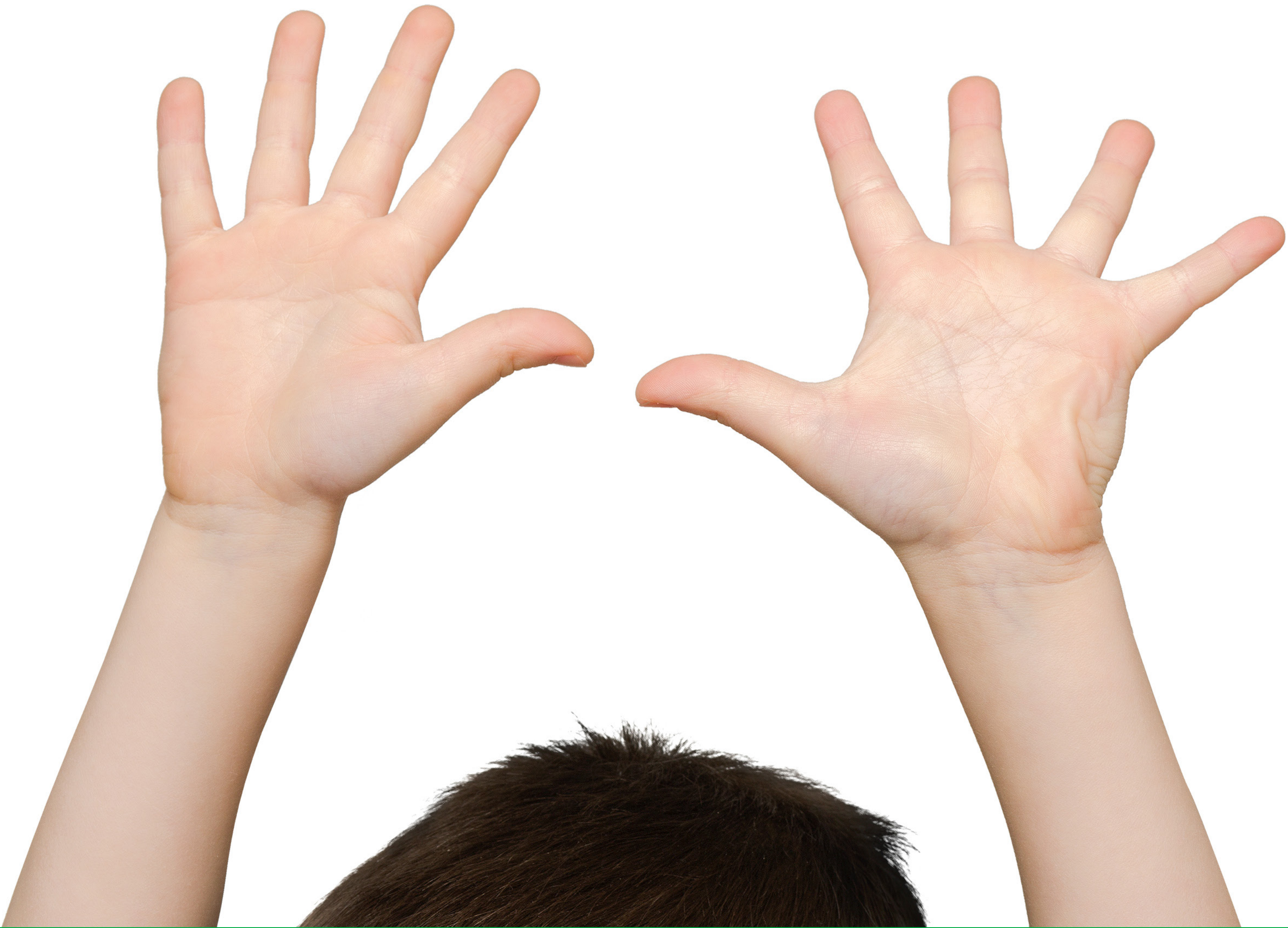
THE MATHEMATICAL ASSOCIATION OF VICTORIA

PRIME NUMBER

The primary journal of The Mathematical Association of Victoria



03/25

INSIDE

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ON THE COVER

The concept of 10 is integral to our base ten number system, where place value is built on multiples of ten.

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EDITORIAL

Aylie Davidson

ASSESSMENT AS A WINDOW INTO MATHEMATICAL THINKING

In the mathematics classroom, assessment is far more than a tool for grading. It is an opportunity to understand, to observe, and to notice – not just what students can do, but how they think. By using a range of assessment approaches and by deliberately tuning in to what students say and do, teachers open up a powerful lens on students' current thinking.

Effective assessment is multi-faceted. It includes the formal – such as standardised tools like the Mathematics Online Interview (MOI) – and the informal – such as observations, classroom dialogue, work samples, and student self-reflection. The richness of assessment arises when we view it not as a judgement but as a means to understand students' conceptual journeys.

When teachers engage with diverse forms of assessment, they begin to uncover the nuances in each learner's mathematical development. For instance, when students are given opportunities to demonstrate their thinking through open-ended tasks like in Kate Durling's article *What equals 10?* or composite shape creation in Michael Nelson's *The Logo Task*, we see their strategies, misconceptions, creativity, and mathematical language unfold. These windows into thinking aren't easily captured by a single test score. Instead, they reveal the depth and range of a learner's understanding – their readiness, not just their result.

The use of growth points, as seen in the recent Wendouree Primary School project, is a prime example of how assessment data can inform teaching. Donna McNeight describes how mapping student understanding and analysing their progress using MOI data, teachers noticed patterns, gaps, and needs – not abstractly, but concretely. Students who were operating below expected growth points were not simply labelled; they became the focus of structured learning sequences and targeted support. Planning moved from guesswork to evidence-based instruction, and professional learning became about noticing, naming, and nurturing mathematical ideas.

Importantly, noticing is not confined to data analysis. It happens live, in real time. When a student uses non-standard language to describe a shape or counts a group of objects inaccurately, the skilled teacher sees more than a mistake. They see a teachable moment. Assessment, in this view, is ongoing and relational. It values the voices and actions of students as meaningful data.

To notice well, we must slow down. Rushed teaching – sometimes driven by inflexible scope and sequences – risks missing the moments where understanding can surface. When we ask students to explain, justify, or represent their thinking in multiple ways, we not only assess their understanding, we invite it to deepen. A classroom rich in noticing is a classroom where students feel seen and heard, and where assessment is aligned with learning, not separate from it.

In this issue of *Prime Number*, we see many examples of teachers using assessment creatively and responsively. They are not just collecting data, they are interpreting, questioning, and acting on it. The power of noticing lies in what follows: a change in instruction, a shift in grouping, a new focus for planning, or even a better question posed next time.

Let us continue to broaden our understanding of assessment, not merely as measurement, but as an act of attention. Because when we notice thoughtfully, we teach more powerfully.

– Aylie

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K–2

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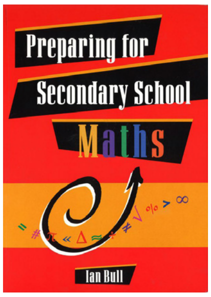

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5–7

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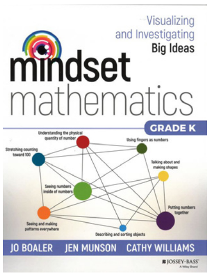

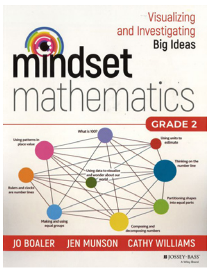

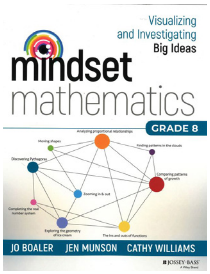

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WORKING EFFECTIVELY WITH MATHEMATICS ONLINE INTERVIEW DATA

Donna McNeight, Numeracy learning specialist, Wendouree Primary School

As a passionate mathematics teacher, I always challenge myself to provide an engaging mathematics program where my students can investigate, explore, explain, evaluate and review their learning in a safe and positive environment. In the spirit of collegiality, my passion also includes sharing my classroom and leadership experiences with other teachers. In this article I describe a project that was undertaken in 2024 that focused on using data from the Mathematics Online Interview to build teacher capacity and inform a student intervention.

BACKGROUND TO THE PROJECT

I work in a small regional school that has a high SFO index and provides a student-focused, engaging and differentiated mathematics program.

In 2023, as a part of my role as Numeracy Learning Specialist, I successfully applied for a maths grant through the not-for-profit organisation Schools Plus. One focus of my application was to build important mathematical connections in the early years through written activities and oral dialogue. A second focus was to support students entering Foundation to strengthen their existing number and place value knowledge. Hence, the *Building Mathematical Connections Using Written and Oral Dialogue* project was created to build our early years learners' understanding of important mathematics concepts.

The project also incorporated elements of the Multi-Tiered Systems of Support (MTSS) framework to effectively address students' diverse learning needs. MTSS provides a tiered approach to intervention, offering support at three levels: Tier 1 encompasses whole-class instruction, Tier 2 targets small groups with specific needs, and Tier 3 delivers individualised, one-to-one support.

This article reports on a small aspect of the larger project that explored how we could use data more effectively. In particular, I report on how we used the Mathematics Online Interview (MOI) in this project for Tier 1 and Tier 2 support.

WHAT IS THE MATHEMATICS ONLINE INTERVIEW?

The MOI was created in conjunction with the Victorian Department of Education as a part of the Early Numeracy Research Project ([ENRP] Clarke et al., 2002). The ENRP sought to identify processes for supporting and enhancing numeracy learning in the early years of school (Clarke et al., 2001).

One outcome of the ENRP was the development of the MOI which is an assessment conducted as a one-on-one interview to generate rich insights into students' mathematical understanding and is widely used in schools throughout Victoria. Growth Points (GPs) are used to describe students' understanding in specific domains in mathematics. Most importantly, GPs provide a lens through which children's mathematical thinking can be understood (Clarke, 2001).

INITIAL USE OF MOI

GP data can help teachers to understand a possible trajectory for understanding how children develop particular concepts, identify where a child is currently positioned, and identify children who may be vulnerable in each domain (Gervasoni et al., 2007).

Initial analysis of our Foundation students indicated that our students' ability to read, write, order, and interpret single digit numbers varied considerably.

We then completed the MOI for students from Foundation to Level 3. Data was analysed to identify specific mathematical areas for future learning and individual learning goals.

For example, for students in Year 2 to 4 the MOI analysis identified specific areas that students needed support with. 63% of students were working at GP1 or below for Place Value which was much lower than we expected. Regarding Counting, 19 out of the 43 students were at GP2 or below, equivalent to 45% of the cohort. Overall, the data showed that students' knowledge in Counting and Place Value required strengthening.

DEVELOPING LEARNING GOALS FROM MOI DATA ANALYSIS

With such a variation in baseline data, finding a way to effectively support classroom teachers to plan for individualised learning became a focal point for the teachers. The analysis also prompted the following questions in our Professional Learning Community (PLC) meeting:

1. What did we notice?
2. What are the common misunderstandings or gaps across the cohort?
3. How do I include this data into my classroom practices?
4. Why are the growth points lower in place value?
5. Are the identified gaps being planned for in our teaching?
6. What are the next steps going forward?

From here, teachers worked together to use the data to develop specific learning goals. A recurring theme of teacher discussions was how to determine what mathematical knowledge the students needed to focus on as the teachers felt that the GP descriptors were broad. For example, the Counting GP1 descriptor states: rote counts the number sequence to 20 but is not yet able to reliably count a collection of that size. In other words, teachers were looking for more direct guidance on where to start and how to design learning tasks required to achieve this GP.

After seeking advice from a critical friend, a checklist (Figure 1) was created using resources from the text *Working Out What Works* (Hoad et al.,

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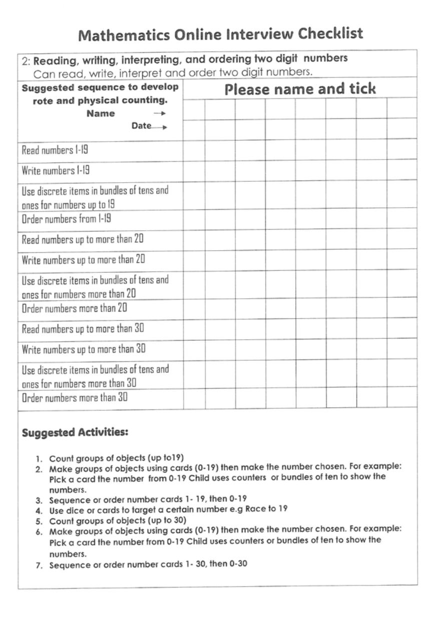

Mathematics Online Interview Checklist

2: **Reading, writing, interpreting, and ordering two digit numbers** Can read, write, interpret and order two digit numbers.								
Suggested sequence to develop rote and physical counting. **Name →** **Date →**	**Please name and tick**							
Read numbers 1-19								
Write numbers 1-19								
Use discrete items in bundles of tens and ones for numbers up to 19								
Order numbers from 1-19								
Read numbers up to more than 20								
Write numbers up to more than 20								
Use discrete items in bundles of tens and ones for numbers more than 20								
Order numbers more than 20								
Read numbers up to more than 30								
Write numbers up to more than 30								
Use discrete items in bundles of tens and ones for numbers more than 30								
Order numbers more than 30								

Suggested Activities:

1. Count groups of objects (up to19)
2. Make groups of objects using cards (0-19) then make the number chosen. For example: Pick a card the number from 0-19 Child uses counters or bundles of ten to show the numbers.
3. Sequence or order number cards 1- 19, then 0-19
4. Use dice or cards to target a certain number e.g Race to 19
5. Count groups of objects (up to 30)
6. Make groups of objects using cards (0-19) then make the number chosen. For example: Pick a card the number from 0-19 Child uses counters or bundles of ten to show the numbers.
7. Sequence or order number cards 1- 30, then 0-30

Figure 1. Example of the place value checklist, a planning tool for teachers.

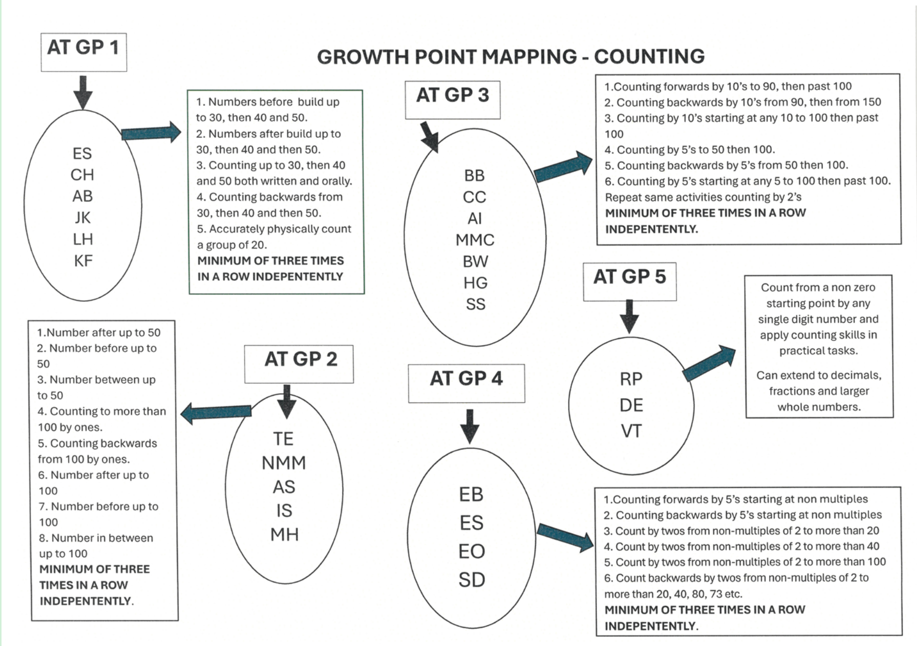

Figure 2. Growth point mapping of students and the GP activities to complete.

2005) which provides guidance on how to progress a student from one GP to another.

SUPPORTING STAFF AND STUDENTS

Two project goals were identified in our PLC meeting.

The first goal was to provide professional learning to classroom teachers to plan learning sequences using the GP data. This was achieved through teacher collaboration of ideas and resources in meetings and modelling classroom lessons that were based on the GPs. Even though we had starting GPs it was important to dig deeper to design and facilitate learning activities that were sequenced appropriately. In our PLC meetings, the teachers mapped the GPs in a visual representation that would become part of the teachers' planning documents (see Figure 2).

The second goal of the project was to identify students who would benefit from targeted support through an intervention program. Research suggests that a more intensive, short-term learning experience can be particularly effective in accelerating progress for some students (Gervasoni, 2018). After discussion it was decided that aspects of the Extending Mathematical Understanding Program (EMU) would suit our goals.

Professional development by an accredited EMU Specialist Teacher was provided to the whole school staff where the underlying principles of the program were explored. Tier 2 support would be provided to the early years teachers by the accredited teacher through collaborative planning and in-class modelling.

Due to the complexities of school timetables, location, financial restraints, and limited EMU instructors, we had to vary the program to suit our circumstances. The program was delivered three times a week and was underpinned by four key beliefs on how children learn (Gervasoni, 2015):

1. Children construct mathematical ideas from their experiences.
2. Children learn through being actively and intensively engaged in mathematical learning experiences.
3. Children construct mathematical ideas through discussing, listening, simulating and reflecting upon their mathematical experiences.
4. Mathematical learning involves taking risks and this requires confidence.

GOAL 1: USING GROWTH POINTS TO INFORM WHOLE CLASS PLANNING AND TEACHING

To ensure success in the project it was essential that teachers had a strong understanding of how the GPs could be used to support their planning to be structured, specific and purposeful. Providing the teachers with resources that included checklists to support this focus was a priority.

Firstly, it was essential to create an example of how the counting and place value data could be used to identify a clear mathematical focus for a sequence of learning experiences (see Figure 3).

Learning tasks included hands-on experiences using materials to develop their understanding of mathematical ideas. The information from the

2: Counting Collections Confidently counts a collection of around 20 objects		
Learning Sequence	**Gr1**	**Gr2**
Count by ones forward to 40	**Mon**	**Tue**
Count by ones backwards from 30	**Thu**	**Fri**
Accurate physical count with teen numbers	**game**	**game**
Count by ones forwards to 50	**Tue**	**Wed**
Count by ones backwards from 40	**M wk2**	**Tu wk 2**
Accurate physical count to 20	**game**	**game**

Figure 3. Sequence of learning goals that were used to create whole class activities to support goal one.

GROWTH POINT 2: COUNTING COLLECTIONS Confidently counts a collection of around 20 objects								
Suggested sequence to develop rote and physical counting	**Please name and tick**							
	5/6	**19/6**	**21/6**	**18/7**	**19/7**	**1/8**	**2/8**	**11/8**
Name	**GD**	**CC**	**LH**	**AM**	**PK**	**AI**	**HG**	**AB**
Count by ones forward to 40	23	25	32	40	32	19	27	40
Count by ones backwards from 30	12	19	9	0	16	13	22	0
Accurate physical count with teen numbers								
Count by ones forwards to 50	44	41	31	46	32	38	27	50
Count by ones backwards from 40	5	19	5	0	16	13	22	8
Accurate physical count to 20								

Figure 4. Data collected using the checklist for a group of Year 2 students. This was recorded by the teacher over a four week period where the goals were reevaluated.

checklists provided specific activities where students were placed in learning groups with explicit learning intentions.

Figure 4 contains an example of how teachers used the checklist in action with a group of Year 2 students. These students were identified to be at GP2 which focused on the students' ability to be able to count a collection of around 20 objects.

Figure 4 shows how teachers used the checklist as they completed a learning sequence that focused on counting forwards and backwards. The table demonstrates the final number that the students achieved independently at the completion of the activities. For example, student LH achieved 32 which indicated that she could count orally to 32. The statements highlighted in green were not included in this sequence of activities, due to counting being the specific focus of the sessions.

The strategic sequencing of lessons, focused on building specific skills, strengthened students' foundational knowledge. Learning experiences also ensured there were opportunities for substantial oral dialogue that teachers could use as a form of assessment.

One teacher commented that 'sequencing the lessons with specific goals increased the understanding and retention of maths concepts with the added bonus of improving the students' confidence.' As noted by Clarke et al., (2001), it appeared that the 'shared language' about young children's learning, so evident among teachers in the context of literacy, was becoming a reality in mathematics as well. The teachers also spoke about how the checklists made identifying areas for future learning easier.

GOAL 2: DEVELOPING TARGETED INTERVENTION USING EMU

The second goal for the project was to support students who were identified as vulnerable to build their number sense, basic number facts and their confidence in a small group environment. Of particular interest were the children on the lowest growth points who were not thriving in the classroom.

This was quite a difficult task due to the broad scope of the data. The students chosen to participate in the EMU Program all had low growth point profiles especially in counting and place value. Next, with input from classroom teachers and an analysis of MOI profiles, students that would be a suitable participant of EMU were identified (see Figure 5).

Learning sequences were created and the students participated in small group intervention where the activities were directed to the students' point of need.

MOI PROFILE				
	Count Feb	**PV Feb**	**A/S Feb**	**M/D Feb**
Student group 1				
LH	1	1	1	1
CC	2	0	1	1
AI	2	1	1	1
Student group 2				
CG	1	1	1	1
AB	1	0	1	1
HG	2	1	1	1

Figure 5. An example of students' MOI profiles for number.

This approach recognises that teachers need to be an expert at understanding how individual children learn mathematics, and how they can advance this learning. As part of the program formative assessment was systematically recorded that included photos, videos and written statements of what the students were demonstrating in the interactions with the teacher and each other. The data was a catalyst for the future learning of the group therefore making the recording of the student's knowledge vital in the group's learning journal.

WORKING EFFECTIVELY WITH MATHEMATICS ONLINE INTERVIEW DATA

Donna McNeight, Numeracy learning specialist, Wendouree Primary School

WHAT WE ACHIEVED

After working with the classroom teachers and implementing the EMU Intervention Program, it was time to evaluate the success of the project. Teachers retested their students in November to determine growth. Evaluation of the data identified several positive outcomes across the project. One success was providing Tier 2 support to the junior teachers who had implemented the MOI assessment. Analysis of end-of-year MOI data for the Foundation to Level 2 cohort (see Figure 6) revealed both positive student outcomes and areas for future instructional focus.

Overall, the 43 students involved in the project demonstrated positive progress, with many advancing to the next GP. Significant progress was observed in the GPs of counting and addition/subtraction, exceeding initial expectations. While the primary project goal focused on place value, the data revealed a clear transference of knowledge, leading to notable growth in related domains. Students demonstrated increased numerical flexibility, relating numbers to quantities and making connections between addition and subtraction. Overall, the data indicated substantial movement towards growth points three and higher, signifying the students' ability to employ a wider range of strategies, a firmer grasp of mental maths facts, and enhanced capacity for detailed reasoning.

Feedback from the Foundation/Level 1 teacher was positive, they described how the students' use of mathematical language had grown as well as their confidence and their ability to use one-to-one correspondence when counting. Analysis of the data ensured that the teacher could see the success across the cohort, as well as individual students.

Figure 7 presents MOI growth point data comparing students' performance from February to November following participation in the Early Numeracy (EMU) intervention.

GROWTH POINT COMPARISON TABLE

Growth point	Count Feb	Count Nov	PV Feb	PV Nov	A/S Feb	A/S Nov	M/D Feb	M/D Nov
0	0	0	4	0	0	0	0	0
1	7	0	23	11	12	2	25	6
2	12	4	12	18	9	8	12	18
3	13	8	3	5	11	5	3	7
4	7	9	1	7	9	13	0	12

Figure 6. Students' growth point data for F-2 from February to November. The table demonstrates the GP data as a whole for evaluation in a PLC meeting.

These 12 students, divided into four groups of three, demonstrated positive results. The highlighted sections in Figure 7 underscore the significant growth achieved through the program, with a majority (seven students) progressing by at least two counting growth points – exceeding the typically expected annual growth. The remaining five students achieved the anticipated increase of one growth point.

The results in Figure 7 also indicate that students progressed in their counting strategies, moving beyond 'count all' to 'counting on', a significant step in their numerical development. The EMU intervention program also yielded excellent outcomes in addition and subtraction, with eight of the 12 students advancing at least one GP. This suggests that students were successfully making connections between different mathematical strands. For example, student IC demonstrated exceptional progress, advancing three GPs in both counting and addition/subtraction from February to November.

Finally, while GPs represent significant mathematical milestones, it is important to remember that substantial learning occurs between these points (Clarke et al., 2001). Therefore, a student's lack of progression to the next GP should not overshadow their individual learning achievements. Students may acquire critical skills and understandings that, while not yet demonstrated independently, lay the necessary foundation for future growth.

CONCLUSION

This project yielded several key outcomes that will inform future practice. Teacher feedback indicated a significantly improved understanding of growth points, data collection methods, and effective strategies to support student progress. One teacher noted that administering the MOI is now viewed as a valuable tool rather than a burdensome task, due to its clear and explicit benefits for informing instruction. Furthermore, early years teachers have integrated project resources and planning into their ongoing practice in 2025.

Another important factor contributing to classroom success was the professional learning and resources provided to classroom teachers. This dedicated support fostered a safe and collaborative environment for discussing and addressing challenges,

While implementing the EMU intervention program resulted in positive student growth, it also highlighted potential challenges. Participating students demonstrated strong growth in targeted domains, reflecting the learning goals established by our EMU instructors. However, the compressed nature of the professional development for the EMU instructors, coupled with limited guidance due to time constraints and the EMU leader's full-time teaching load, presented difficulties.

Overall, this project demonstrated the effectiveness of using growth point data from the MOI to guide supportive and targeted teaching and learning. The project successfully enhanced teachers' knowledge of the MOI, and their ability collect and analyse data to design effective learning sequences to support student growth. The integration of checklists facilitated the easy identification of student misconceptions and learning gaps, reinforcing the value of providing Tier 1 and 2 support, an approach that will continue to be implemented in our school.

MOI PROFILE								
	Count Feb	Count Nov	PV Feb	PV Nov	A/S Feb	A/S Nov	M/D Feb	M/D Nov
Student group 1								
LH	1	3	1	1	1	2	1	1
CC	2	3	0	1	1	1	1	2
AI	3	4	1	2	1	4	1	2
Student group 2								
CG	1	3	1	1	1	4	1	1
AB	1	2	1	1	1	2	1	1
HG	2	3	1	1	1	2	1	2
Student group 3								
AB	3	5	1	2	3	5	2	2
MF	2	5	1	2	2	5	1	2
IC	3	6	2	2	2	5	1	2
Student group 4								
DH	1	3	0	1	3	3	2	2
AP	2	5	1	1	2	3	1	2
LR	1	5	1	2	3	4	1	2

Figure 7. EMU data across the four small-group intervention.

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THE LOGO TASK

Michael Nelson, Gordon Primary School and Mike Nelson Maths

In the Term 2 2025 edition of *Prime Number*, John Gough from Deakin University (retired) wrote a fantastic article *Double House and Crazy Houses* (2025). In his article he focused on activities for making sense of spatial ideas, a concept he argues is undertaught in classrooms with which I would agree.

John's article, in particular the image he used to launch the investigation as shown in Figure 1, prompted the creation of an activity entitled *The Logo Task*. This process, of using high-quality lessons to inspire other lessons, even if they are not directly connected, is something I encourage all teachers to trust themselves to explore more often. I believe this finds a middle-ground between not starting from scratch but also not being reliant on pre-prepared materials.

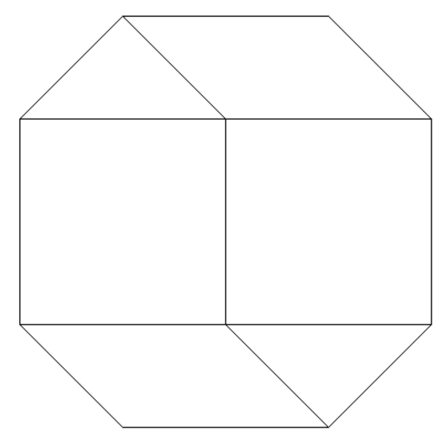

Figure 1. A sample logo to launch the lesson.

The Logo Task focuses primarily on the concept of forming composite shapes (a figure made by combining two or more simple shapes) but can easily be extended to include concepts such tessellations, transformations and symmetry as were covered in John's lessons. Something that educators need to factor in when using this task is the ability of students to identify 2D shapes that are orientated in non-standard ways. Often students rely on what a shape 'looks like' rather than naming shapes based on their features. If this is the case, this may form the teaching focus either before or during this task, as students will find the task difficult without this skill.

SETTING THE SCENE

To launch the task, students are shown a range of different logos, some with words (think of famous soft drink logos) and others that use shapes (such as famous sport brand logos). After a discussion around the purpose of a logo, the hook of the activity is that our school needs a logo and we need the students to design one. When we were looking at logos, many included the use of words or circular based shapes, and we wanted our school logo to stand out by doing something different. So, our challenge was to create a logo using different 2D shapes that were not circular. I used the design from Figure 1 as a model for the way the logo can look. This also prompted a discussion about what shape had been formed by combing the other shapes, which in this case was an octagon.

DURING THE TASK

Initially, students were given a chance to explore for themselves how they wanted to approach the task. This allowed me to collect valuable formative assessment about the level of understanding of my students. In particular, students who had difficulties often had a narrow understanding of shape, either because they only knew the common shapes (triangles, squares, rectangles etc) or because they were only familiar with shapes with the standard orientation or not knowing that shapes can have regular and irregular forms. These students then formed a mini lesson with me before continuing with the task.

For students who had difficulties with drawing shapes, they were scaffolded by being given shapes they could manipulate, similar to using tangrams.

Another scaffold that can be used is to provide the composite shape and allow students to decompose it. With a small group of students, we created a design on the mini whiteboard that they then copied onto their sheet to help get them started, as shown in Figure 2.

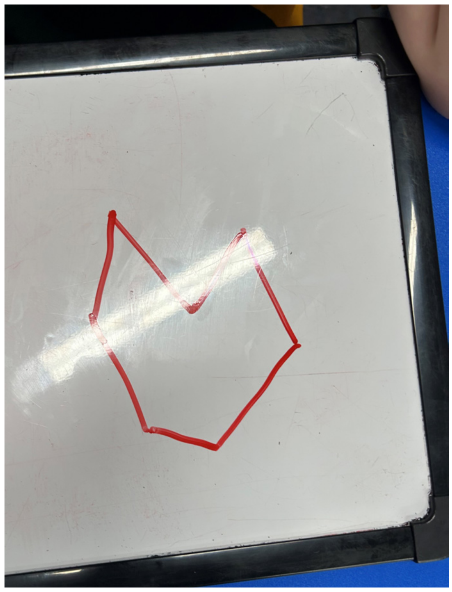

Figure 2. A shape created collaboratively to support students.

Initially, some students used a limited number of different shapes (squares and oblongs). For some, this was because they liked the way they tessellated together as shown in Figure 3. For others, it was because their shape knowledge was limited. If this was the case, the scaffold of shapes they could manipulate was introduced.

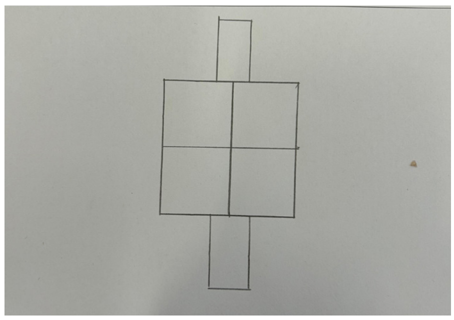

Figure 3. A student's response using only rectangular shapes.

To complete the task, students needed to create their logo, identify the shapes used to create the overall shape of the logo and what shape the logo took (the composite shape). Students used a recording sheet when completing the task, which is available for free on my website and shown in Figure 4.

As advocated by Sullivan (2021) and Russo (2018) amongst others, having pre-planned extensions is important in a task like this. Something that I've added to my more open tasks is inspired by Tierney Kennedy (Back to Front Maths 2017), which is adding constraints to an open tasks. She proposes using the prompts 'But you must…' or 'But you can't…'. These two prompts fit very well with *The Logo Task*. These were displayed on the board and students could choose which ones they wanted to try.

Examples of the prompts were:

- Create a logo but you must use exactly 20 sides
- Create a logo but you can't use the same shape twice
- Create a logo but you must use every shape with sides 3 to 10

This is not an extensive list and can be adjusted to suit the needs of your students. Example of logos that students came up with and the completed recording sheet is shown in Figure 4.

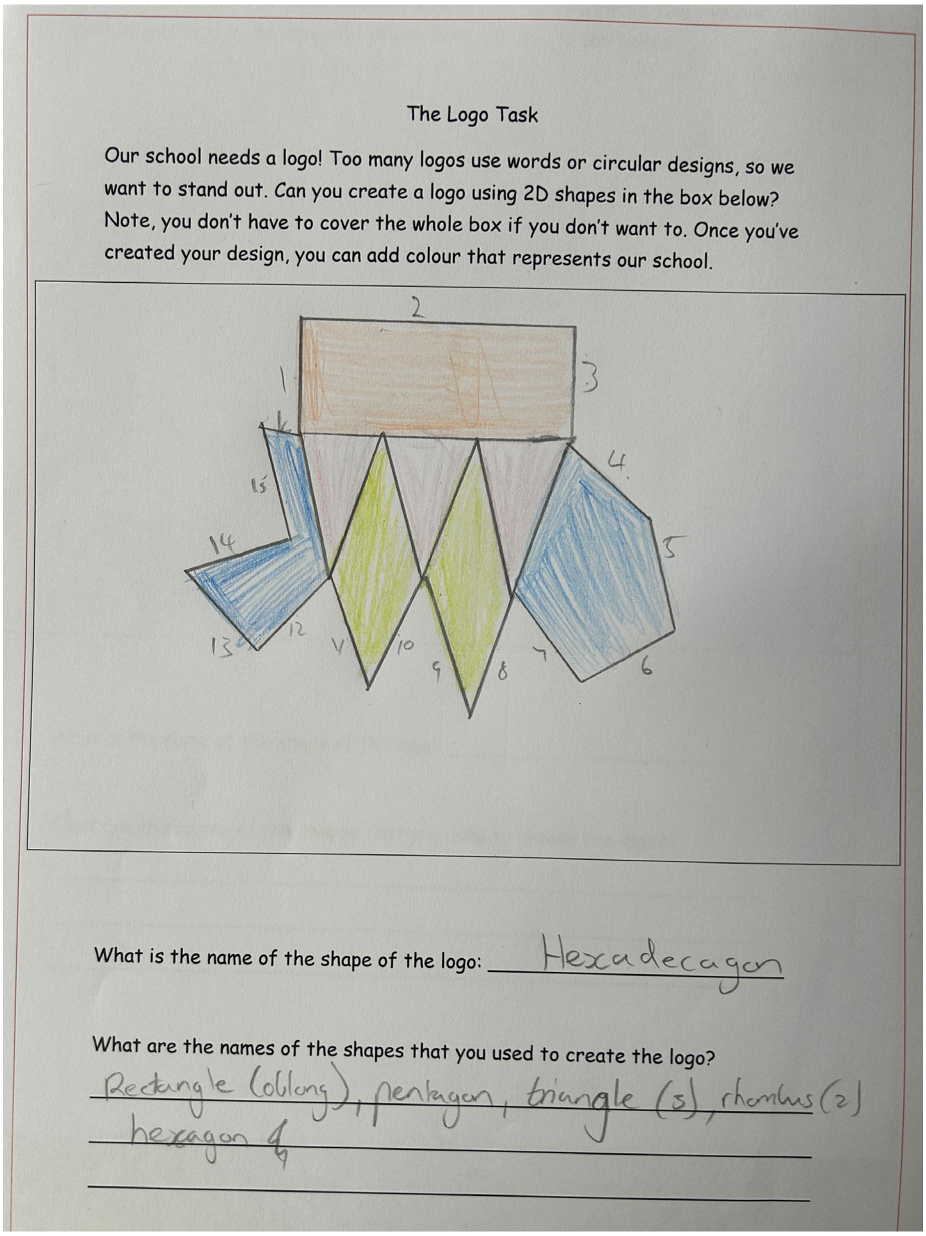

Figure 4. A students completed work sample of the task.

CONNECTED TASKS

After completing *The Logo Task*, we continued to explore the concept of combining shapes to form composite shapes using tangrams. Pattern blocks are just as effective, but I use tangrams because they are easy to print and replace when they go missing! A simple challenge is can you make all the shapes from 3-sided to 10-sided using just the tangram pieces?

AUTHOR

Mike is a Learning Specialist and an educational consultant with Mike Nelson Maths. The recording sheet is available for free to download at www.mikenelsonmaths.com.au

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JELLYBEANS

Michael Minas, Love Maths

USE THESE PICTURES AS A STIMULUS FOR LEARNING TASKS.

FOUNDATION

How many of each colour jellybeans are there in the bag? How many are there in total?

ENABLING PROMPT

How many black jellybeans are there in the bag?

EXTENDING PROMPT

How many different bags can you make with exactly 20 jellybeans using only green and blue jellybeans?

YEARS 1 and 2

There are four people sitting at Jonah's table. If each person decides to tip their smaller bag of jellybeans into a bowl, how many jellybeans will there be altogether?

Work out your answer using two different methods. Explain which method you like best and why.

ENABLING PROMPT

How many jellybeans are in one small bag? How many would there be in two bags?

EXTENDING PROMPT

Can you work out how many jellybeans there would be if nine people tipped their small bags into a bowl?

YEARS 3 and 4

The Love Maths team need to make up 172 bags of jellybeans, with each bag containing the exact same number of jellybeans as in the bag in the picture. How many jellybeans will they need in total?

Work out your answer using two different methods. Explain which method you like best and why.

ENABLING PROMPT

The Love Maths team need to make up seven bags of jellybeans, with each bag containing the exact same number of jellybeans as in the bag in the picture.

How many jellybeans will they need to fill two bags? How many will they need to fill seven bags?

EXTENDING PROMPT

The Love Maths team buy the jellybeans in giant bags that contain 1,000 jellybeans. How many small bags can they make from one of the jumbo bags? Will there be any jellybeans left over?

How many giant bags will they need to make up 172 smaller bags?

YEARS 5 and 6

Each small bag of jellybeans has a mass of exactly 31 grams. How many small bags will the Love Maths team be able to make up from a one kilogram bag?

Work out your answer using two different methods. Explain which method you like best and why.

ENABLING PROMPT

What would be the mass of two bags of small jelly beans? How much would 10 bags weigh?

EXTENDING PROMPT

The Love Maths team need to make up 172 bags of jellybeans, with each bag containing the exact same ratio of black, purple and pink jellybeans as in the smaller picture. How many one kilogram bags of jellybeans will they need to purchase for each colour if they want to ensure they have the smallest amount of leftover jellybeans as possible?

Work out your answer using two different methods. Explain which method you like best and why.

The Prime Number team are always on the lookout for mathematically stimulating images. Contact the editor if you have a photo or a suggestion.
primenumber@mav.vic.edu.au

THE MATHEMATICAL ASSOCIATION OF VICTORIA

THINK BEFORE YOU ACT: ESTIMATE BEFORE YOU MEASURE

James Russo, Monash University and Toby Russo, Wirrigirri Primary School

There is an activity that we have often undertaken with pre-service teachers and Year 5 students respectively that involves giving students a worksheet with two sets of ten angles. Students are invited to make an estimate for each of the angles in the first set, then measure each angle with a protractor, and finally to work out the average difference between their estimates and their respective measurements. The students then go through the same process for the second set, and try to apply what they learnt from the first set of angles to become more accurate with their estimates.

When giving pre-service teachers the second set, James is often reminded of a quote from *The Simpsons*, when Bart is forced to help Principal Skinner in his office because he has forgotten his permission slip for the class trip to the chocolate factory: 'Licking envelopes can be fun, all you have to do is make a game of it… For example, you could see how many envelopes you can lick in an hour, and then try to break that record'. Perhaps unsurprisingly, Bart is less than enthusiastic in his reply to Principal Skinner. By contrast, it is almost startling how pre-service teachers (and Year 5 students) will take to this task. They enthusiastically compare and discuss estimates and measurements, literally filling the room with shrieks of delight when someone's estimate was 'exact' and carefully appraising the extent to which they improved their ability to estimate across the two sets.

It has always struck us that without the estimation component, students would literally just be measuring angles on a worksheet for no purpose other than to practice measuring angles – an activity that in our experience, is not particularly behaviourally, cognitively or emotionally engaging. Indeed, it is because of this stark contrast that it is through this activity more than any other that the visceral power of estimation as a pedagogical move is laid to bare. Reflecting on this, we thought it might be useful to try and capture many of the reasons why estimating before measuring is so valuable and important, and to draw on some relevant research literature to substantiate these reasons. The remainder of this article presents 10 reasons why we should consider developing the mantra in our classrooms of always 'estimating before we measure'.

Figure 1. With only a makeshift measuring cup, students are required to draw on their estimation skills.

WHY ENCOURAGE STUDENTS TO ESTIMATE BEFORE MEASURING?

ESTIMATION IS OFTEN SUFFICIENT IN REAL LIFE

> Large-scale studies suggest that estimation, rather than exact calculation, meets the mathematical demands of many real-world tasks. (Gainsburg, 2005)

When navigating life, we are far more inclined to estimate than to measure precisely. From contemplating how much petrol it will take to fill your car and what it is likely to cost, to deciding which size garbage bags to purchase for your various bins at home, to 'feeling out' how much water you need to put into a pot and even how long to cook your pasta for – estimation can be highly efficient compared with exact measuring. Even in cases when 'taking a measurement' has been made particularly quick and easy by technology, for example, using Google Maps to check exactly how long it will take you to walk back from the shops, our instinct is often still simply to rely on estimation, with a strong sense that 'close enough is good enough'.

In fact, there are times when too much precision can move beyond unnecessary and even become burdensome (e.g., 'if we split it three ways, you each owe me $13.35 for lunch').

TOOLS WON'T ALWAYS BE AVAILABLE

> Research has shown that, in the absence of tools, students draw on mental referents and environmental cues to generate reasonable estimates.
> (Gooya et al., 2011)

Related to the above point, it is just as well that estimating is 'good enough' in the vast majority of instances, and that we have the capacity to become so adept at it, because often measuring tools won't be available to us anyway. Anyone who has had to move house or rearrange furniture without ready access to a tape measure would have experienced the satisfaction that comes from having to improvise in what can feel like a 'high stakes environment' (because couches are heavy!). These first two reasons together reinforce the idea that, in real life, an estimate is often all we want, all we need, and all we can have, which is why honing our estimation skills is such an integral aspect to becoming a numerate citizen. See Figure 1.

ESTIMATION PROMOTES A SENSE OF WHAT'S REASONABLE

> It has long been recognised that estimation encourages critical judgement by helping students identify when numerical results are implausible or in need of review.
> (Levin, 1981)

Perhaps the most obvious reason why we would want to encourage students to estimate before measuring is so they can critically evaluate their measurements (or computations), particularly to detect dramatic 'order of magnitude' errors. For example, if a Year 4 student measures and records their height as 142 metres, but was anticipating they were around a metre and a half tall, they will hopefully realise that something is off, and take a second measurement. Estimating before measuring effectively 'frontloads' a sensible response, although this process is contingent on students having become at least somewhat skilled at estimation in the first place.

Figure 2. Developing internal benchmarks supports accurate estimation.

So, how do we support students to develop this integral skill?

ESTIMATING BUILDS INTERNAL BENCHMARKS

> Explicitly teaching students to use everyday objects as estimation anchors has been shown to improve both the accuracy and consistency of their measurement estimates.
> (Joram et al., 2005)

One of the key components to becoming a successful estimator is developing internal benchmarks. This often involves making connections to formal units mediated through comparisons with everyday objects whose measurement is known. For example, many of us are likely to have a solid intuition for whether something is longer or shorter than 30cm, based on years of experience with standard rulers used in classrooms.

ESTIMATING DEEPENS NUMBER SENSE

> Estimating activities, when paired with conceptual instruction, can enhance students' flexibility in thinking about number.
> (Star et al., 2009).

Using these benchmarks in more sophisticated ways also supports the development of number sense, as students combine measurement estimation with computational estimation. For example, a student might suggest that a jug holds approximately two litres, based on the idea that its capacity looks equivalent to 'just over' three 600 ml drink bottles. This is built around having a strong internalised sense of what 600 ml of liquid 'looks like' through repeated exposure to a standard drink bottle as representing this quantity, and the knowledge that three

THINK BEFORE YOU ACT: ESTIMATE BEFORE YOU MEASURE (CONT.)

James Russo, Monash University and Toby Russo, Wirrigirri Primary School

lots of 600 ml is just under 2000 ml or two litres. More generally, on a meta-level, estimation develops number sense because it encourages students to first think about the meaning and purpose of a numerical value in context (e.g., 'the angle looks halfway between 45 and 90 degrees - so about 65 degrees'), rather than beginning by simply executing a procedure and recording the numerical value (e.g., 'reading the protractor, it is 68 degrees').

ESTIMATION SUPPORTS FLEXIBLE STRATEGY USE

> Instruction in estimation can help students move beyond routine strategies, fostering a flexible repertoire that can be matched to the problem context.
> (Lemonidis & Likidis, 2021).

Building on this discussion, estimation encourages flexibility in terms of mathematical strategy use because there are usually multiple viable strategies available to support the estimation process, and these strategies can often be combined in sophisticated and creative ways to support an accurate estimate.

Beyond benchmark comparison, and iterating with known benchmarks (discussed previously), students may use the multiplicative strategy of 'decomposition' (i.e., estimating the size of an area, and then multiplying this initial estimate by the number of areas of that size) or the additive strategy of 'chunking' (mentally breaking the whole into more manageable parts, estimating the size of these parts and then summing these estimates), as well as many other variations and combinations.

ESTIMATING SUPPORTS SPATIAL REASONING AND VISUALISATION

> As students engage in visual estimation, they often shift from counting and grouping strategies toward more intuitive approaches such as global perception and spatial comparison.
> (Markovits & Hershkowitz, 1997)

Related to this idea of flexibility in strategy use is the notion that estimation supports spatial reasoning and visualisation.

Although this is perhaps fairly obvious, given the previous points we have made describing some of the specific estimation strategies students can be encouraged to develop, we have highlighted this as a separate point because of the substantial research that links spatial sense training to improvements in mathematical performance across multiple domains (Lowrie et al., 2017). This further reinforces the idea that there are a variety of positive spillover effects from building a classroom culture that elevates estimation.

ESTIMATING CREATES OPPORTUNITIES FOR RICH DISCUSSION

> Estimation tasks often lead to mathematical dialogue, as students compare, justify, and refine their thinking in response to others' estimates.
> (Towers & Hunter, 2010)

Diversity and fluidity in strategy use both between students and across different problem types also lends itself to a learning environment that is conducive to rich mathematical discussion. Estimation is by its very nature a somewhat 'fuzzy' and inexact activity. It creates a space within the mathematics classroom for putting forward competing possibilities, in a manner that is both low risk and that shifts the focus to the quality of student reasoning, rather than the correctness of answers. However, estimation within the context of a measurement activity is not without some sort of 'final adjudication', in that there will eventually be an opportunity for students to evaluate and compare their estimates to an actual measured value.

ESTIMATING IMPROVES WITH PURPOSEFUL PRACTICE

> Structured estimation activities that involve prediction, feedback, and multiple attempts can significantly improve students' estimation accuracy
> (Russo et al., 2022).

It is indeed this 'final adjudication' and associated feedback loop that explains why estimation improves with purposeful practice. Students have an opportunity to informally move through a series of steps that involve:

- Developing their estimates based on a range of intuitive and more mathematically sophisticated strategies.
- Discussing their strategies and corresponding estimates with their peers.
- Reflecting on the relative accuracy of their estimates post-measurement.
- Evaluating the effectiveness of their chosen approach.
- Refining their estimation approach by applying what they have learnt to a subsequent estimation and measurement task.

This process of developing, discussing, reflecting, evaluating and refining creates a virtuous cycle, leading to students becoming both more accurate estimators, and better mathematical thinkers more generally.

ESTIMATING INVITES CURIOSITY AND ENGAGEMENT

We hope that this last point is so obvious and self-evident given the preceding discussion that it does not require any research to substantiate it. For us, James' experience watching a group of mostly young adults, all of whom have access to technological stimulation the world has never before known, chatter excitedly as they complete an angles worksheet that has literally been brought to life through estimation is proof enough. Estimating is engaging!

FINAL THOUGHTS

Reflecting back on where we began this article, we cannot help but wonder that if Principal Skinner had of asked Bart to 'make an estimate first', whether Bart would not have found the envelope licking activity strangely compelling despite himself. Perhaps this is taking it too far, but the fact that such a thought even gives us pause reminds us that estimation can serve to 'supercharge' our teaching of measurement in a way that is hard to overstate. We hope reading this article has left you excited to make estimation even more central to your mathematics teaching practice than it no doubt already is. Happy estimating!

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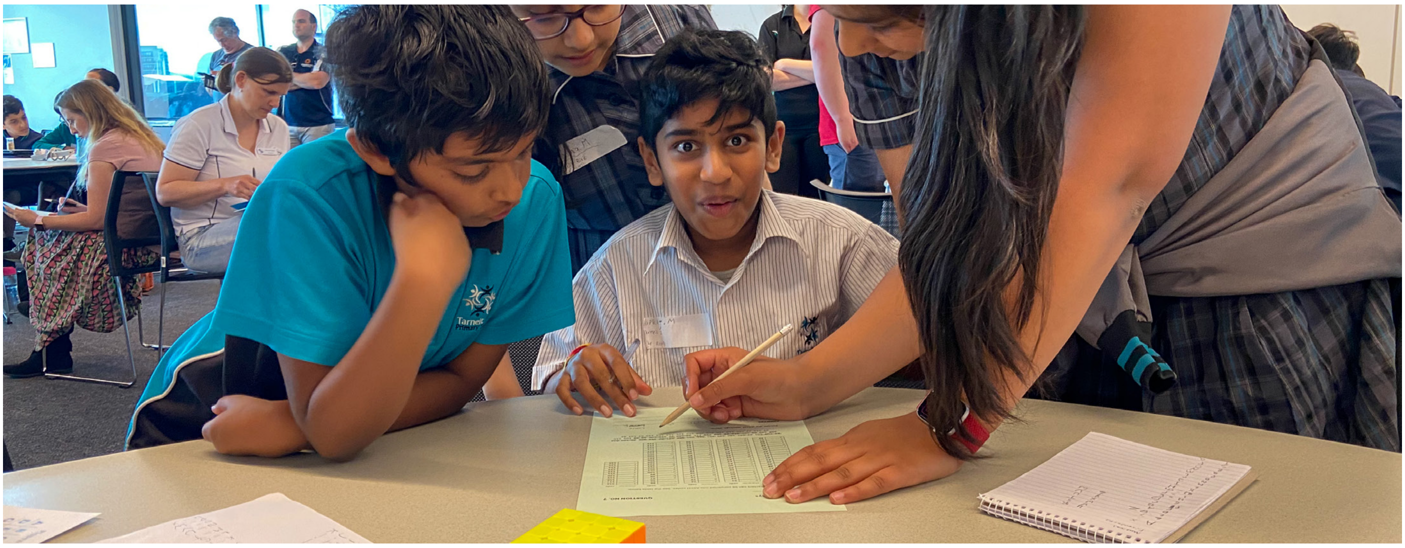

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What to expect

- A virtual kit with fun and challenging coding tasks.
- Solve real-world problems through coding, some maths, and algorithmic thinking.
- Learn and explore at your own pace, with scaffolding and resources.
- Teachers can access suggested solutions for support.

Details

- Accessible via an online platform until the end of 2025.
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- Free for government schools or $12 per student for non-government schools.

Year level categories

- Years 5 and 6
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- Solve challenges, play games, and win exciting prizes!
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TEACHERS MUST REGISTER STUDENTS

MAKING TEN: AN APPROACH TO FORMATIVE ASSESSMENT

Kate Durling, Learning specialist and freelance curriculum writer

In my work with Year 1 students, I wanted to find out about the depth and breadth of their current understanding of how to 'make 10' - the addition facts of 10, often called 'friends of 10' or 'rainbow facts'. Establishing this knowledge would enable me to design appropriate learning tasks to build their understanding about the concept of 10.

The concept of 10 is embedded in the Australian mathematics curriculum across many levels. Our base ten number system is built around the use of ten digits (0 - 9) and place value is formed based on using multiples of ten. Others refer to this as the idea of 'ten-ness' i.e. that 'ten of these, is one of those' (Sullivan et al., 2023).

My search on the Victorian Curriculum Mathematics 2.0, using '10' in the search bar and locating items within Mathematics Curriculum Content across primary levels, revealed 41 results. This suggests that the concept of '10' is given high importance. It is a valuable question to ask – how is knowledge about making 10 established, assessed and built upon throughout the primary years? Noting that the concept of 10 is very in-depth, here I share one small aspect of a larger unit of work that focused on the concept of 'equals' or 'makes 10'.

WHAT EQUALS 10?

If you asked your colleagues 'What equals 10?' and asked them to record as many responses as they could, what would you expect to see? Perhaps a systematic recording of addition facts (1 + 9, 2 + 8 etc), perhaps connections to other operations (11 – 1, 2 × 5) or even measurement concepts (100 cm divided into 10 cm pieces). How about if you asked a class of six and seven year olds? I definitely had some wonderings about the knowledge my learners in Year 1 had about making 10 such as:

- What is their understanding of the term 'equals'?
- Do these learners know some or all 'friends of 10' or 'rainbow facts'.
- Do they have an understanding of 'part + part = whole'?
- Will they require equipment to model 'making 10'?
- How do they record their thinking?
- Do they understand place value and use the language of 10 ones makes 1 ten?

These wonderings helped to guide my planning for a unit on addition that included the 'making 10' concept. Following this I summarised my thinking in Table 1. The next step was to design a formative assessment task that would further guide my planning for the unit.

THE FORMATIVE ASSESSMENT TASK

Students were asked to work independently and use plain white paper in their scrapbooks. I strategically decided not to have any equipment available at first as I wanted students to draw on their prior knowledge. I reminded students they could show their thinking in any way on their paper and not to worry if something ends up being incorrect or if they made a mistake.

FORMATIVE ASSESSMENT TASK SEQUENCE

Step 1: I displayed the prompt 'What equals 10?, along with stating it verbally. I provided thinking time and asked if there were any clarifying questions, ensuring not to make this a 'teaching' opportunity, allowing for more authentic formative assessment. It was established by a student explaining that 'equals 10' means the same as 'makes 10'.

Step 2: Students used a grey lead pencil for the first 10 minutes. During this time, I roamed around to observe students' use of strategies, whilst also limiting my interactions with them. I answered questions if needed, ensuring further prompts only offered clarity e.g. 'What are some ways that you can show how to equal 10?' Some students benefited from reassurance as they recorded their thinking on paper. For example, I reassured students by saying:

- I see you are using numbers to show your knowledge.
- You have a few different examples, can you come up with more?
- I can see you might be doing lots of thinking, can you draw or write down what you have in your mind?

Step 3: I paused for a few minutes for a share time. The purpose of this short discussion was to spark prior knowledge and through seeing how their peers were approaching the task, develop some reassurance and persistence with recording their own knowledge. I reinforced the use of pictures, words, numbers, and using lots of examples.

Step 4: Next, students were asked to change to a red pencil for another 5-10 minutes to record further examples. This was deliberate to enable me to see what was recorded after the share time. It was important to monitor how students were going at this time, as there was no point giving more time if most students had exhausted their thinking.

Step 5: I asked students to share some of their examples by recording them on a class anchor chart and naming each method. Some initial examples included:

Drawing objects 4 objects for one person and 6 objects for another.

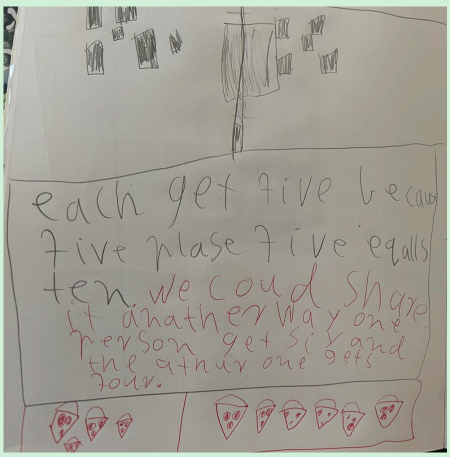

Figure 1. Drawing objects, using number names, using stories and reasoning.

MAKING TEN: AN APPROACH TO FORMATIVE ASSESSMENT (CONT.)

Kate Durling, Learning specialist and freelance curriculum writer

A tens-frame drawing 2 rows of 5 dots.

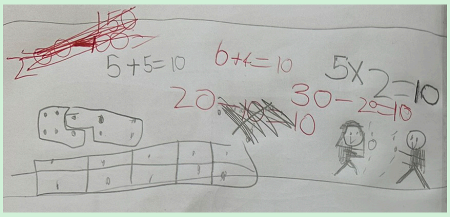

Figure 2. Drawing objects, using a tens-frame, using equations.

Addition equations showing 'friends of 10' using numbers and symbols.

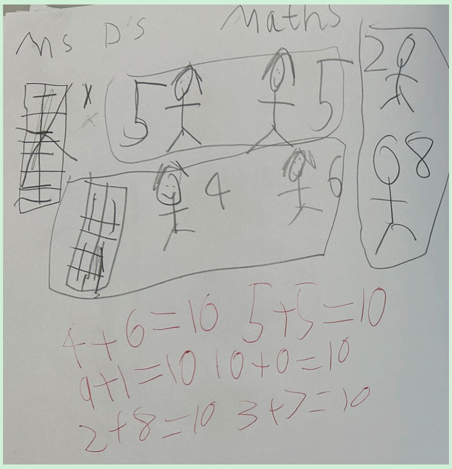

Figure 3. Showing 'friends of 10'.

Step 6: Reflection time. As part of all my maths tasks or activities, I allow a few minutes for a brief reflection asking students how they felt about the activity. Reflection prompts included:

- Did you like showing or recording your own thinking on paper?
- How did you feel about writing your ideas instead of discussing them?
- What was easy or difficult?
- Why do you think I asked you to complete the task this way?
- What do you think will happen next?

Overall, this was a really rich part of the assessment task. Students used a range of strategies and representation. The next step was to analyse the assessment to inform planning and teaching.

MY WONDERINGS	MATERIALS	PEDAGOGY
How do I best help students develop knowledge about making ten? What explicit teaching is essential? Do my learners need automaticity or fluency in what makes 10 at this age? How can my learners build connections between concepts of ten? e.g. relating 6 + 4 = 10 to other mathematical concepts such as measurement. How can I support students to build deeper knowledge of 10?	Tens-frames - blank and pre-made Reversible coloured counters and other counting objects Playing cards and number cards Dominoes Dice Unifix and other connecting cubes Cuisenaire rods Number lines, tape measures Analogue clocks Money - 10c coins, $10 notes	Clearly articulated learning goals Explicit teaching and focus groups Multiple exposures Retrieval practices using games Collaborative groups to work on rich tasks exploring use of 'friends of 10' Reflection tools using feedback and feedforward

Table 1. My wonderings about students' knowledge in making 10.

ANALYSIS OF STUDENT UNDERSTANDING

The power of such assessment is that I was able to see and hear what students were saying and doing during the task. Triangulating my observations together with student work samples would inform next steps of teaching.

Some questions that guided the analysis were:

- Which skills or methods are students demonstrating the most confidence in?
- Are there obvious gaps in skills across the whole group or among specific students?
- What evidence demonstrates Foundation, Level 1 and Level 2 Achievement Standards?

Across students' work samples, there was evidence of student understanding from Foundation to Level 2 Achievement Standards. This included:

Foundation

- Connections between number names, numerals.
- Partition and combine collections up to 10 in different ways representing these with numbers.
- Adding to and taking away from collections to at least 10.

Level 1

- Partition collections into equal groups.
- Solve problems involving addition and subtraction of numbers to 20.
- Use modelling to solve practical problems involving addition, subtraction, equal sharing and grouping.
- Use numbers, symbols and objects.

Level 2

- Recall and demonstrate proficiency with addition and subtraction facts within 20.

NEXT STEPS

The work samples illustrated a diverse range of skills and understandings about making 10. Most students displayed confidence in using objects, names and symbols for the numbers that can equal 10. For example, drawing objects in different ways to equal 10 (Figures 1 and 2); writing the number names five and ten in words (Figure 1); writing numbers as symbols 6, 4, 10 (Figures 2 and 3).

The work samples also revealed that some students were using stories to explain how to equal 10 (Figure 1) along with writing addition equations using numbers and symbols (Figures 2 and 3). Based on my analysis, I developed the following learning goals that would focus my teaching and support my students to develop greater proficiency of the Foundation and Level 1 Achievement Standards. The teaching goals were:

1. Make a collection of 10 using 'part part whole' language and representations (objects, names and symbols).
2. Demonstrate that something equals 10 by using a tens-frame (objects); using words (names) 'nine and one equals ten'; and recording in a written format using numbers and symbols, such as equations.
3. Explore that 'equals' means 'equivalence' or 'the same as', represented using objects, names and symbols.
4. Embed the use of place value language with ones and tens when adding, that '3 ones and 7 ones equals 10 ones or 1 ten'.
5. Develop fluency in showing all the ways to make ten using objects, names and symbols.
6. Systematically recording tens facts using an efficient method and symbols (1 + 9, 2 + 8, 3 + 7 etc)
7. Integrate the use of mathematical proficiencies by demonstrating understanding and using reasoning when problem solving.

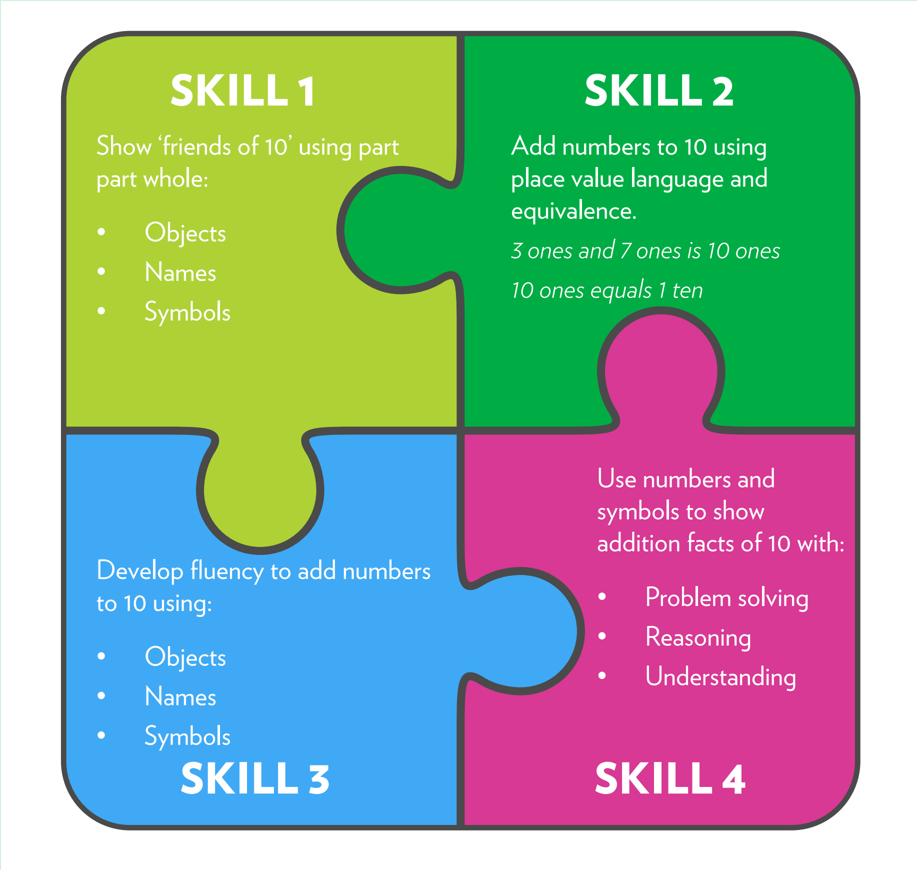

Figure 4. Student learning goals.

ACTIONS: SETTING STUDENT LEARNING GOALS AND PLAN PEDAGOGICAL PRACTICES

I narrowed down the learning goals into four student friendly skills that will develop students' understandings in making 10 (Figure 4). These skills can be seen as a puzzle that work together to build students' understandings and capacity to demonstrate proficiency of the addition facts of 10.

Each skill formed the learning intention for the lessons over the subsequent weeks, using a range of pedagogical practices including explicit teaching, collaborative learning and multiple exposures.

CONCLUDING THOUGHTS

In this article I shared an approach to formative assessment to gain insights into how my students could 'make 10'. I used this information to develop teaching and learning goals. By encouraging diverse representations and providing a range of materials, I hope to create a learning environment where all students can develop a deep and flexible understanding of how numbers work.

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NUMERACY LEADER'S CORNER: JESSICA KURZMAN

I AM

Jessica Kurzman, I work at St Patrick's Primary School in Kilmore, a regional town located approximately one hour north of Melbourne. We have an enrolment of 575 students.

MY ROLE

I have held the role of Mathematics Leader at St Patrick's for the past nine years. I also share responsibilities as the Learning and Teaching Leader. Across both roles, I am allocated four days per week, with the majority of that time – around three days – dedicated to maths.

My key responsibility is to build teacher capacity through facilitated planning. This involves collaborative lesson planning, engaging with current research, analysing student data, and strengthening teachers' mathematical content knowledge. I work with each year level team for 90 minutes every fortnight, and I try to complement this with in-class support through modelling, observation, and feedback.

MY JOURNEY

My journey into mathematics leadership began in my fifth year of teaching, while at St Francis of Assisi Primary School in Mill Park – a large and dynamic school setting. In hindsight, stepping into leadership in such a big school, at that early stage of my career, was a bold move, but I was fortunate to have a principal who believed in me.

That opportunity sparked a deep passion for leadership and mathematics education. After eight years in the role, I transitioned to St Patrick's where I returned to classroom teaching for a year, which provided a valuable opportunity to embed and trial the pedagogical practices I had previously advocated. By the end of that year, I was appointed Mathematics Leader at St Patrick's – a role I've continued to grow in for nearly a decade. Five years ago, I began a Master of Education in Mathematics Leadership at Monash University, an experience that significantly shaped my thinking and reinvigorated my leadership practice. Today, I remain committed to my own ongoing professional learning and am proud to contribute to the wider education community as a mathematics consultant with MAV.

THE BIGGEST CHALLENGE

Without a doubt, the greatest challenge in my role is time – or the lack thereof. Balancing in-class support, professional learning, facilitated planning, meetings, and everything else that comes with the role can feel like a constant juggling act. There's always more I want to do to support both teachers and students.

BEST NUMERACY RESOURCE

Cards and dice remain my go-to mathematics resources. Their versatility allows for rich, differentiated tasks and engaging games across all year levels. They support conceptual development while keeping learning playful and accessible for all students

THE BEST PART

The most rewarding aspect of my work is witnessing those magical 'a-ha' moments – whether it's a teacher who gains newfound confidence and clarity in teaching mathematics, or a student who grasps a concept they've previously struggled with. It's in those moments of transformation and connection that I feel I'm making a genuine difference.

I'M WORKING ON

Our current whole-school focus aligns with the Melbourne Archdiocese of Catholic Schools Vision for Instruction, which has guided our implementation of Daily Reviews across all year levels from Prep to Year 6. We continue to refine these practices, ensuring that each Daily Review is responsive to student needs and promotes retention and fluency.

In parallel, we are deeply invested in the practice of spotlighting during mathematics lessons.

We view this as a powerful method to embed explicit teaching and to strategically highlight and consolidate key mathematical concepts throughout every maths lesson. Our ongoing professional learning supports teachers in refining these elements for consistency and impact.

BEST BIT OF ADVICE

If I could offer one piece of advice, it would be this: make maths enjoyable. Fostering a positive mathematical mindset is essential. When students experience joy and success in mathematics, we build the foundation for a lifelong willingness to engage with and explore mathematical ideas.

MATHS IN THE WORKPLACE: CAFE OWNER

Dean Bowden

MY JOB...

I own and manage a popular café/bar on busy Chapel Street in Windsor. It's a fast-paced, ever-evolving business that blends hospitality with creativity and requires a good deal of strategy.

MATHS IS CENTRAL TO MY WORK...

Maths is absolutely essential in my day-to-day work. It's something I use constantly, sometimes without even realising it. Here are some examples of how I use maths every day.

Calculating gross margins: When setting prices for food and drinks, I need to ensure we're covering costs and making a profit. This involves understanding our cost of goods sold and then applying percentage calculations to determine appropriate margins. It's a fine balance between profitability and affordability for our customers.

Budgeting and forecasting: Running a successful café/bar means looking ahead. I use maths to create monthly and annual budgets, forecasting future sales based on trends, seasons, and local events. This involves a lot of data analysis of historical numbers, average spend per head, daily foot traffic, all of which inform decisions about staffing, inventory, operational hours and marketing efforts.

Profit and loss reports and rostering: Reading profit and loss reports is vital for understanding how the business is tracking financially. This requires not just reading numbers, but interpreting them. Am I overspending in certain areas? Is labour as a percentage of revenue in the right range? Rostering staff also involves maths for estimating expected sales and busy times, matching them to ideal labour percentages, and distributing shifts accordingly.

On top of these, there are daily stocktakes, adjusting portion sizes to reduce waste, and even simple tasks like balancing tills at the end of the day. All of it relies on basic to intermediate mathematical skills.

AT SCHOOL...

When I was at school, I didn't really enjoy maths. I found it abstract and hard to connect with real life. It felt like something that lived in textbooks, not something I'd genuinely need later on.

AS AN ADULT...

As an adult, and especially after completing a Master of Business Administration, I've gained a whole new appreciation for maths. It now feels like a practical tool I can lean on, something that gives me clarity and confidence when making business decisions. I'm much more comfortable using numbers in real-world contexts.

MY OBSERVATION OF THE IMPORTANCE OF MATHS...

Maths is often underrated in hospitality, but it really is the backbone of a successful operation. From managing cash flow to optimising pricing, it helps us make smarter, faster decisions. And in such a competitive industry, that edge can make all the difference.

What I've learned is that maths doesn't need to be scary. You don't have to be a genius, just willing to engage with the numbers and understand what they're telling you. In fact, maths has become one of the most empowering tools in my business toolkit.

THE MATHEMATICAL ASSOCIATION OF VICTORIA

INVESTIGATIONS

Michaela Epstein, Maths Teacher Circles, mathsteachercircles.org/MAVPrimeNumber

GAME OF 12

With few rules to learn, the *Game of 12* is quick to get started on and offers a great combination of accessibility and challenge. Many variations of the game are possible!

HOW IT WORKS

Introduce students to the *Game of 12*:

1. Take turns with a partner to remove a number from this set (see right). Say the total that's been removed (by both players) as you go.
2. You win if you get exactly 12, or if you force your partner to get more than 12.

Run 1-2 demonstration games, so that everyone can see the game in action. For example:

- Player 1 takes 1. Total is 1.
- Player 2 takes 4. Total is 5.
- Player 1 takes 2. Total is 7.
- Etc.

Challenge students to work out a strategy that they can use to successfully win, no matter who they play. Encourage them to also use any losses as an opportunity to learn from their opponent.

Each pair of students will need number cards (2 sets of the numbers 1-4), or a piece of paper to tear up and make their own cards.

Allow students plenty of time to play the game on their own. Some will find it helpful to think about:

- At what point did you know you'd won/lost the game?
- Are there any good/bad numbers to start with?

Wrap up by sharing strategies, observations and remaining questions.

A key insight is that it is *usually* better to go second. By going first and starting with a 2, 3 or 4, the second player can make strategic moves to guarantee a win.

1 2 3 4

1 2 3 4

GO DEEPER

The beauty of the *Game of 12*, is that the game itself is just the starting point. Some prompts to help students to take their thinking further, as they explore this game:

- George goes first and chooses 4. Kath then selects a number and says she knows she will now win. What did Kath choose? Convince someone that she can't lose.
- Kath says it's better to start with a 1 than a 3. George disagrees. Who do you agree with? Why?
- If you played the *Game of 13* (or 14), would the same strategies still work?
- If you flipped the game, so that you lose if you get exactly 12, does that mean you flip your strategies?

WHY USE IT?

The *Game of 12* gives learners valuable practice in:

- Addition and subtraction strategies.
- Comparing quantities.
- Testing strategies and looking for patterns.
- Justifying and explaining their thinking.

VC:M 2.0 LINKS

Level 1: VC2M1N04, Level 2: VC2M2N04, Level 3: VC2M3N01, Level 4: VC2M4N10.

Scan this QR code to get 10 free problems for building strategy and reasoning in maths.

What kinds of investigations have you used in your classroom as a launch for mathematical exploration? Our readers would love to hear your experiences. You can share your ideas with us at primenumber@mav.vic.edu.au.