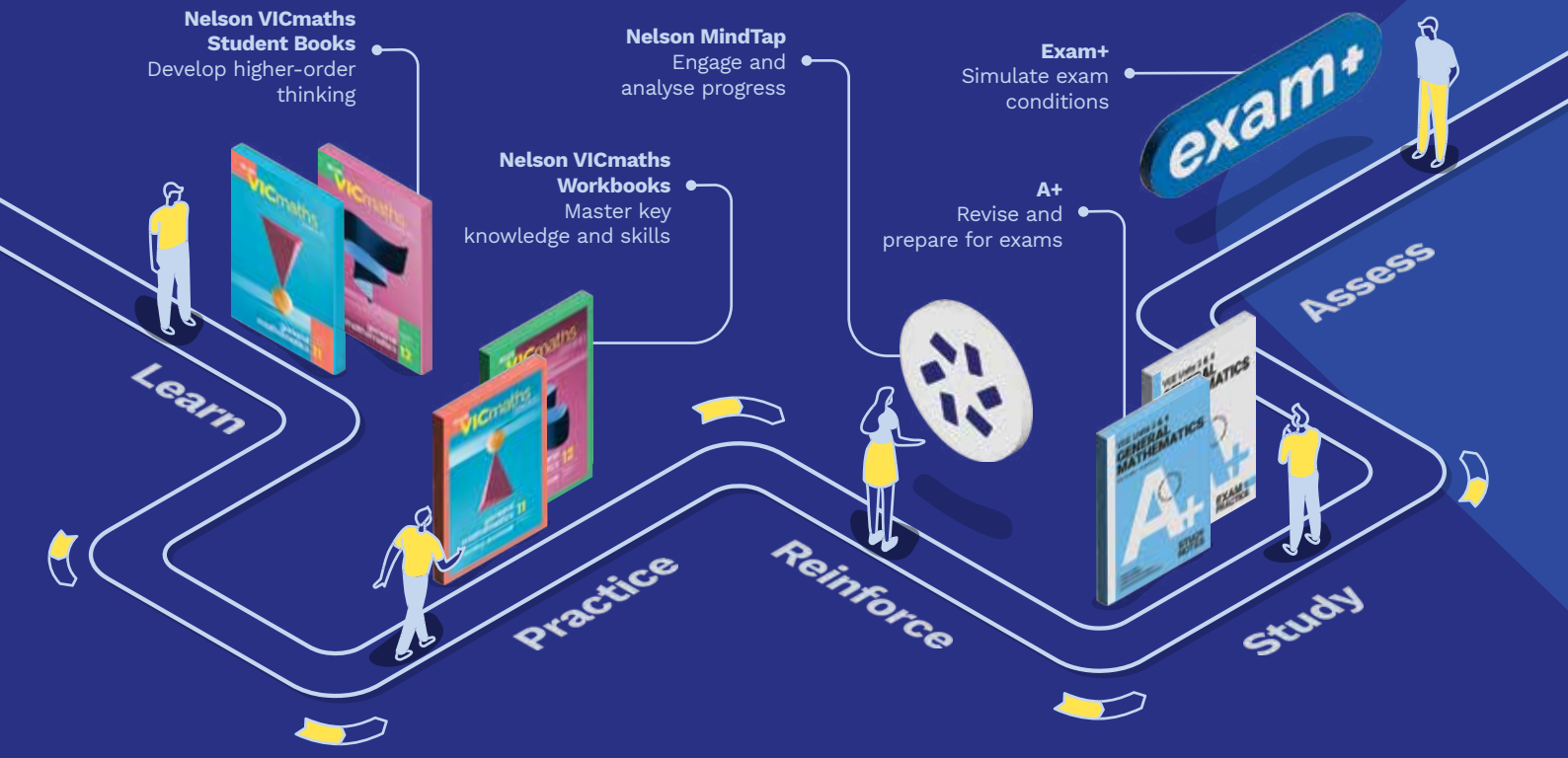

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Dirk Strasser, Greg Neal, Sue Garner, George Dimitriadis, Toudi Kouris, Stephen Swift, Sue Thomson, Judy Binns

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ONE MINUTE WITH MASON PEATLING

I'M....

Mason Peatling, a professional basketball player in the NBL with Melbourne United.

I GOT INTO BASKETBALL...

When I was busy playing lots of sports with my friends in primary school. I loved playing team sports where we could all try really hard to win something together.

MATHS IS PART OF THE GAME...

It's always important to know the score! You need to know how much you are ahead, or how much you are behind. Remember that there are five players on each team on the court, so if two are guarding you, one of your teammates is open!

GEOMETRY PLAYS A PART TOO...

We want easy shots, they have a higher chance of going in. We need to spread out, and give each other as much space as possible. On defence, we do the opposite. We try to take up as much space as possible to make the shots harder for the other team.

MOST PEOPLE WOULDN'T REALISE...

That professional basketballers have a lot of spare time off the court. It is important to train as much as you can, but it is even more important to recover and rest your body. Because of this, many of my teammates and myself included do extra reading, listen to podcasts and watch all sorts of videos on YouTube for extra knowledge.

I'M AMAZED BY ...

How the more you put into things, the more you get out of them. Time and time again I have seen others succeed not because of where they started, but how they pushed themselves along the way.

MY MOST INFLUENTIAL TEACHER WAS...

My English teacher Mr Lee. He was from England, and he encouraged me to truly push myself in the classroom, but also in life with what was to come for me in the future. He also was instrumental in making me feel like going on my own unique journey was the right thing to do. Don't just go along with the crowd because it might be easier... go for it!

I'M KEEN TO LEARN ...

More about the changing world. There are so many new technologies that will emerge and it's an exciting time to be alive.

WHEN I STUDIED MATHS...

I enjoyed the process. The more you practised, the better you got. There's always a problem that is a little easier, and another that is a little bit harder. That way you can start somewhere easy for you, and improve over time. With enough effort, anyone who wants to can achieve their goals.

I'D ENCOURAGE YOUNG PEOPLE TO...

Try as many things as possible, and follow your passions. Everything that you've tried and not enjoyed is just another thing to cross off your list. However, every success you have, brings you one step closer to finding something worth striving for.

SUCCESSFUL WARM-UPS

TOP 5 TIPS FOR TEACHERS

Warm-ups are used in the maths classroom to prime student thinking in preparation for a lesson. Warm-ups should be purposeful, easy to start and take ten minutes or less. Make your warm-ups meaningful and engaging.

1. LINK TO THE LESSON

Warm-ups must be purposeful. Make the link to your lesson to get students thinking about the maths to come.

Ask yourself: How might this warm-up prepare students for the mathematical concepts and proficiencies that will feature in my lesson? From there design or select a task.

2. GET RIGHT TO IT

A good PE lesson often begins with an immediate warm-up task. Students might be asked to throw a beanbag in the air and count how many claps they can do before catching it.

This approach can be used in the maths classroom, starting immediately maximises the limited time available for warm-ups

3. MIX IT UP

A variety of warm-ups will help you engage and challenge your students over the year.

Warm-ups can include games, visual images, puzzles, number talks, challenges, riddles and picture-story books.

The MAV Learning Activities Prep to 9 is a great launching point for building your repertoire of warm-up ideas. www.mav.vic.edu.au/Resources/Learning-Activities-Years-Prep-to-9/

4. REVISIT MORE THAN ONCE

When a new warm-up is introduced, the set up and clarification of task rules takes time. For this reason, consider revisiting a warm-up throughout the week to maximise its potential to stimulate thinking.

On Day 2, students have an opportunity to approach the task more strategically. On Day 3 vary the warm-up to increase the level of challenge. On Day 4, allow the students to create and trial their own variations.

5. PRIORITISE THINKING

Incorporate strategies to prioritise mathematical thinking:

- Create random groups of 2-4 students to encourage engaged discussion and ensure that turns come quickly.
- Provide resources to support visible thinking such as mini whiteboards, 100s charts, open-number lines, counters, or blocks.
- Use visual prompts to encourage non-verbal thinking.
- Come together to discuss the strategies and big ideas. Ask questions like: Can you explain your strategy? Who used a similar strategy? Who saw the maths a different way?

THE MATHEMATICAL ASSOCIATION OF VICTORIA

www.mav.vic.edu.au

CLASSROOM TO COURT

Bree Collins - Mathematics Education Consultant, MAV

USING SPORT TO INTRODUCE MATHEMATICAL CONCEPTS IN THE EARLY YEARS

During our chock-a-block school week, our students are sent off to their weekly PE lesson with our energetic sport specialists.

Here, they are taught the fundamental movement skills (FMS) that children require as a foundation to move, manipulate, play and be healthy active learners. After much lockdown, couch and TV time, it seems more relevant than I recall over the last 10 years of teaching to get children active, curious and simply motivated and moving.

As mathematics teachers, we aspire to show our students that mathematics is all around us and you can find or develop good maths questions and activities at any moment of the day. Somewhere in every school you can locate a basketball court beautifying the concrete for all to enjoy. Seeing that this is such a readily available resource for schools, I'm going explore the use sport in particular basketball, to introduce mathematical concepts in the early years.

Frequently, we ask our young students to demonstrate with their bodies an emotion from a picture book such as excitement or direct them to pretend they are climbing a ladder. What would that look like? Stand up and show me. This simple physical movement engages not only students' attention but promotes cognitive development. With this in mind, my class left the classroom and headed out to the court to get mathematically active.

One of my favourite ways to launch a maths lesson is to begin by reading a picture story book or using an image as a purposeful hook. I read aloud *A Basketball Story* by Richard Torrey, with emphasis one particular page. See Figure 1. Now students can discuss the two different types of basketball passes in the text, a chest pass and a bounce pass. The maths lesson explored addition. I explained to the students we'll only use a bounce pass for the warm-up and bouncing or dribbling for the task. I asked students to stand and pretend to bounce pass to each other. This introduction generates a lot excitement amongst students, giving them one minute to think of a basketball team name once paired up is worthwhile.

Figure 1.

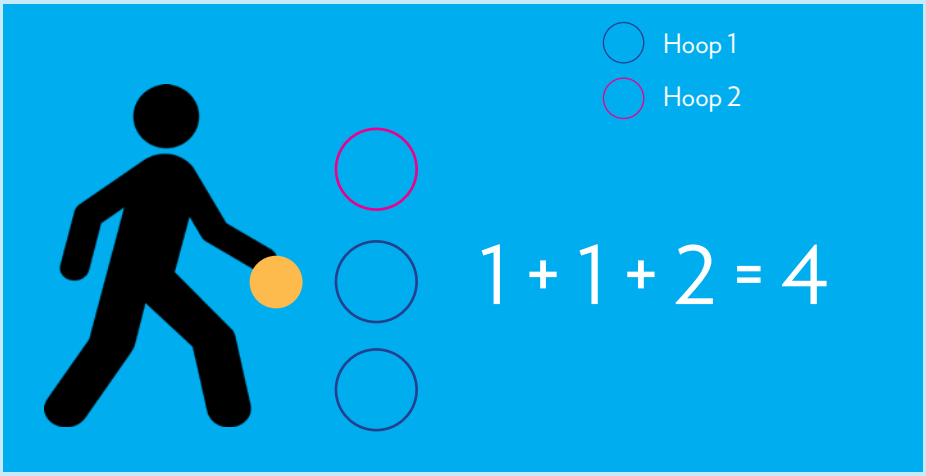

Figure 2.

I found it valuable to spend a moment asking my students to consider other features of the illustrations in the text, such as working as a team with a partner, speaking kindly and being helpful to your teammate. It's important to remember: marvellous mathematicians work better together.

Before heading outside, I found it helpful to draw the task on the whiteboard to give students a smaller visual. Unpacking mathematical language is an important part of this lesson, terms such as sequence, patterns, counting, adding, key, how many and total are all vocabulary that need explicit modelling and students are encouraged to use them as much as possible whilst exploring the task outside.

To warm-up, students bounced passed the ball to each other and counted by any of the following number sequences:

- 1s, 2s, 5s, 10s
- Count backwards from 20
- Count by odd or even numbers
- Count next few numbers in this sequence: 11, 22, 33

BOUNCE IT ADD IT

In pairs, students are given a few hula hoops in 1-4 colours depending on ability. Students need to lay their hoops in any sequence on the court, a straight line being easiest, or zig zagged. For this task let's say, blue hula hoops equal 1 point and pink hula hoops equal 2 points. See Figure 2.

The first player bounces the basketball in each hula hoop and the partner counts how many bounces they do in each hoop, initially aiming for one bounce in each hoop. Next, the first player needs to record their points or number sequence either using chalk,

CLASSROOM TO COURT (CONT.)

paper or an iPad e.g.. blue, blue, pink (B B P) 1 + 1 + 2 = 4. The second partner can set up their turn by rearranging the hoops in a different sequence before beginning, e.g. pink hoop, blue hoop, pink hoop or change hoop colours. Both players need to check each other's adding before having a second turn. Getting children to record their thinking is an important part of this activity. It will consolidate their understanding and provide evidence for the teacher, demonstrating addition capabilities and interpretation of the task.

Although this task focuses on developing students' addition skills, it can also be modified and adapted to reinforce numerous other mathematical operations at various grade levels.

There are many ways to differentiate this task to increase or decrease the difficulty. The number of hoops, variety of colours and value of points for each colour hula hoop will alter the task to cater for individual student needs. See Table 1.

This variation builds on this task and enables students to utilise the ring on the court, increasing basketball and maths difficulties.

A team scores 10 points in a game, how many different shots could have been made to get 10 points?

Key:

Outside 3 point line = 3 points
Inside 3 point line = 2 points
Foul point = 1 point

ENABLING	EXTENSION
Students only record the colour pattern they bounced e.g.. 	Increase the number of bounces in each hoop
One colour hoop all worth 1 point 1+1	Increase the number of hoops
Players use tally marks to calculate addition	Increase the number value for each coloured hoop
2 hula hoops, 2 colours e.g. pink/blue 1+2	Hula hoops need to show a repetitive pattern e.g. pink, pink, green, blue, pink, pink, green, blue
	Yellow hoops are worth double points

Table 1.

Figure 3.

ROCK, PAPER, SCISSORS, ADD

Students pair up and as a team facing one another they each begin to tap and chant 'rock, paper, scissors, add'. On the fourth beat (add) they hold up or out with a flat hand a number between 1-5. (See Figure 3). The amounts are subitised and players aim to be the first to add the total, for example, 5 + 3. Following, they jog that many steps together (basketball players work as a team) and continue to play, going from one end of the court to the other.

ENABLING THIS ACTIVITY

- One student plays at a time allowing the partner to count their partners fingers using one to one correspondence.
- Students race to identify and say what number their partner is holding up.
- One player can be the number 5 each turn and the partner selects a number between 1-5, allowing students to build to 10 from 5.

EXTENDING THIS ACTIVITY

- Students use both hands to increase the calculations i.e.., up to 20.
- Increase the group size to 3 or 4 students for more complex addition.
- Students can be given a target number e.g. 14 and without talking attempt to make that number and if they don't hit the target they can calculate and count how many more to the target number.

A great way to apply mathematics in the real world is through MAV's Maths Talent Quest.

For more information visit www.mav.vic.edu.au/Student-activities/Maths-Talent-Quest.

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VCE

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PLEASE NOTE: this resource is only available to current practising Victorian secondary teachers. The product is for school use only. It is not to be used by private tutoring services.

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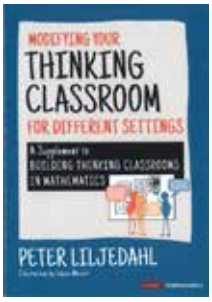

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F–VCE

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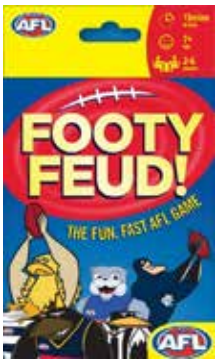

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