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INSIDE

INSIDE THIS ISSUE

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ON THE COVER

The start of the year is all about building relationships, creating a positive culture and setting up routines that will serve you throughout the year. Games 'play' an integral part in this process.

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EDITORIAL

Ange Rogers

At the beginning of each year I focus on three main things with my class: building relationships, my favourite games and working on place value.

Games are a critical part of our mathematics instruction. They are engaging and promote thinking, problem solving and reasoning. You can find or make up games that fit almost every content area and most will address at least one, if not multiple proficiencies. There are quick games that fill in time before the bell rings (I share 4 of my favourite games from this category in this edition).

There are games that require deep thinking and strategy (Strike, Risk and 5 to Make 25 are excellent examples from Paula McMahon, Carmel Delahunty and Michael Nelson in this edition), board games and card games.

Another focus for me at the start of the year is place value. I encourage schools to spend an extended period exploring place value in Term 1. I recommend one week looking at each of the 6 aspects of place value. But like anything, we must keep circling back and revising this content throughout the year. Place value is so critical and plays a part in almost everything we teach throughout the year - so make sure you look for those connections and point them out to your students. In this edition I share some common thinking mistakes I have observed whilst teaching and researching place value.

In this edition I also love the insights Donna McNeight shares from her class related to reasoning boards. It is really clear how important it is to assess, develop and show students we value reasoning.

I love Robyn Twyford's article, which shares some practical and authentic ways to integrate data investigations into F–2 classrooms. Robyn's article has some wonderful ideas that would be great routines to set up in Term 1.

Finally, we have Sharm, who is a biostatistician, sharing how maths is a critical part of the work she does in the medical field. Make sure you share these *Maths in the Workplace* articles with your class (particularly with the senior students). We want our students to see that maths truly is everywhere!

I hope you find this edition practical and useful and have a great start to the year with your new students!!

- Ange

LET'S PLAY: STRIKE

Paula McMahon, Mathematical Association of Western Australia

Strike is a wonderful game that can challenge all, especially the mathematically able students. It can be played individually or in teams of 2 or 3. The best part is you don't need special equipment – just paper, pen and calculator (if you wish).

Aim: The aim of this game is to use the 3 chosen digits and any mathematical operation to build number sentences which equal each of the first 10 counting numbers.

Rules: A digit can only be used once in each number sentence.

Brackets are allowed.

Any mathematical operation can be used and a square root is acceptable.

Scoring: Only use if your class enjoys the challenge of competition. You can award one point for each digit used. You could also award bonus points if students generate more than one number sentence for each number.

EXAMPLE

Given the numbers 2, 5 and 9 the process of creating a mathematical STRIKE is shown below.

$1 = 5 \times 2 - 9$

$2 = (9-5) \div 2, \quad 2 = \dfrac{9-5}{2}, \quad 2 = 2$

$2 = \sqrt{5^2} - \sqrt{9}, \quad 2 = \left((\sqrt{9})! - 5\right) \times 2$

$3 = 9 \div (5-2), \quad 3 = \sqrt{\sqrt{9^2}}$

$4 = \sqrt{(9-5)^2}, \quad 4 = 9 - 5$

$5 = (\sqrt{9} - 2) \times 5, \quad 5 = \sqrt{5^2}, \quad 5 = 5$

$6 = 9 + 2 - 5, \quad 6 = 5 - 2 + \sqrt{9}$

$7 = (9+5) \div 2$

$8 = (9-5) \times 2$

$9 = (5-2) \times \sqrt{9}, \quad 9 = \sqrt{9^2}$

$10 = 5 \times 2, \quad 10 = 5 + \sqrt{9} + 2$

Driven by the needs of this activity I introduce whatever mathematical language seems appropriate.

When introducing the activity I always select the first 3 numbers and I have a set of solutions already prepared. I give the students about 10 minutes to work individually and then pair and share.

We then record all the solutions on the board as a class. I share any of my solutions that the students may have not discovered. This is a great opportunity to introduce mathematical operations such as square roots.

After the introduction activity I ask three students to provide the three numbers. This allows the students to understand that I am not cheating and they begin to identify strategies in the selection of the numbers. For example students quickly realise zero is not easy to work with!

The students will ask questions such as:

- Can we combine the digits to make new numbers using place value? e.g., 1 and 2 to make 12.
- Can we use decimal points?

I always encourage the students to decide as a class. I also find that combining the numbers is not very helpful but allow the students work this out for themselves.

THE GREAT VALUE OF STRIKE

- It is a great 'go to' when students finish set work. Why penalise the students with more of the same task, when creative thinking is so easy to achieve?
- The same format could be used as an assessment task for individuals.
- Great for homework – tell students to get mum and dad to help but the student must be able to explain the mathematical operations used.
- Extension of the activity is easy – use four numbers.
- There are 120 combinations of 3 numbers – more than enough for one year.

Final tip: Keep a book of solutions. This is something I should of done (but never did). Get a student to be the class recorder and then keep the book for future reference.

SIX COMMON PLACE VALUE THINKING MISTAKES

Dr Ange Rogers, RMIT University

When I work with students, I love to celebrate mistakes and promote a growth mindset. I encourage all students to see that through mistakes comes learning. I like to label misconceptions as 'thinking mistakes'. 'Thinking mistakes' are in direct contrast to 'silly mistakes'– ones which I want my students to consciously avoid – these are made when our brain is not 'switched on'. In stark contrast, 'thinking mistakes' are made when our brain is working hard, struggling to make thoughtful and logical conclusions. It is during these times that real brain growth occurs.

This article presents a series of common 'thinking mistakes' which have repeatedly surfaced in my research into Year 3–6 student's whole number place value understanding. Along with each thinking mistake I also present a piece of teaching advice to help address these issues.

My experience as a teacher, leader and researcher in Years 3–6 classrooms has led me to believe that many of our students can be described as 'apparent experts' in place value. These students appear to understand place value, yet often their knowledge falters with deeper questioning. For example, if I asked a Year 4 student how many hundreds, tens and ones are in 375 and to represent the number using Base 10 blocks, most can do so confidently. However, if asked to rename the number in another way, for example 37 tens and 5 ones, many struggle.

As a teacher, we all appreciate place value is like the frame of a house - it holds everything else up. A student who lacks a robust understanding of place value is hindered in all aspects of mathematics, particularly in Years 3-6. From my research it has become clear that the first step to improve the teaching and learning of place value is to concisely define place value. Once we have a shared framework for teachers to follow, our teaching in place value across the school has structure and focus.

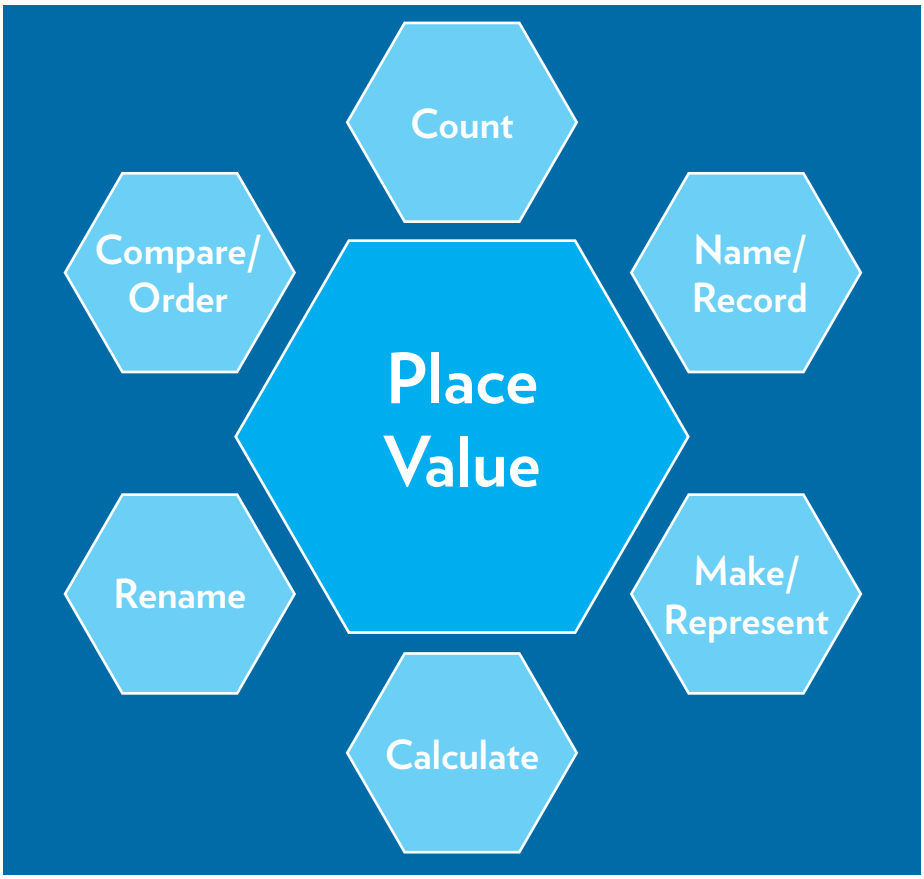


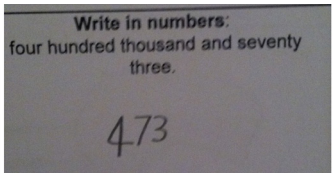
Figure 1: The Six Aspects of Place Value (Rogers, 2014)

Figure 1 shows the 6 aspects which make up place value. I will now take the six aspects, briefly define each and share one 'thinking mistake' I commonly see when working with Year 3-6 students.

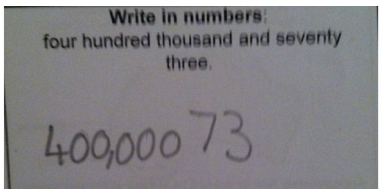
NAME/RECORD

Definition: Read and write a number in words and symbols (e.g., 'seventy-five' and 75). Name the place value columns (the hundreds column is next to the tens column). Determine the value of a digit (the digit 7 in 75 has the value 70)

Thinking mistake: Within the Name and Record aspect, students often find it difficult to write larger numbers. Students either completely ignore place value conventions and simply write the numbers they hear and are familiar with (you can see examples of this in the student samples on the right).



Or students may concatenate numbers, writing each part of the number in sequence, for example:



Teaching tip: I consider reading and writing numbers similar to the skill of decoding in literacy. When we teach reading numbers, we should encourage students to chunk (within the periods), observe patterns (between the periods) and, just as in literacy it is sometimes ok for students to be able to read words

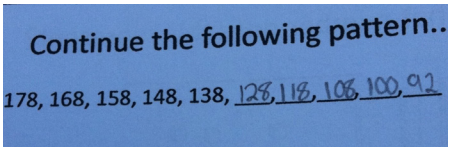
SIX COMMON PLACE VALUE THINKING MISTAKES (CONT.)

they don't understand, it is perfectly ok for students to read and write numbers they have no comprehension of… yet! This comprehension will come as we teach other aspects of place value. For example, the number in Figure 2 is read: Six hundred and fifty *million*, eighty-four *thousand*, nine hundred and seventy. Once the convention surrounding numbers is shown to students, they are less likely to make the errors previously shown.

COUNT

Definition: Counting forwards and backwards in place value parts (e.g., 45, 55, 65 is counting using the unit ten). Bridging forwards and backwards over place value segments such as decuples and centuples (e.g., 995 and one more ten requires bridging forwards over hundreds to thousands). Applying language such before, after, between, more, less.

Thinking mistake: We all know there are 'flash points' that cause difficulty for students when they count. Going forwards or backwards over a place value part, whether it be tens, hundreds or thousands is a challenge. You can see an example of this in the example below. The student clearly becomes confused bridging back from 108 to 98.



Teaching tip: Provide students the chance to observe the pattern they are creating. In the above example, ask questions like, what do you notice is happening in the tens column? Ones column? Could renaming help? For example, 17 tens 8 ones, 16 tens 8 ones, 15 tens 8 ones, 14 tens 8 ones, 13 tens 8 ones…

MAKE/REPRESENT

Definition: Make, represent or identify the value of a number using a range of materials or manipulatives. These may be proportional (e.g., base-ten blocks), non-proportional (e.g. coloured counters) and be presented as canonical (e.g., 3 tens and 9 ones is 39) or non-canonical (e.g., 2 tens and 19 ones is 39) representations.

Billions			Millions			Thousands					
H	T	O	H	T	O	H	T	O	H	T	O
			6	5	0	0	8	4	9	7	0

Figure 2. Place value houses template.
Source: https://nzmaths.co.nz/resource/place-value-houses

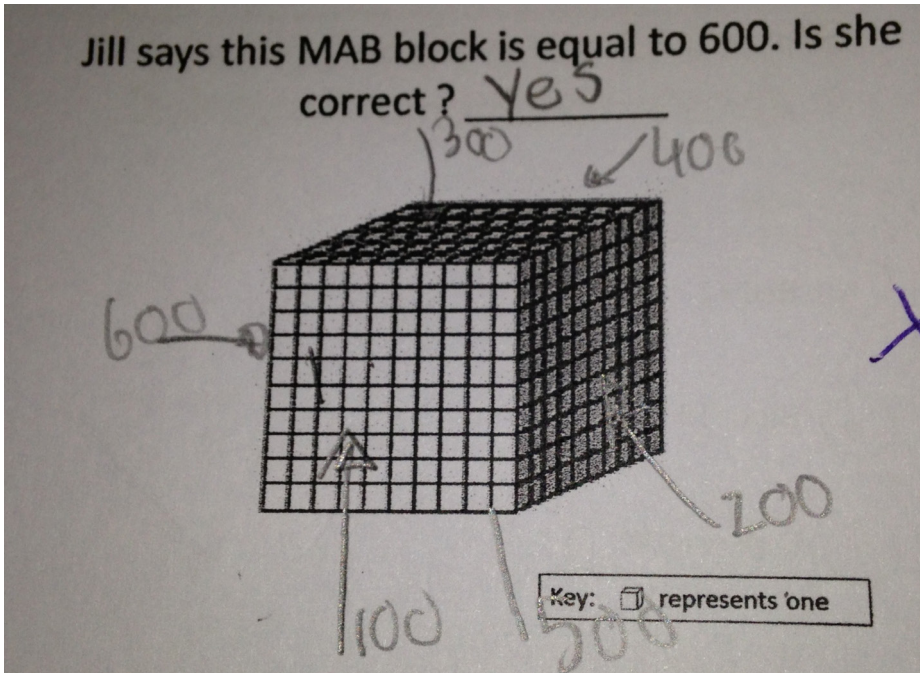


Figure 3. Student response suggesting they have the '600 block misconception'.

Thinking mistake: Students with the 600 block misconception believe (or are not convinced otherwise) that the MAB thousand block has a value of 600. This thinking mistake stems from the fact that students count each face of the thousand block (which is a cube) as 1 hundred, so 6 by 1 hundred is 6 hundreds. See Figure 3.

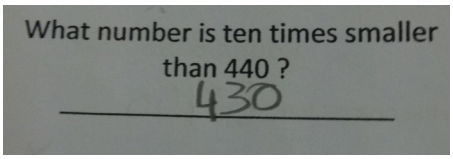
Teaching tip: Instead of telling the students that this is the '1000 block', let them discover this and invite them to prove it to a classmate. Use hundred blocks and stick together with Blu Tack.

COMPARE/ORDER

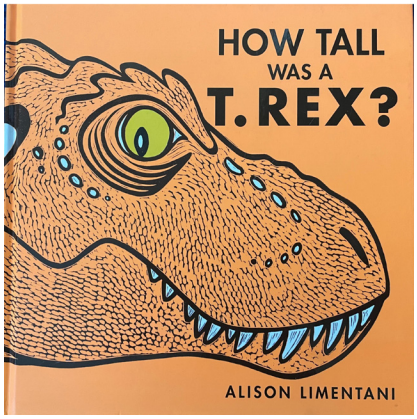
Definition: Compare numbers to determine which is larger or smaller. Compare numbers in a multiplicative manner, for example ten times larger than 54 is 540. Place numbers in descending or ascending order and locate numbers on empty, partially marked or complete number lines.

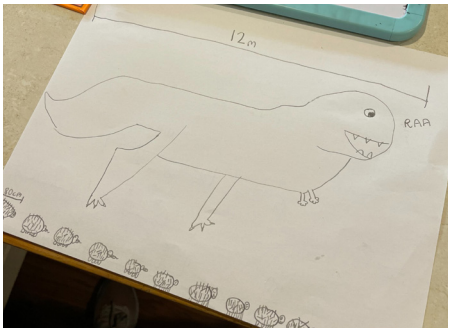
Thinking mistake: Students find multiplicative comparison difficult as we rarely provide them with opportunities to think in this way.

Most students think additively and do not comprehend the meaning or significance of the word 'times'. This can be seen in the image below where the student has simply taken 10 away from 440.



Teaching tip: A fabulous book and activity to reinforce this idea is *How Tall was a T-Rex?* by Alison Limentani. In this book students are prompted to consider scenarios involving multiplicative comparison. For example, a T-Rex is as long as 6 lions. This is the perfect context to talk about a T-Rex being 6 times longer than a lion.



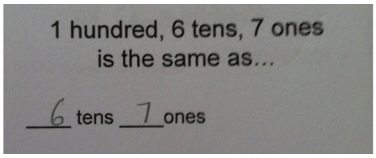


Using the book as a stimulus, students can investigate their own multiplicative comparison examples. The student above investigated the length of a echidna and then compared it to the length of a T-Rex.

RENAME

Definition: Rename numbers in multiple ways in terms of place value parts without the use of manipulatives (e.g., 1,260 is equivalent to 126 tens or 12 hundreds and 6 tens or 1 thousand and 260 ones).

Thinking mistake: My research found that up to 80% of Year 3 students, 48% of Year 4 students, and 15% of students in Years 5 and 6 display Independent Column Thinker characteristics (Rogers, 2014). Essentially these students believe that each place value column has no relation to the others. This stems from us over-emphasising the idea that 'this is the hundreds column and hundreds live in there'. From this, students fail to understand the multiplicative idea that there are smaller units (tens and ones) 'hiding' within a hundreds unit. The image below illustrates how a student who thinks in this way would respond when asked how many tens there are in 167. The student fails to recognise there are 10 tens in 1 hundred.

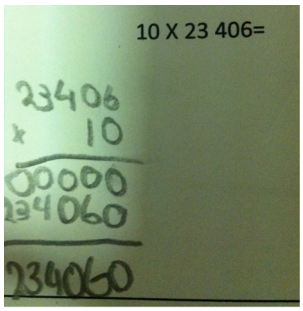


Teaching tip: We know renaming is an abstract concept for students, but visualisation and gesture can assist students to develop their understanding. To introduce this idea I use Russian nesting dolls. I use these dolls to help reinforce the idea that in place value there are smaller units within larger units. I encourage the students to close their eyes. If we are talking about the number 356, I ask them to imagine 3 of the 'hundreds dolls'. I then ask how many tens would be inside each, and ask them to visualise them being 'let out'. I like to use gesture here to model the tens 'escaping'. There would be 10 tens in each, so 30 tens. This visualisation assists students to appreciate that there are units within, and that each column is related to the others.

CALCULATE

Definition: Apply knowledge and understanding of the place value system when completing calculations using the four operations (e.g., 45 multiplied by ten is 45 tens, 45 plus 100 is 145, 120 divided by ten is 12)

Thinking mistake: Students need to be scaffolded to see the link between place value and multiplication and division. Students need to realise that if we are multiplying or dividing by a place value unit (10,100,1000) we can simply move the digits. As you can see in the image below, it is overkill to use the algorithm.



Teaching tip: A Number Slide is a perfect resource to help students to visualise the idea that it is the digits that are moving. You can find a template for a number slide here. https://extranet.education.unimelb.edu.au/SME/TNMY/Decimals/Decimals/teaching/models/numslide.htm

This article has provided a brief overview of common 'sticking points' in place value. When we teach place value, we need to ensure we are looking at all aspects and looking out for these common thinking mistakes.

REFERENCES

Rogers, A. (2014). *Investigating whole number place value assessment in Years 3-6: Creating an evidence-based Developmental Progression* (Unpublished Doctoral Dissertation). RMIT University, Melbourne, Australia.

ALL ABOARD WITH REASONING

Donna McNeight, Numeracy learning specialist and Year 3/4 teacher, Wendouree Primary School

Through my work as a classroom teacher and Numeracy Leader, I often heard the term 'mathematical reasoning' and I wondered how I could support my students to enact this important skill in mathematics. This quickly became a problem of practice for my teaching, and several conversations with my students reinforced the need for us to complete further work in this area.

ONBOARDING WITH REASONING

My story about the impact of reasoning boards starts with my participation in the Mathematics Leadership Mentoring Program with Matt Sexton at the Australian Catholic University. When working with Matt, I designed a Mathematics Leadership Activity Plan where I created a goal for mathematics leadership at my school. I chose to focus on developing teachers' planning and use of activities which would allow students to demonstrate their mathematical reasoning.

As a way of leading by example, I chose to start with my own Year 3/4 students, trialing the use of new ways of teaching, resources and activities. At the same time, I was also participating in the Teaching Excellence Program where I was focusing on building my expertise in teaching mathematics. I decided to combine the work related to my professional learning focus in both programs, so I started working on a 'mini-inquiry', focused on the question: *How can I build my students' reasoning in addition without relying on only the standard written algorithm?*

LOOKING AT THE EVIDENCE

Before starting this inquiry into my teaching practice and numeracy leadership, I knew that I had to collect preliminary data on my students' capability within the important proficiency of reasoning. The first stage of my data collection plan involved creating a 'reasoning board'. I developed the idea of a reasoning board as an extension of the well-known 'think board' (Driscoll, 2015). This reasoning board was a template that included three questions for my students that ranged from addition with no trading through to trading with 2-digit numbers beyond 100.

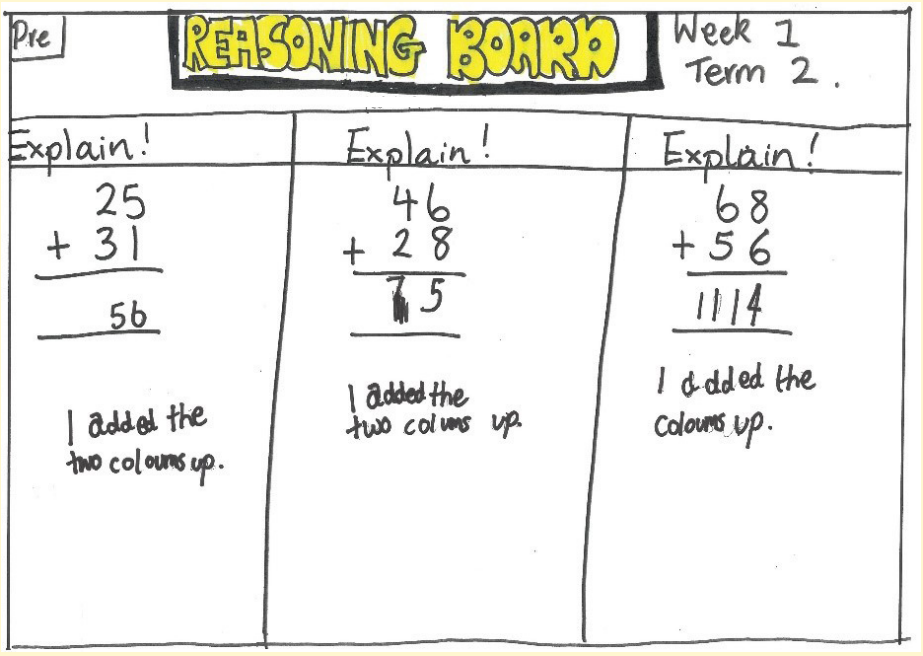


Figure 1. Pre-assessment reasoning board of Student A showing limited reasoning.

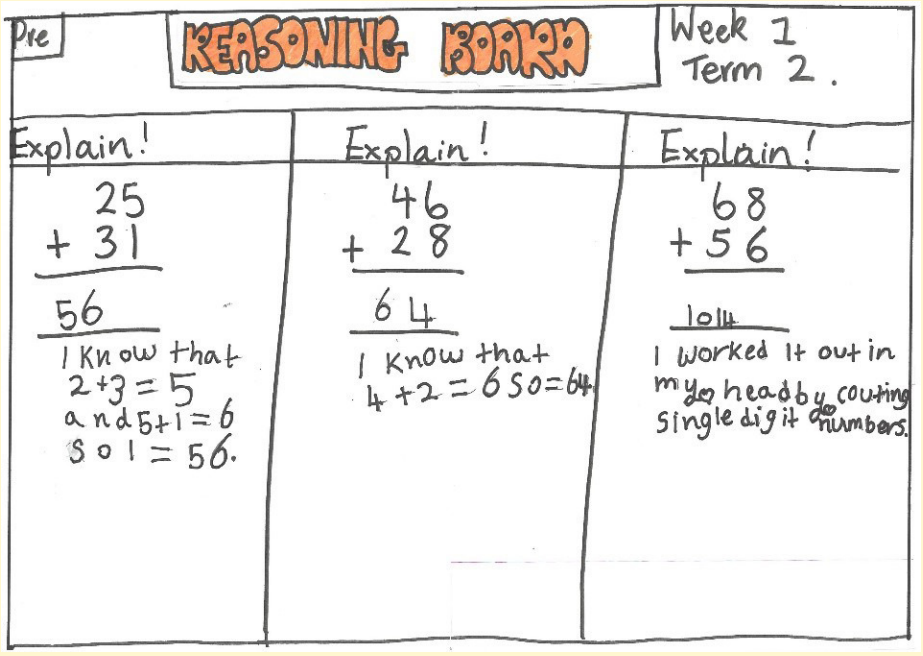


Figure 2. Pre-assessment reasoning board of Student B showing little attention to place value.

The students had to answer the focus questions on the reasoning board, and it was imperative they recorded how they solved each addition problem below the example. This proved to be an invaluable pre-assessment that clearly highlighted the mathematical language and strategies my students were using. It also provided information about how my students engaged in explaining their reasoning in a written format (see Figure 1 and 2).

SOME PRELIMINARY RESPONSES

In one case, a student who usually finds it very challenging to explain how he achieved an answer, sat at his table for fifteen minutes, saying he was not sure what to record. His sample is shown in Figure 1. It shows the use of the standard written algorithm (SWA) but includes little reasoning that shows how the SWA works.

Several students stated that they counted on their fingers or in their head to add up 1-digit numbers, whilst another student (shown in Figure 2) recorded 4 plus 2 to equal 6, rather than 40 plus 20 to equal 60 or 4 tens plus 2 tens equals 6 tens. This revealed that my students were paying little attention to place value when adding two 2-digit numbers.

These were common responses across all three questions in the pre-assessment suggesting to me that my students had little understanding of place value (Clarke, 2005). Many were using limited counting strategies which included counting on by ones from the larger number and skip counting by 2's in a visual representation when working with 2-digit numbers.

One common misconception that was evident in several students' thinking was an example like the following: '80 plus 40 equals 112 because 8 and 4 equals 12 and I know I am over the hundred.' There was some attention paid to place value in this response, but diminished number sense was evident.

The reasoning boards are an important pre-assessment tool that provides instant access to my students' reasoning. This is something that would not have been evident in a quiz or online test.

CREATING A PLAN

My analysis of the students' reasoning boards directed my future planning and teaching. Firstly, I created a set of learning intentions that focused on exposing the students to a variety of mental and written strategies for addition tasks. Using manipulatives, pictorial representations, and having an emphasis on place-value relationships (Charles, 2020) became essential goals for building my students' number sense and operation sense about addition. The intentions were also crucial in providing learning opportunities that built my students' proficiency with mathematical reasoning.

LESSON ONE: MODELLING THE MAB BLOCKS

To provide my students with the best opportunity to achieve success, I used base 10 blocks to build their understanding of the 'adding tens first' strategy. I focused on this because concrete materials like base 10 blocks can be powerful in supporting students to explain their strategy use (Back, 2019).

Using mathematical language, I emphasised how we can partition 2-digit numbers when we add. It was vital for the students to see how important their understanding of the place value was and using that knowledge when combining larger quantities (Charles 2020). In pairs, the students were challenged to represent multiple 2-digit numbers using base 10 blocks and then calculate the total using the 'adding tens first' strategy. (See Figure 3).

Next, the students recorded their reasoning, step by step describing how they arrived at their answers. As the students worked, I listened closely for the mathematical language being used in their conversations. Providing explicit and immediate feedback to the students was extremely meaningful for their learning. It was essential that I modelled appropriate mathematical terms in my feedback as a way of further developing their language and understanding.

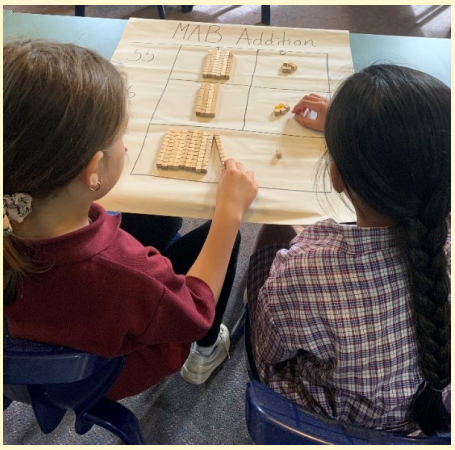


Figure 3. Students using Base 10 blocks to model the strategy of 'adding tens first'.

LESSON TWO: THE NIFTY NUMBERLINE

Using the empty number line, the students explored the addition of 2-digit numbers through a visual representation. They used their knowledge about place value to partition numbers by showing tens and ones which they represented as jumps on the number line (see Figure 4).

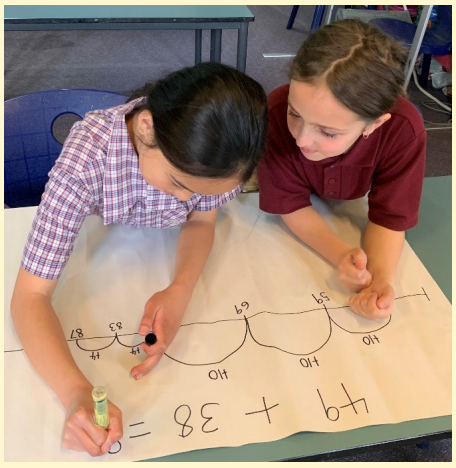


Figure 4. Students using an empty number line to represent partitioning strategies.

Students explained their strategies by 'showing' them to others. This made the empty number line a powerful communication tool when focusing on mathematical reasoning (Bobis, 2007). Many found it challenging to add on tens to a number other than zero. I also noticed that when it came to adding the

ALL ABOARD WITH REASONING (CONT.)

Donna McNeight, Numeracy learning specialist and Year 3/4 teacher, Wendouree Primary School

ones, most of my students jumped by individual ones rather than using more efficient strategies like bridging to the next ten.

After noticing this, I made the decision to focus on these strategies as a way of nudging student understanding and further developing their ability to think mathematically. Feedback about the number line was very positive with many students stating that the number line made reasoning visible and they found it easier to find and correct errors in their thinking.

LESSON THREE: HUNDREDS CHART

To assist the students with their understanding of place value, we moved to exploring the hundreds chart. This was another focus for students to connect to the importance of place value (Charles, 2020). This was vital for the students to strengthen their knowledge of adding tens starting at any number and their single digit addition facts so that they could see how to bridge to ten. The students partitioned the 2-digit numbers to add using the chart.

Next, they jumped forward the specific number of tens and ones. Throughout this activity the students explained their thinking with their partner and gave feedback to each other. One student noticed 'This was a different version of a number line' whilst another student exclaimed very excitedly, 'I finally understand the patterns involved in adding by tens.'

LESSON FOUR: ADDING OVER THE HUNDRED

Adding over the hundred in a written representation was my final lesson in this series on addition strategies. After reinforcing place value concepts using manipulatives where I focused on language, adding and encouraging reasoning through partner talk, I wanted them to transfer their learning to a written representation. We explored

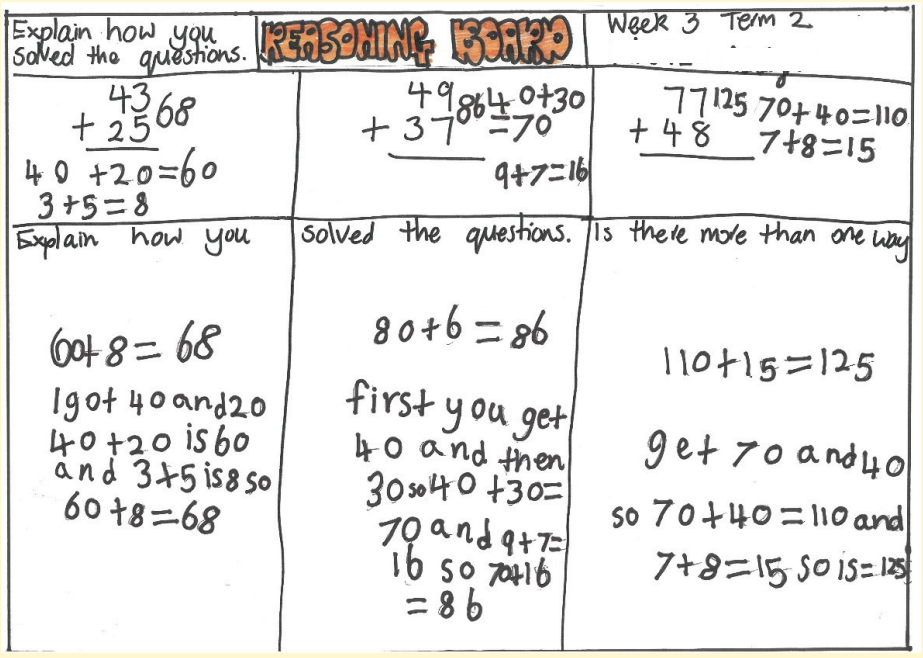


Figure 5. Student A showed that his ability to explain his reasoning dramatically improved. (See pre reasoning board Figure 1 for comparison).

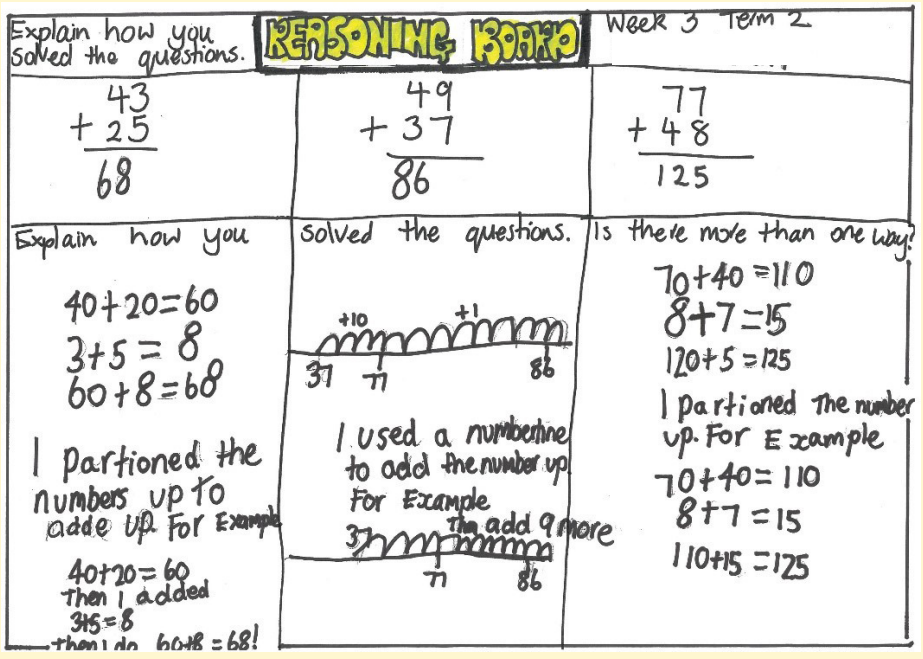


Figure 6. Student B used more precise terminology and there was no indication of counting on her fingers or in her head (see pre reasoning board Figure 2 for comparison).

strategies for solving 73 + 45. Students were asked to think about the steps in their strategies and ensuring that their explanations involved precise mathematical language. For example, in our whole class discussion the students talked about showing the equation as the following 7 tens + 4 tens = 11 tens and 3 + 5 = 8, so 110 + 8 = 118. They stated that it reinforced their understanding of the place value of the individual digits. The students completed these tasks

independently. I encouraged the students to engage in self-talk. They practised different ways of explaining their thinking and evaluated whether their recording matched their strategy use.

POST REASONING BOARDS

I was excited to see what my students had achieved. I knew providing a reasoning board as a post-assessment was the best way to see the impact of my teaching. The three addition problems on the post-assessment reasoning board were similar to those on the pre-assessment reasoning board.

THE GROWTH IN STUDENT LEARNING

I was so pleased by the growth the students showed in their reasoning. Student A (Figure 5) was able to complete full explanations with mathematical language. This was a dramatic improvement for this student who previously found it hard to explain his thinking. (See Figure 1).

A large percentage of students successfully added tens which involved bridging over the hundred independently. In the students' detailed responses, they demonstrated the strategy in which they were most confident. It was wonderful to see the students validate their mathematical thinking at the level required to support their conceptual understanding (Back, 2019). To enable the students to examine their growth, I provided both reasoning boards so that they could compare their responses.

They were very proud that they could make up their own minds about the best strategy to use (Bobis, 2007).

WHAT HAVE I LEARNED?

Using the reasoning board as a pre-assessment meant that I was not focusing on a specific score but rather the strategies that my students used and the reasoning that they expressed through their explanations. This was a big change for the students and myself.

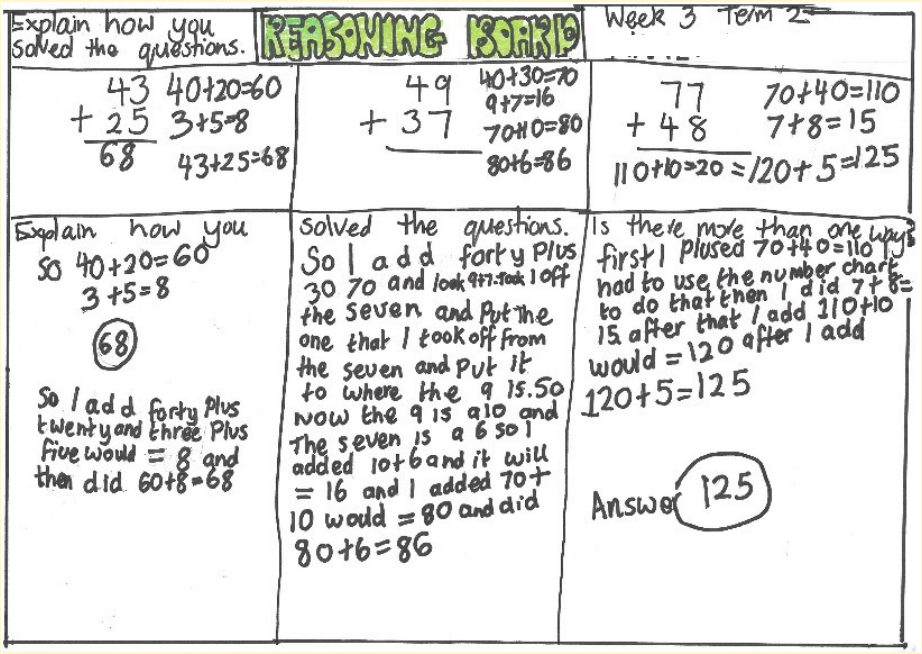


Figure 7: Student post assessment reasoning board which showed the 'adding tens first' strategy, place value language and bridging to ten.

My observations during this time allowed me to identify many of the misconceptions or errors students were making, something that is very difficult to determine in an online assessment. Evaluation of the reasoning boards provided me with a clear path for the students' future learning. The focus of my teaching moved towards emphasising the use of mathematical language and using manipulatives.

A big change was that the students directed our learning. This meant I had to release the reigns to allow them to say it was time to move on. The students consistently reinforced that they appreciated being able to choose strategies and not have the teacher tell them what to do or how to do it. The success of the post reasoning board provided me with a greater amount of confidence to use this approach in my teaching. I now regularly use reasoning boards as part of my planning, to assess student learning, and as an opportunity to provide feedback to the students.

I thank Matt Sexton from Australian Catholic University for his guidance and support in writing this article.

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SAUSAGE SIZZLE

Michael Minas, Love Maths

USE THIS PICTURE AS A STIMULUS FOR LEARNING TASKS.

FOUNDATION

Julia purchased three items from the sausage sizzle. What might she have purchased and how much did she spend?

ENABLING PROMPT

Gabe purchased two items from the sausage sizzle. One was a sausage. What else might he have purchased and how much did he spend?

EXTENDING PROMPT

The Hall family spent exactly $20 at the sausage sizzle. What might they have bought?

YEARS 1 and 2

The Rudd family spent exactly $30 at the sausage sizzle. What might they have bought?

ENABLING PROMPT

How much would it cost to buy 5 sausages?

EXTENDING PROMPT

Can you find all the possible answers to the task? How do you know that you have found them all?

YEARS 3 and 4

The school fundraising committee purchased 480 sausages and sold them all. Can you work out how much profit they are likely to have made? You will need to do some research to work out how much they spent on buying various things required to make the sausages. Make sure you show all your working out clearly.

ENABLING PROMPT

If each sausage costs 50c to make, how much profit will they make if they sell 500 sausages?

EXTENDING PROMPT

If one out of every three people also bought a drink, how much additional profit will they make?

Would it be better to sell the drink and sausage as a 'combo'? How much would you charge and how many extra people would you need to buy a 'combo' to make this a better option?

YEARS 5 and 6

For the 2022 school sausage sizzle, the fundraising committee purchased 480 sausages. However, they ran out by 12.15pm and needed to go back and purchase more from the butcher's shop. How many extra sausages should they buy this year? Will the number of sausages sold per hour remain constant throughout the day, or will it fluctuate? Make sure you explain the reasoning behind your decisions and clearly show your thinking.

ENABLING PROMPT

The fundraising committee purchased 480 sausages. Their stall opened at 9am and they ran out of sausages by 12pm. How many sausages are they selling each hour? If they go to the butcher's shop to buy more, how many extra sausages should they buy?

EXTENDING PROMPT

In 2022, the sausage sizzle ran out of sausages at 12.15pm. Use this information to plan for the 2023 sausage sizzle. What supplies will you need? Make sure you explain the reasoning behind your decisions and clearly show all your work.

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

MY TOP 4 TIME FILLER GAMES

Ange Rogers, Numeracy Teachers Academy

We have all been there... there is five minutes before the bell and we are trying desperately to fill the gap with something valuable...

You don't want anything that requires equipment, takes too long, or is difficult to explain.

Over the years I have developed a bank of several 'go-to' games that can fill these gaps *and* ensure we are getting an extra five minutes of numeracy in our day- and who doesn't need that?!

I have tried all the games with different year levels and they are *all* winners. The students love them, they ask for them over and over again, and I love them because they are so easy!

I encourage you to take the time to try each of the games with your class. Remember with every new game, the most awkward part is the first time you play, after that it gets easier.

Each year I invest time teaching all 4 of these games to my class during Term 1. Then by the time you are ready to use them - they will only take five minutes because everyone knows the rules and are ready to go!

Below I explain each game and point out how maths is involved. I hope the games are a hit in your classroom!

TEN SECOND WALK

In this game, you choose two places in the classroom. One is the 'start' and the other the 'end' of the 'walk'.

Student A is selected and is required to walk from the start to the end point.

As they do this they are timed by Student B. Student B says 'Go' and starts the timer.

Student A walks and is required to get to the end point in as close as possible in ten seconds.

Student A yells out 'Stop' when they want Student B to stop the timer.

Student B calls out the time they recorded. The class 'Ooohs and ahhhs' depending on how close they are to 10 seconds and then another student is chosen to do the walk. Play continues until the bell rings. The winner is the student closest to ten seconds.

Where's the maths?

Elapsed time, counting, comparing numbers, decimals.

Adaptations

Record all the times on the board and calculate the closest to ten seconds.

ELEVENS

The object of the game is to not say the number '11'. On their turn students can say 1, 2 or 3 numbers. So here is an example: Student A chooses to say: 1, 2 (but they could have said '1' or '1, 2, 3')

Student B may say 3, 4, 5

Student C may say 6

Student D may say 7, 8, 9

Student E may say 10

Student F has no choice but to say '11' (As such, every house colour gains a point except Student F's house colour)

The game then starts again with Student G starting at 1.

The game continues until the bell rings.

The house colour with the most points wins.

Where's the maths?

Counting, strategy, problem solving.

Adaptations

Play using fractions... so you could count by quarters and the 'out' number is 3¼.

LOWEST NUMBER WINS

Tell your class that the person who selects the lowest number in the class wins... but if they have the same number as someone else in the class, they are both out.

Each student gets five seconds to choose their number (this game relies on students not changing their number, so you may ask them to write their number, or I say 'this game only works and is fun if everyone follows the rules' and hope for the best!)

Once the five seconds thinking time is up, everyone must stand up and lock their number in their mind. Ask the students 'Who chose zero?'

If there is more than one person who chose 0 they all must sit. If there is only one person they win! 9/10 times more than one person will pick zero!

Move onto asking 'Who chose one?' If there is more than one person they must all sit, if not, that student wins.

Continue asking about each number in order. The winner is the student who selected the lowest number that no one else has selected.

Where's the maths?

Strategy, ordering, comparing, chance.

NUMBER PICNIC

You, as the teacher, think of a rule to determine if particular numbers are permitted to 'attend' the *Number Picnic*.

Don't tell the students the rule, but give them an example of a number that is allowed to attend. For example, if your secret rule was 'only odd numbers can attend', you might start by saying: 'I am having a picnic and I am bringing along the number 59'.

Every time a student says an odd number you say 'Yes that number can come to the picnic.' And every time an even number is guessed, say 'No, that number can't attend the picnic.'

Go around the class with students making guesses until the bell goes. Ask if anyone knows the rule and share it just before they leave (or leave them stewing overnight)!

Where's the maths?

Classify and sorting numbers, odd, even, prime, composite, factors, multiples, triangular numbers.

Remember to look out for the MAV Maths Games days throughout 2023. They are a great way to promote maths in your school. This book from MAV also has some excellent games you could use to run your own games day!

EXPLORING REASONING WITHIN GAMES: 5 TO MAKE 25

Michael Nelson, Drysdale Primary School

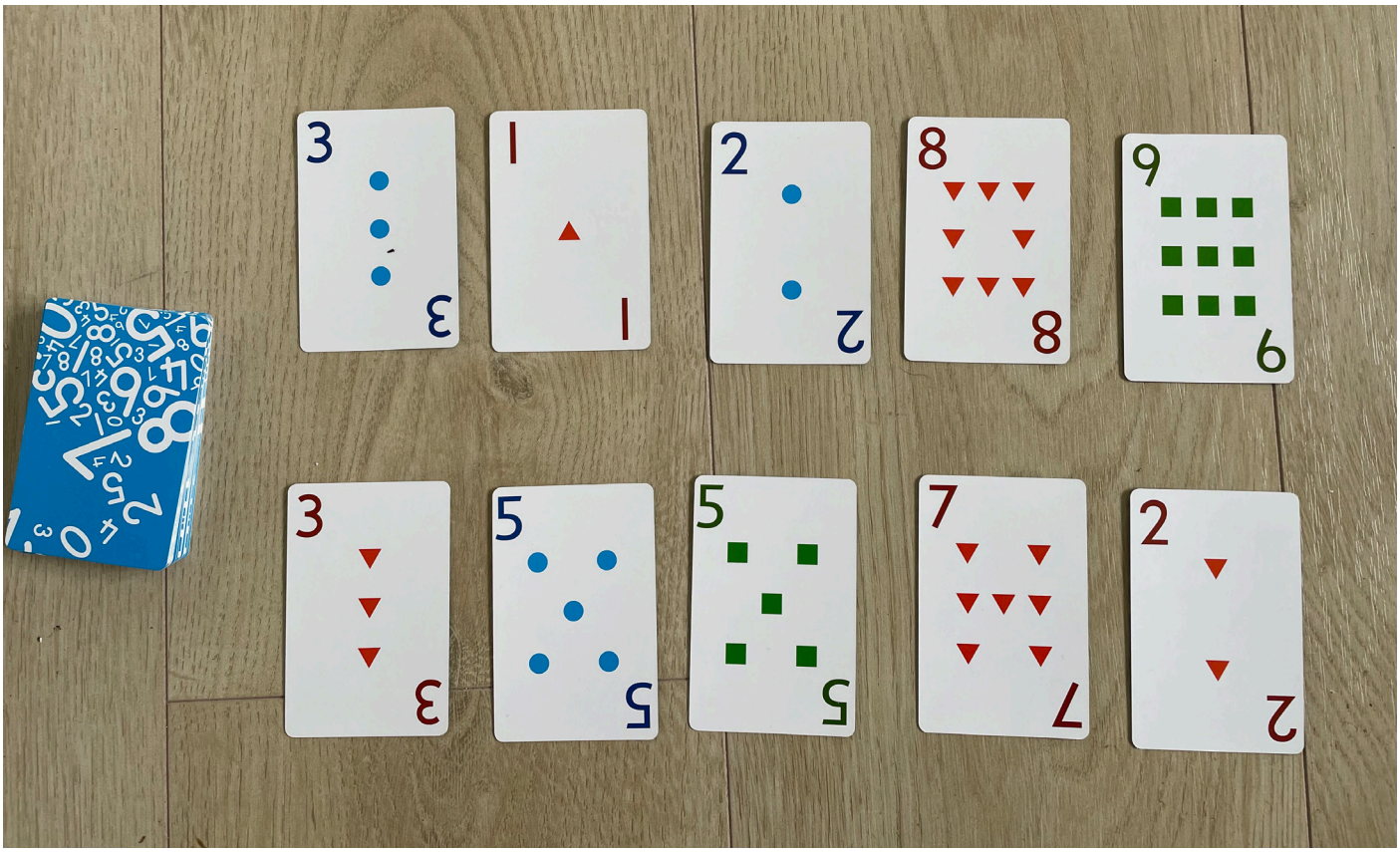

Figure 1. Cards set up for '5 to make 25' game.

Games are, quite rightly, becoming a more popular tool for teachers of mathematics. Games are inherently engaging and require minimal equipment, making them perfect for both a warm up or a whole lesson.

A major reason that games are a perfect component of a rich maths program is their ability to be easily differentiated. Games are also favoured because they allow students to practise their fluency, but they can also be used to explore a student's reasoning. This article discusses the game, *5 to Make 25*, exploring how the game can be differentiated as well as looking at how it can be used as a window into student's reasoning.

HOW TO PLAY THE GAME

The basic version of the game involves students being dealt five cards each. Students place the cards face up so each player can see all the cards (Figure 1). This allows a more collaborative approach, with students being able to help each other. From the 5 cards dealt, each student needs to find a combination of up to five cards that add up to 25. If students make 25, they receive the perfect score of zero points (the lower your score, the better).

When a student cannot get 25, they need to make the closest number possible with their cards. This can be either less than 25 or more than 25. They receive a point for the difference between their score and 25.

For example, if the most I can make with my cards is 17, then I receive 8 points. If I can make 29, I receive 4 points. Play continues until all the cards in the deck have been used. The winner is the student with the *least* amount of points at the end.

ENHANCING THE GAME

One of the key components of games in my classroom is making sure students are verbalising the strategies they are using. This is a powerful assessment tool, as teachers can use cross checks (Nelson, 2021) as they rove to record how students are solving the addition equations. The way I ensure that students are doing this in my own classroom is by making the 'verbalisation' part of the rules. In *5 to Make 25*, if students don't verbalise how they got their total, then the other player can 'pass on' their points. So, if I get 5 points and my partner got 9 points, but I don't verbalise how I added the numbers to get 20, then I get a total of 14 points, 5 of mine and 9 passed on from my partner.

It is optional for students to record their equations. This can also be used as a formative assessment tool.

EXPLORING REASONING

Within the basic version, students are using the game to practice addition strategies, both within each round and while keeping track of the total of points through the rounds. The game allows us to focus on fluency, problem solving and reasoning. How the students arrive at the answer is just as important as the answer itself.

In my classroom, students Kate and Jan played this game. Looking at Figure 2, Kate was attempting to work out her total. She placed the 10 and 9 together. She knew that 10 and 9 more is 19. She then attempted to find a third card that was closest to 25, which she chose the 3, giving her a total of 22. When asked could she get closer, she wasn't sure. I asked her how much she had (22) and then how far she was from 25 (3). I then asked, 'If you are 3 away, do you have a card that you haven't used (the 10 and 13) that is 3 more than a card you have used?'

After thinking, Kate replaced the 10 with the 13 and made 25. In the event they can't score exactly 25, their ability to be flexible with numbers, to problem-solve the different combinations, and their willingness to persist are important things for teachers to observe.

5 to Make 25 also allows students and teachers the chance to explore manipulating numbers to make addition easier. On her next hand, Kate had the cards shown in Figure 3.

She quickly recognised that she couldn't get to 25, so was trying to make the largest number possible. She began adding the cards in the order she had put them out, adding 0 + 6 + 1 + 4 + 2. I asked if she thought this was the fastest way she could add the cards, to which she replied 'no'. I then asked could she see any familiar numbers. She put the 6 and 4 together and said '6 and 4 make 10' and then the 1 + 2 is 3. She then added 10 and 3 more as 13 and 0 is still 13. The way in which students explore addition equations, identifying

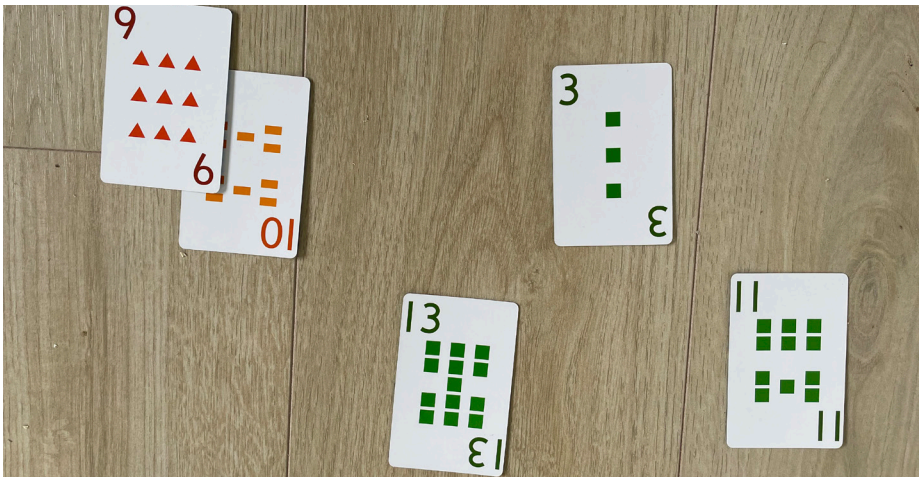

Figure 2. Kate's cards in the first round.

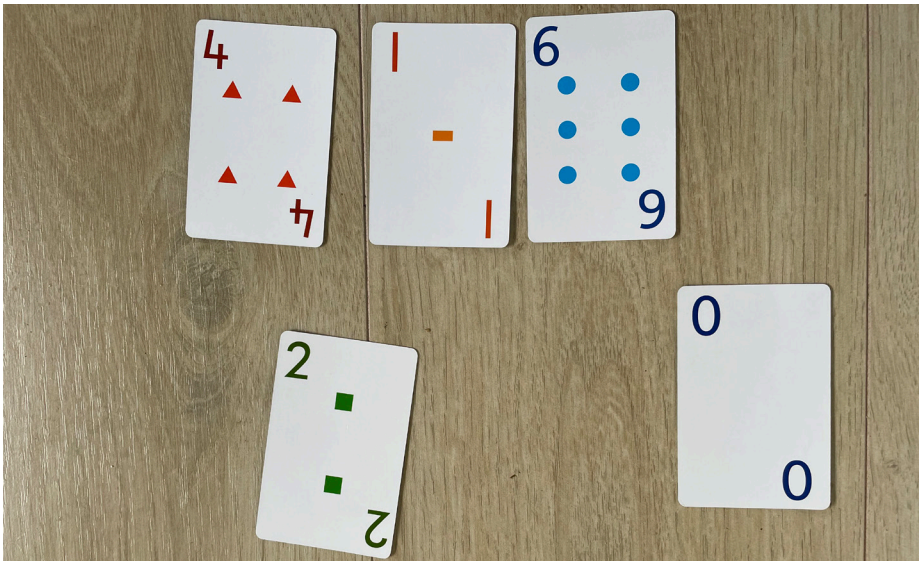

Figure 3. Kate's cards in the second hand.

known pairs and groups of numbers, is important.

EXTENSION

The natural extension of this game is to begin to include the other operations. For example, a student playing with addition and multiplication with the cards in Figure 3, would be able to do 6 × 4 + 1. Recording answers also provides an opportunity for students to explore order of operations.

When extending the game, students with different focuses can play together. In the game above, Kate was playing the basic game whilst Jan was using multiplication as well as addition. This allows for mixed ability groupings within your class.

CONCLUDING REMARKS

Often when we play games, we focus too much on the fluency aspect. Whilst this is very important, the thinking, reasoning and decision making is equally important. Students who have played *5 to Make 25* love the fact that there is a level of strategy within the game. I hope you and your students enjoy the game.

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MATHS IN THE WORKPLACE: BIOSTATISTICIAN

Sharmala Thuraisingam

Maths in the Workplace series is designed to highlight how important maths is outside the classroom walls. In this issue, Sharmala Thuraisingam reflects on how she uses maths in her role as an Biostatistician.

OCCUPATION

I work as a Biostatistician at the University of Melbourne, St Vincent's Hospital. I use data and maths daily to improve the health of Australians. Before that, I worked as a Mechanical Engineer for Telstra where I used maths to design buildings that housed important computer equipment.

I USE MATHS DAILY

Maths is a really big part of my work. I use mathematical models and equations to make predictions about people's health. For example, I develop models to predict who might feel better after taking certain medication, which patients would benefit from surgery, and who is likely to attend hospital. These predictions are then used by doctors to ensure their patients receive the best treatment as early as possible.

I also use maths to assess the effectiveness of new medical devices and instruments in improving people's health. This includes looking at devices and instruments that can be sold in pharmacies to support people to manage their own health conditions.

Lastly, I use maths to look at relationships between particles in the blood and certain diseases so we can tell from blood tests who may be likely to develop a certain disease in the future.

AT SCHOOL...

When I was at school I liked maths but I didn't understand its purpose. I constantly wondered why were we learning the quadratic rule or what was the point of algebra? I remember learning lots of different types of maths and doing various exercises from the textbook without really knowing how it related back to the real world. Therefore, for me, maths was just really something everyone had to learn at school.

AND NOW...

My feelings about maths are very different as an adult. After school I went on to study engineering. It was here that I learnt how powerful mathematics is and how maths is really all around us! It can be used to explain almost anything: the trajectory of a ball being thrown, the weather (except in Melbourne of course), how infectious diseases spread, how Netflix knows the movies you like to watch etc.

Realising that maths could be used almost anywhere was really exciting for me, especially when I discovered you could use maths to help people! This is what led me to become a Biostatistician. Now, I see maths as a very powerful tool that has the potential to change the world!

OBSERVATIONS

I think it's important to know that it's ok if you don't like maths at school. There are so many different types of maths out there. One way to make it more interesting is to think about something you do like – there will most definitely be some maths in there somewhere!

NUMERACY LEADER'S CORNER:
DONNA MCNEIGHT

I AM

Donna McNeight. I teach at Wendouree Primary School. We are a small school with 140 students located in Ballarat. There are 6 classroom teachers and several specialists that includes art, PE, and STEM. We also have the Stephanie Alexander Kitchen Garden Program.

MY JOURNEY

I started as Numeracy Leader approximately 12 years ago. I have always been interested in maths teaching, and after receiving coaching, I had a light bulb moment and wanted to improve my skills in this area. Throughout the last 12 years, I have completed the Primary Mathematics Specialist Program twice, qualified as an EMU (Extending Mathematical Understanding) instructor and I am currently participating in the Mathematics Leadership Mentoring Program with Matt Sexton. This year I also completed the Teaching Excellence Program focusing on mathematics. Other programs I have done include the Student Assessment in Mathematics and many of the webinars from the Mathematics Teaching and Learning Centre (ACU).

MY ROLE

I have been Numeracy Leader for the last 12 years and Learning Specialist for the last four. I am allocated one day per week in my role as Numeracy Leader. My main responsibilities have been to support fellow staff members through modelling lessons, providing coaching conversations and building on our school's mathematical resources. I have also been working with the teachers to create engaging maths planners that encompass explicit teaching, purposeful mathematical games, picture story books and differentiated problem solving tasks.

RIGHT NOW I'M WORKING ON

We are working towards building our classroom teacher's capacity to implement a differentiated numeracy program that enables all of our students to achieve success in their learning. We are providing focused PD, resources including picture story books, problem solving tasks and modelled lessons to support our teachers to achieve this goal.

BEST NUMERACY RESOURCE

My favourite resource are Paul Swan's Child Friendly Playing Cards because they have so many applications. My students absolutely love the cards and it is great to see the conversations that they have as they play the games or work on the specific task.

THE BIGGEST CHALLENGE

The most challenging part of my role is managing my time between the work I need to complete as Numeracy Leader and as a classroom teacher. This can become quite tricky especially as we are working on updating our maths planners. Another difficult aspect when it comes to time management is having enough time to work with the teachers consistently without interruptions, which I'm sure is a problem for many schools.

THE BEST PART

The best part of being a Numeracy Leader is sharing my passion for maths with my class and with students across the school. I love to teach lessons across the year levels where I can trial different ideas, resources and strategies with both students and teachers.

I love the connections I create especially when I have students coming and telling me about the maths they completed at home, while I am on yard duty. I often receive work or pictures that they have completed in their own time. Building a positive mindset to maths across the school community is lots of fun!

BEST BIT OF ADVICE

One piece of advice I always give is to allow thinking time. We need to give the students time to process the task and think about the strategies that they are going to use. Often we promote fluency as a strength, not realising that this disadvantages about 80% of the class who need time to think first!

DATA IN CONTEXT

Robyn Twyford, Assistant Principal, Templestowe Park Primary School

Throughout 2022, our whole staff were lucky to have benefitted from the wisdom of the after school professional learning sessions run by Michael Minas and Rob Vingerhoets. These sessions are excellent value for money, with many ideas to take back to the classroom the very next day. What we have found to be really important is the engagement and richness of the mathematics conversations that can stem from simple tasks. Thank you to Michael and Rob for always making the sessions fun and thought-provoking.

I wanted to share one idea that our F–2 staff have taken on with gusto, and the power of the maths understandings shown by our students. The idea was presented as *Whole Class Pictographs* by Michael and Rob. On a regular basis, a question is posed to the class that everyone answers to create a class graph. They do this by moving a small photo of themselves to one of the given categories so a real-life graph grows before their eyes. A simple question is all that is required, such as: What is your favourite colour? What is the best sport? Which pet do you wish you had? Or after a recent excursion: What was your favourite exhibit at the Melbourne Museum? The idea is to make collecting data for statistics and probability a natural, regular process. The real power is in the discussion and investigation of the data.

Rather than being another 'add on' we needed to make sure our teachers were committing to making this a regular part of what they do, so we decided as a school that we would pose a different question weekly. Every Monday morning, a new question would be waiting for the eager F–2 students. We would spend the week discussing and unpacking the data.

It was also important to make it manageable. During the PL session, Michael shared that the size of the graph was important.

We were warned – don't make it life size on your class whiteboard because it will take up all of that space!

We decided to purchase a 60cm x 90cm portable whiteboard for each F–2 class. This meant the students could access the board from the floor and it could then be moved to working and display spaces.

Each class started with a simple column graph. The Preps were given a little more scaffolding as we wanted to ensure the task was manageable. They had just had a *Market Fresh* incursion, so what better way to put the data in context. They were asked: What is your favourite fruit? The Prep teachers already had the axes drawn up and they guided the students on how to choose their response and place their photo above each fruit. Upon completion, the students were asked to discuss what they noticed about the data. The students were able to talk about categories that were equal, the most and least popular fruits and how many people had answered. (Figure 1)

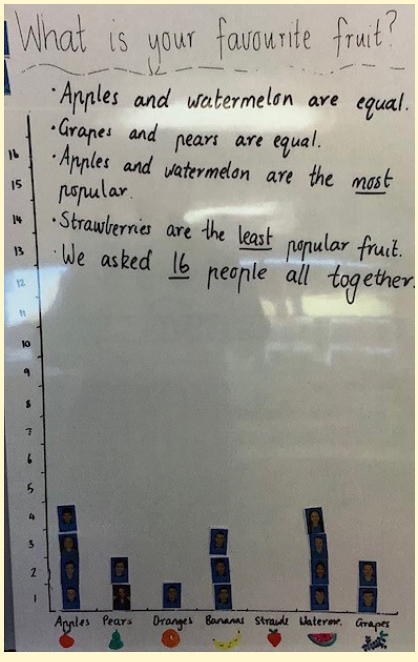


Figure 1. Prep fruit graph.

For Years 1 and 2, we chose not to give instructions. The whiteboard, along with its graph, sat at the front of the room waiting. As students walked in, they were directed to 'Please go and look at the whiteboard at the front and move your photo to your answer.' Students did this easily. Some grades combined Rob and Michael's *Tell Me 10 Things About* idea to get the students started with the discussion about the graphs. Interestingly, the students gave us insights into different areas of understanding. The Year 1 students spoke of 'the difference' between categories? (Figure 2), while the Year 2s identified that '2 out of 8 people who liked soccer were girls.' (Figure 3) This gave our teachers a focus for 'where to next' in our planning.

For instance, the Year 1s began an in-depth discussion about the 'difference' between numbers and exploring number sentences, whilst the Year 2s moved to fractions. If 2/8 students who liked soccer were girls, then 6/8 were boys. When added together there were 8/8 who liked soccer or one whole group. This was fractions in a real-life context.

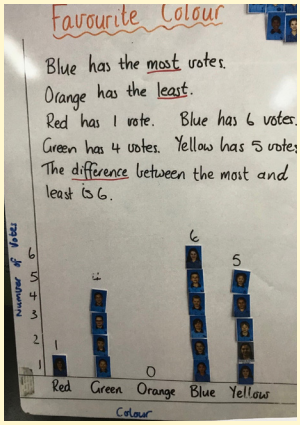


Figure 2. Year 1 colour graph.

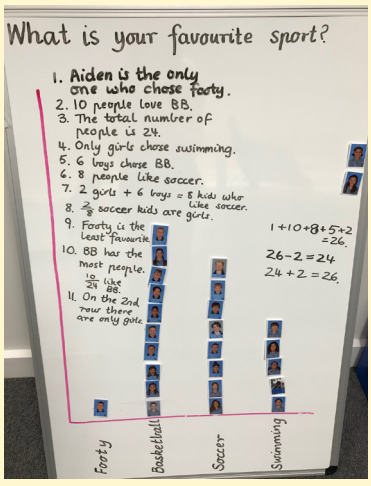


Figure 3. Year 2 sport graph.

The following week, the Year 2 students once again, made a reference to fractions.

This time the teacher used their interest to focus on equivalence: 4/8 is the same as ½ of the whole group. Explicit teaching was given. (Figure 3).

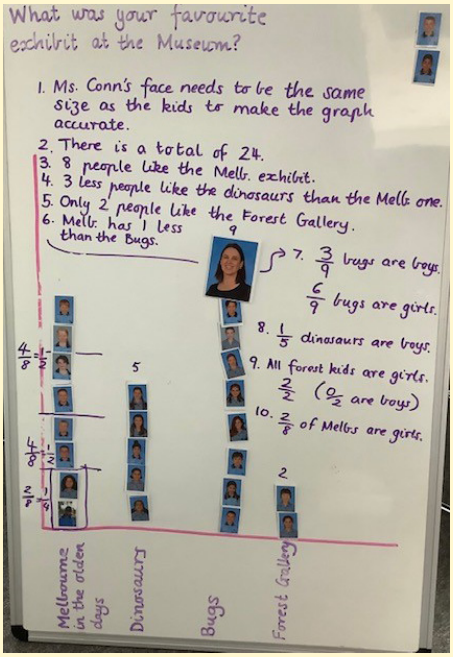


Figure 4. Year 2 museum graph.

When the Preps were faced with the question, 'What's your favourite colour?', they explained to the teacher which column was coming 1st, 2nd, 3rd and 4th, without any input from the teacher. The class had been using ordinal number as part of their daily reference to the name of the day and date.

After several weeks of column graphs, a Year 1 teacher decided she would like to see what would happen if she swapped the orientation of the board and the axis to make a bar graph. As the students came in, we observed from afar. The first couple of students paused, frowned and one asked, 'What do we do?' The other replied, 'I think it goes this way,' placing the photo in a horizontal manner to begin a bar graph. As more students came to the graph, they just continued in the same manner – there was no questioning of what they should do.

Some were put on fairly roughly, so it was noted by another, 'We need to fix the line so it looks neat.'

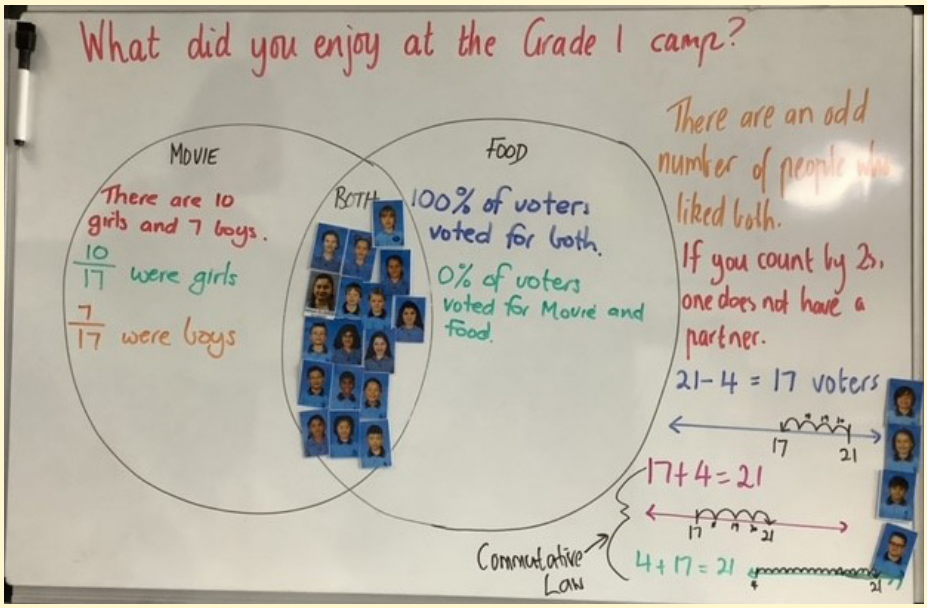


Figure 5. Year 1 Venn diagram.

They went on to carefully alter each photo slightly so there was an obvious line.

The opportunity to explore a variety of data representations is wide – column graphs, bar graphs, Venn diagrams. The Year 2 teachers are considering presenting a line for students to place themselves along a continuum. Rather than a 'possible', 'impossible' line, they are thinking of inviting students to place themselves on a continuum indicating their preference for savoury or sweet foods. It'll be interesting to see how that turns out!

Some handy tips we have learnt along the way include using our school management system, Compass, to print and laminate a photo of each student so they are all the same size. Rather than using Blu Tack on the back of the photos, you can use a strip of magnetic tape (provided you have magnetic boards).

Instead of buying magnetic strips, we cut up some of the magnetic advertising you receive in the letter box from real estate calendars or the local electrician or plumber. A strip of double-sided tape can easily stick the magnetic strip to the back of the photos.

At the end of each week, teachers take a photograph of their board, then print and add it to their class 'maths graph book'.

It is a popular book at reading time and is invaluable to return to in order to make links with new learning… 'Remember when we made a bar graph about…'.

What I love about this is how a simple, regular task places maths into a real-life context for students. We are constantly being pleasantly surprised by what our students are noticing and how they are linking areas across the maths curriculum.

Who would have thought that following a Year 1 camp experience, the teacher could pose a wondering from the Venn diagram which led to a discussion about percentage? The teacher noticed, 'This part in the middle has the whole class - everyone. I wonder what this would mean as a percentage.' A couple of students burst out, '100%!' (Figure 5). I am also impressed with our staff who are constantly thinking about where they could go next to deepen understanding or how they could expose students to a new way of displaying and sorting the data. I encourage you to give it a try!

RISK: QUICK ACTIVITY

Carmel Delahunty, Monash University

OBJECTIVE

To make the highest/lowest number.

MATERIALS

Two players, one deck of cards zero to 9; a barrier for between each player.

HOW TO PLAY

Step 1

The 'barrier' is placed between the players before they are dealt three cards face up in a horizontal line. The first card is hundreds, the second is tens and the third is ones e.g., cards 3 6 2 is three hundred and sixty-two. Five additional 'risk cards' are dealt to each player, face down.

Step 2

Using the cards in Step 1, play may proceed as follows: Player 1 decides they want to chance their luck to get a higher card in the hundreds so says: I am going to risk my hundreds.

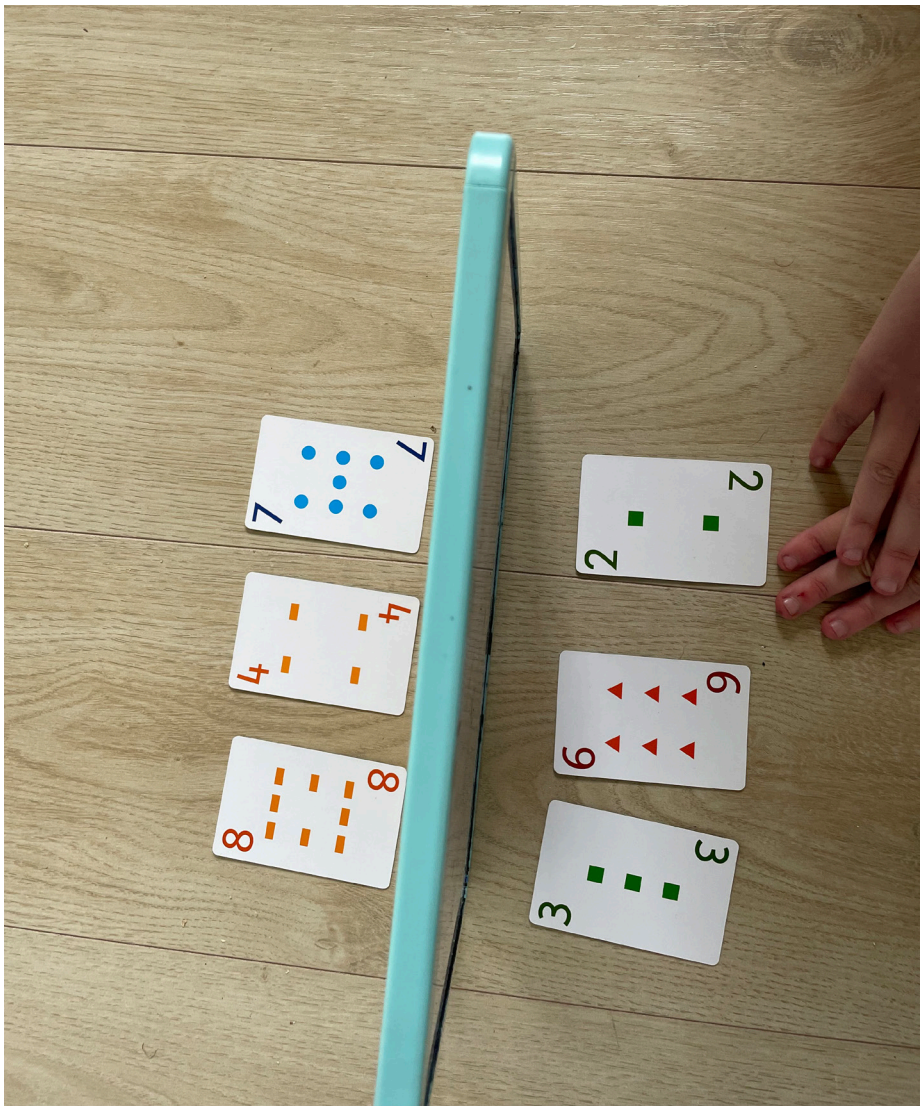
They then must swap their hundreds card (the 3) for the card on the top of their risk card pile.

Step 3

Play continues until one player decides they have the greatest chance of having the largest number and says 'stop'. The players remove the barrier and compare numbers. If the player who calls 'stop' is correct, they win the game (or receive 1000 points or however you wish to score, depending on the focus)

VARIATIONS

- Risk can be differentiated using smaller/larger numbers, and/or decimal numbers.
- This game could be enjoyed by more than two players, providing opportunities to compare more numbers. This would require additional barriers.
- The game could be played over several rounds with the final number in each round added together to create a total (which could also be compared).
- Players could calculate the difference between the two final numbers.
- Numbers could be rounded before they are compared with another pair/team. This could be framed in an investigation: If you had to round your final total, how might this impact your choices in the game?



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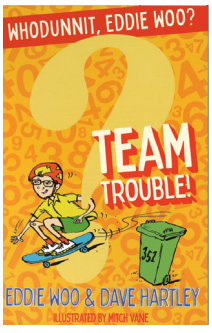
ENGAGING MATHS: 21 MORE FAVOURITE LESSONS

F–8

This book follows the success of *Engaging Maths: 25 Favourite Lessons* ('the Blue Book') which continues to stimulate a lot of interest from teachers, mathematics leaders, and pre-service teachers alike. With over 160 classroom photos encourages both physical and cognitive engagement, with lots of fun thrown in! Teachers can use concept cartoons to develop geometry understanding, enhance visualisation through *Look Make Check Adjust*, build mental computation through *4Up!*, provide real challenge with *Cubes in My Pocket*, or head outside for *Footy Angles*. With Matt Sexton joining the writing team, new features include an extended introduction with topics such as rethinking ability (achievement) grouping, using enabling and extending prompts, valuing productive struggle, and the importance of recording. There's also advice for school mathematics leaders on how they might use the book to facilitate teacher professional learning. Each lesson has a section on possible assessment strategies to help make assessment work for teachers. The going further section provides ideas on additional investigations which can potentially build on what has happened during the lesson. More engaging maths? Yes please!

$72.80(MEMBER)
$91 (NON MEMBER)



WHODUNNIT, EDDIE WOO? TEAM TROUBLE!

3–VCAL

Eddie Woo Super Sleuth is ready for action and mystery. With a mind for maths and a nose for adventure, he is about to skateboard into ... danger.

When Eddie receives a cryptic message from Mr Appleby, a Woo family friend and resident of Sunny Side Aged Care, he is soon on a mission to thwart the evil plans of smugglers. It's up to Eddie to crack the clues and improve his skateboarding so that he can enter the annual school Triple Threat Quest with his best friends Rusty and DT.

$13.70 (MEMBER)
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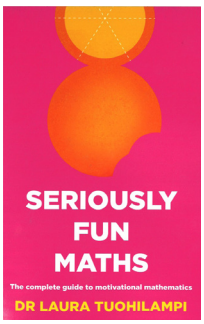


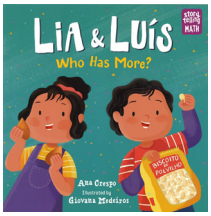
SERIOUSLY FUN MATHS

3–VCAL

Dr Laura Tuohilampi changes the narrative of mathematics education into something fascinating, intriguing and something that touches every human. Based on her cutting-edge research, she challenges the outdated ways of motivating students around maths. This engaging book provides teachers with research, resources and activities to teach a lesson a month. The rich activities are accessible to young students and deep enough for secondary students. Even adults!

This book will help mathematics educators reflect on their skills of orchestrating mathematical discussions and problem-solving. They will learn how to increase students' engagement in ways that reduce stress -inducing expectations around what a 'good' student in maths can and cannot do. Everyone will have serious fun while learning maths!

$33.50 (MEMBER)
$41.90 (NON MEMBER)



LIA & LUIS...WHO HAS MORE?

F–2

Celebrate diversity, maths, and the power of storytelling! Twins Lia and Luís argue over who has more of their favorite snacks. Can the siblings use maths - and a little sharing - to pick the winner? A playful exploration of measurement, counting, and estimation, featuring Brazilian American characters.

$12.70 (MEMBER)
$15.90 (NON MEMBER)

ONE BIG PAIR OF UNDERWEAR

F–3

Count and share with...underwear! What's one thing that two bears, three yaks, four goats, and six cats have in common? They hate to share. But look out - here comes a pack of twenty pigs ready to prove that sharing makes everything twice as fun! This seriously silly board book irresistibly combines the concepts of counting and sharing.

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$13.75 (NON MEMBER)

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INVESTIGATIONS

Toby Russo, North Fitzroy Primary School and James Russo, Monash University

MR HAPPY

Read *Mr Happy* by Roger Hargreaves, and have a go at this problem-solving task that involves exploring the power of exponential growth.

TASK: MR MISERABLE RETURNS HOME

Mr Miserable arrived back to his village, Sadtown, after his time with Mr Happy feeling like a new person. The entire Village, more than 200 people, gathered in the Town Hall to have a party to welcome back Mr Miserable. As they waited for Mr Miserable to arrive, you would think these people would be happy – I mean, they were at a party! But far from it. They were as sad as Mr Miserable was before he met Mr Happy.

Suddenly, Mr Miserable, who was now one of the happiest people in the world, arrived at the Town Hall for the party. Not only was Mr Miserable extremely happy, he had learnt from Mr Happy how to make others happy too. As he walked around the room, greeting one villager every minute, he made them happy. How long until everyone in the village was happy?

What if Mr Miserable's happiness is contagious, just like Mr Happy's? When he makes someone happy, they go on to make someone else happy, every minute. If happiness is contagious, how long would it take to make everyone in the village happy?

EXTENDING PROMPT

What if Mr Happy attended the party with Mr Miserable, and they both greeted someone every minute and their happiness was contagious? How long would it take to make everyone in the village happy?

ADDITIONAL EXTENSION

How long would it take Mr Happy and Mr Miserable to make everyone in the whole country of Sadland (with a population of over one million people) happy? What if Mr Happy couldn't make the trip after all?

How much longer would it take Mr Miserable to make everyone in Sadland happy without Mr Happy's help?

AND IF YOU WANT TO TAKE IT FURTHER

What if Mr Happy and Mr Miserable could instead make two people happy every minute, and their happiness was contagious, so that the people they infected with happiness could also make two people happy every minute. How would this change the answers to the above questions?

Image https://mrmen.com

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.