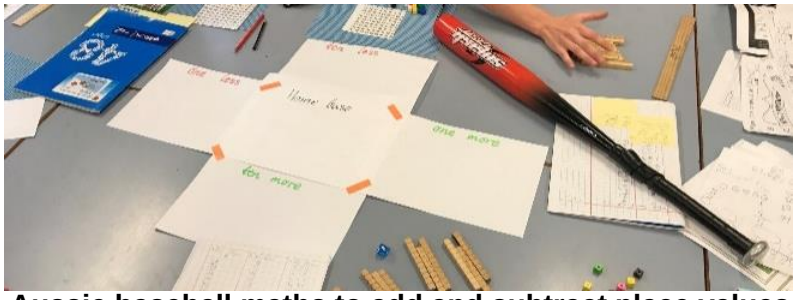
Active, materials-based maths with students constructing concepts - no worksheets! Real-life and linked to students' interests, created in Australia



Aussie baseball maths to add and subtract place values

Figuring out the duration of current movies using place value blocks to convert between units

Years 3-6 Real-Life Maths Package

10 Developmentally Sequenced Units

with over 400 Sequential Lessons

plus Whole-School Diagnostic Assessments

Created by Australian Maths Leaders and Teachers for Ten Years in Classrooms

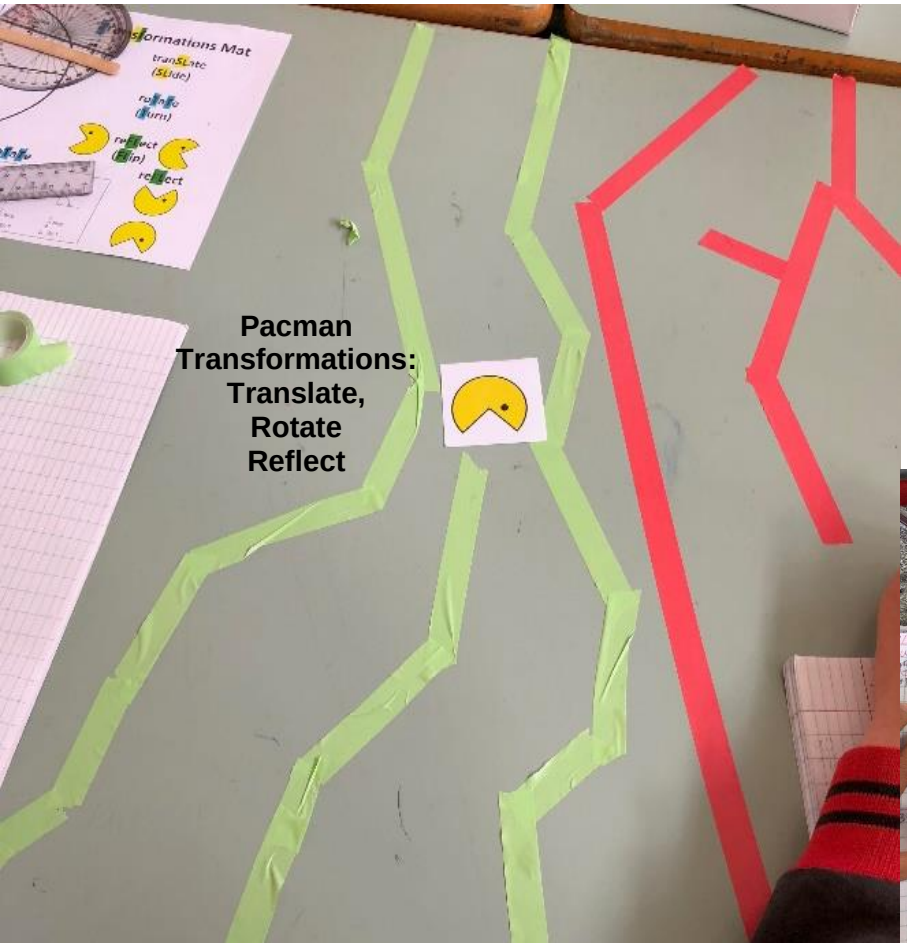
Hands-on Lessons to Develop Critical Concepts

Explicit Teacher Modelling with Materials and Photos

Real-life Maths with Sequential Skill-building through <u>over 400 LESSONS</u>

Extension and Support

Easy Differentiations for Maximum Growth for All Students within Low-Floor High-Ceiling Lessons



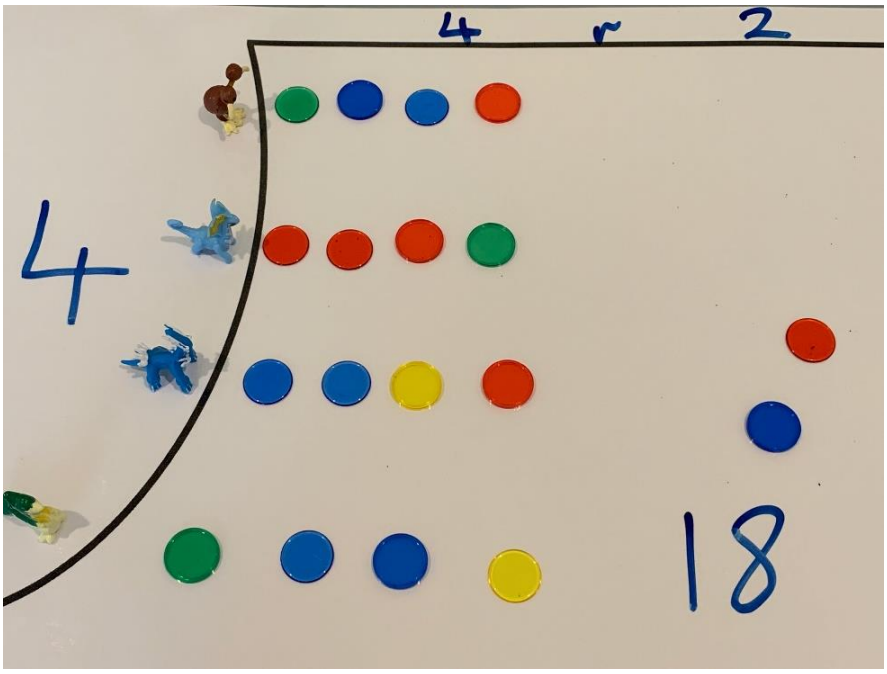
SHORT SAMPLES FROM THE UNITS

Angles Unit 3-6: Developmental Step 3 – Rotate objects and describe turns as ¼ (90°), ½ (180°), ¾ (270°) and full (360°)

1 of 20 Lessons in the Angles Unit 3-6

ANG 3.1	SKATEBOARDING THROUGH ROTATIONS AND ANGLES
Hook: These next two sessions, we are not just learning maths. We are learning about surfing, skating and snow-boarding! In fact, if you play any sport where you turn or twist (take class suggestions – netball, AFL, gymnastics etc.), over the next few days you'll learn how to describe the movements you make as you train each weeknight or play on weekends!	**Modelling:** Set up 4 quadrants using chalk or two 1m rulers as in the visual. Model angles using a skate/surf/snowboard (whichever is most relevant to your students). ***Question as you model:*** Start with a full turn. So what would I call this then? Model a ½ turn. Then break that down into a ¼ turn and ¾ turn. Now link degrees of turn to the 9 times tables as you put labels down as in the photograph, e.g. So if this is zero (where I started) and this is 90º, what do you think comes next? So this is 180º, what times tables are these following? ***Real-life link questioning:*** - Why do you think the original mathematicians chose 360º as the measure of a full turn? (Close to 365 days for Earth's full rotation around the sun). - Without turning, how many degrees can humans see? (Approx 180º). - Link to TV shows, why is it called AFL or NRL 360º? (AFL from all angles). As a class, invite students to model and identify more turns. Then ask students to record their learnings so far in their books in any format that sticks with them.  **Investigation:** Play the skateboard and snowboard video clips listed below. Pause frequently and ask students to identify the nature of the turns in both fractions and degrees (e.g. ½ turn, 180º vertical flip): - Easier skateboard version: https://www.youtube.com/watch?v=cXMlNfKYeuE Alternatively, if you cannot access YouTube, or after this easier one, invite students to model twists and turns to the class using the skateboard (safely). - What would we call it if Fred did two full rotations? Three? One and a half? - Harder snowboard version: https://www.youtube.com/watch?v=2YzP0cqG6_A **Follow-on / home learning opportunity:** In pairs, students create their own version of these video clips using any board of their choice (with helmets) and label each twist. Show their video to the class, pausing it to quiz their peers.

Teaching Tip: Using Arrays to Solve Divisions



1. The characters or smiley faces on the left of the algorithm show how many people you are sharing between.

2. Under the algorithm place the total number of things you are sharing. Share these one or more at a time in neat columns – but remember that <u>the share must be fair!</u>

3. Your answer is then how many items each character received. This goes above the line, with any remainders to the left of

The division algorithm is read from bottom-to-top, right-to-left (the exact opposite way we read and write): 18 shared between 4 gives 4 to each person with 2 remainders

Extension version using notes and coins:

$100 shared between 4 friends gives $25 to each friend

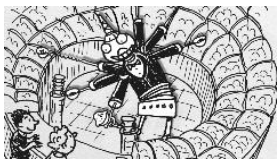
$34 shared between 5 mates means each friend pays $6.80 for the football

Multiplication 3-6 Unit: Step 4 – Build arrays to solve 'groups of' situations

1 of 50 Lessons in the Multiplication Unit

MULTI 4.0 **CREATE YOUR OWN ICE CREAM STORE**

Hook: ***Literacy Link:*** *Bleezer's Ice Cream Poem* by Jack Prelutsky, 1940 (full version easily available via Google search). YouTube of the poem (if accessible): https://www.youtube.com/watch?v=YuPlUQvViX8. Buddy read the poem for fluency. As a writing session prior to maths, students create their own store and poem, brainstorming whacky flavours with alliteration like 'Cotton Candy Carrot Custard' using the same list poem format.



Literacy Link: Page 16 of the *26 Storey Treehouse* by Andy Griffiths with 78 crazy flavours served by a robot.

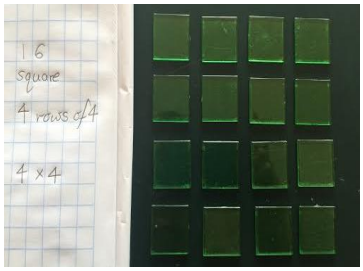
Students determine their ideal ice cream store (array) layout.

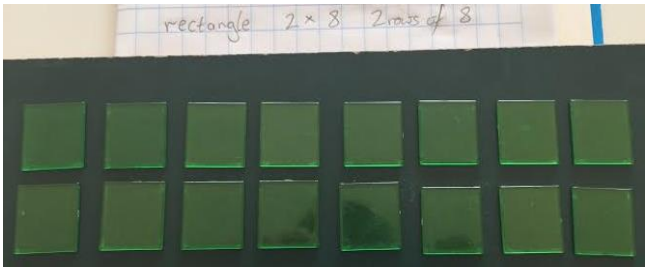
Questioning: Imagine that you have just walked into Bleezer's Ice Cream Store. When you have walked into ice cream stores in the past, how were the flavours set up? (In arrays).

As a new store owner, today your job is to solve these 2 big questions:

1. If you chose to have 17 flavours, how many options would you have to set up your store?
2. What do you think is the <u>best number of flavours</u> for your store? Consider that you want to:
   - Rearrange your array every day to keep customers interested (in retail this is called 'fronting up' so that customers want to buy heaps of your products), AND
   - Offer a variety of options for customers (but not too many so you need a robot to serve them all!)

Modelling: Use 16 counters with the class around a fishbowl modelling desk and model trialling all possible arrays, taking student suggestions:





For recording, model using both the language of 'rows' and the 'x' symbol to mean 'rows' in this context. "Like the examples, use your book to record what you find out as you go."

Cross-Content Link: 2D Shapes (rectangles, squares, regular/irregular shapes – an array must be regular).

Final Instruction: Now, try some numbers and make some informed decisions so that your store can successfully open!

For extra engagement, students could also use lollies to model their arrays.

Support: Keep counter supplies under 25 to begin the task.

Tip: Firstly just focus on creating a (regular) rectangle/square with the counters – then you know it's an array. Beware of the misconception that it is an array if one is missing, e.g. that 17 could be made using 2 rows of 8 with 1 extra on one side.

Encourage all students, but these in particular, to find *all* possible arrays before choosing their next new number of flavours to trial.

Extension: Next page for an advanced goal using the same context.

Extension Prompt for 'Create Your Own Ice Cream Store' with factors, prime/composite and square number understandings

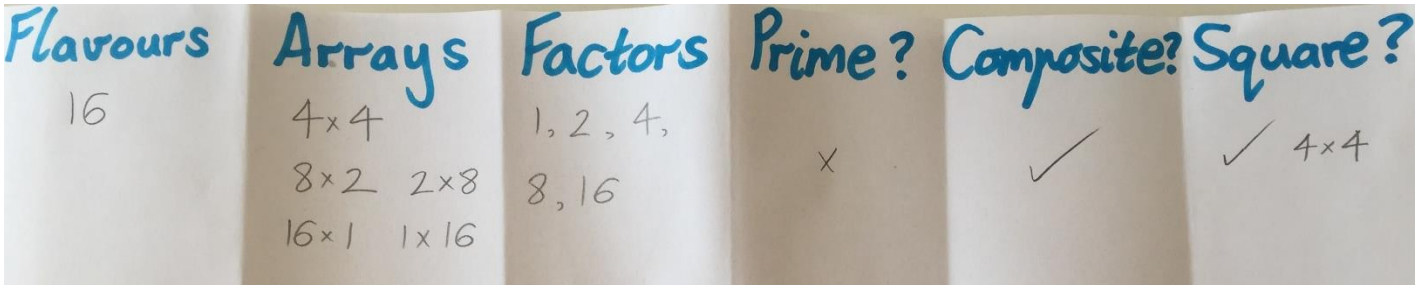
Teaching Tip

Prime v. Composite Tip: Link it to arrays

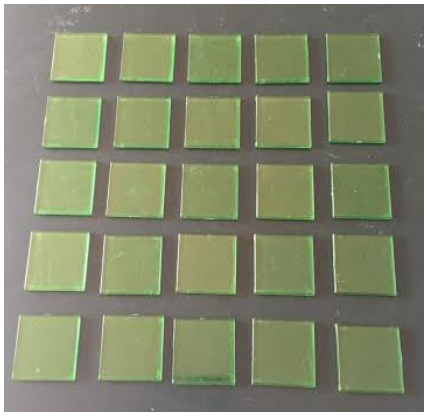
Prime: Only has two arrays, a long column or long row: 1 x itself and itself x 1
Composite: Has many different arrays, e.g. 16 can be 4 x 4, 2 x 8, etc.

Factors: Look at the number of rows: that's a factor! Look at the number of columns: that's a factor! Make another array using that number of counters and record the other factors.

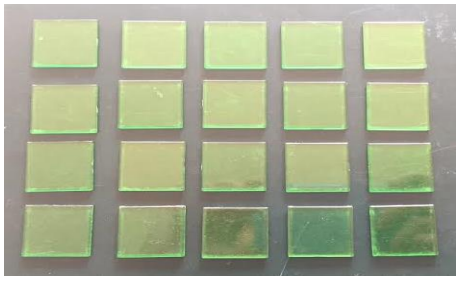
Square numbers: Can you make an array in the shape of a square? Then it's a square number!



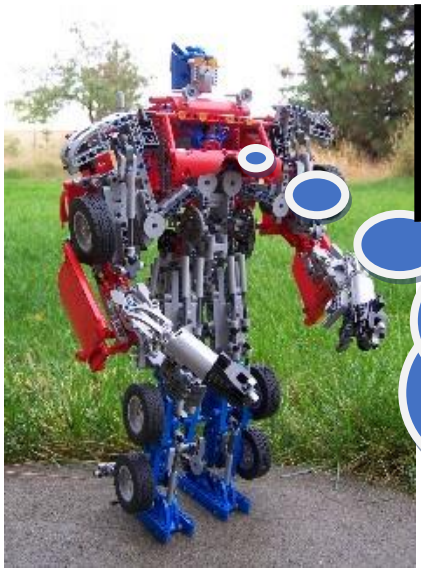
Flavours	Arrays	Factors	Prime?	Composite?	Square?
16	4×4 8×2 2×8 16×1 1×16	1, 2, 4, 8, 16	X	✓	✓ 4×4



"25 is a square number because the array looks square.
Its factors are 5, because the array can be made using 5 rows of 5."



"20 is not a square number,
the array creates a rectangle.
Its factors include 4 and 5, as you can see from the array."



Prime real-life link: Prime numbers are like Optimus Prime (from the *Transformers* movies) who in the original version could only transform into two forms, an Autobot and a truck. E.g. 17 can only transform into 1x17 and 17x1 as an array.

Thanks to Bailey (a grade 3 extension student) who made the connection between transformers and prime numbers.

Whole-School Approach to the Times Tables

My Ultimate Multiplication Strategies Booklet

Students develop their own best method for learning each of the times tables, focusing on efficient strategies rather than just memory.

As a class, designate a times table of focus for three consecutive days.

The suggested order and some supporting prompts for strategies are:

Firstly: **2s:** doubles **10s:** place value tens pattern **5s:** the analogue clock or half the tens

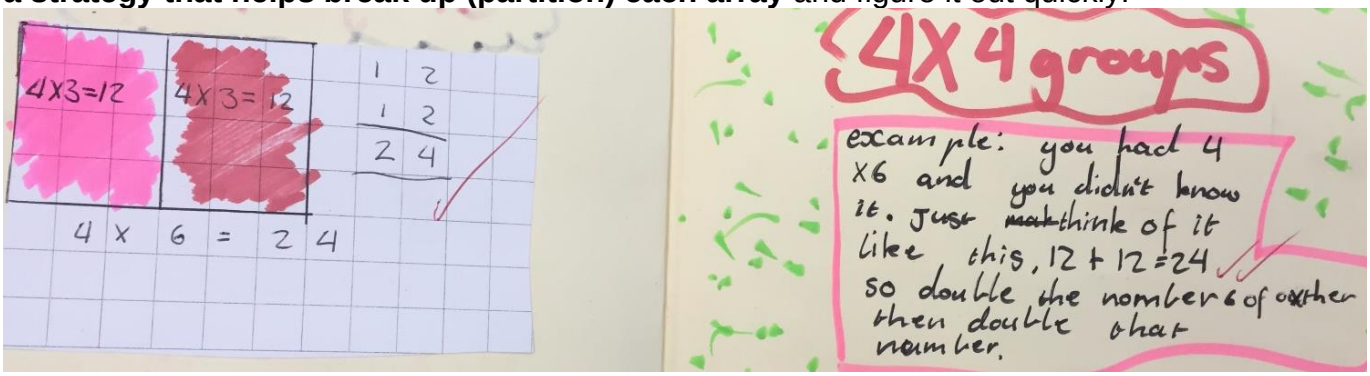
Then: **3s:** doubles + one group **4s:** double double **9s:** 10s – one group

Finally: **6s:** double the 3s **8s:** double double double or double 4s

7s: use all of the other times tables they know (e.g.3x7 is 7x3) and just learn 7x7=49

However, *do not tell the students these strategies. Use the modelling tips* below to enable them *to form their own efficient strategies*, which may not always be the exact same as above.

Method: On a draft page, students draw the arrays relating to that times table. Now brainstorm **a strategy that helps break up (partition) each array** and figure it out quickly.



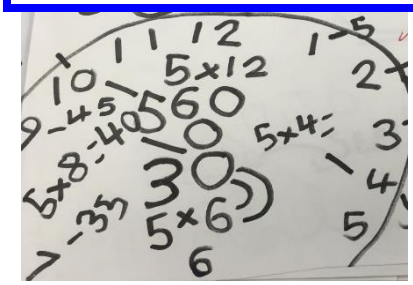
Students can also write out the times tables to **search for patterns**, e.g. answers for 9s all make 9 when you add the digits, e.g. 9x7 = 63 (6+3=9). Once satisfied with their strategy, students create a maths journal page in an ultimate/secret strategies booklet that they will keep and use for the rest of the year. Many students are keen to retain these for future years too.

Peer share: At the end of each two day focus, students share their pages in small mixed ability groups and replicate any other strategies or explanations that they wish to include in their own booklets from their peers' explanations and findings.

Modelling: As a class, start with a times table like the 2s or 10s and model a 'what your strategies booklet will look like' page including written explanations and diagrams as shown. Photocopy samples of the best explained strategies each day and create a compiled class strategies book for your class library. For the remainder of the year, combine the use of these booklets with a regular home learning emphasis.

Throughout the year: Use the 5 minute whole-class fortnightly times tables progress check-ins, certificates and 'learn next' cards – in ***assessment resources folder –*** to focus on one point-of-need strategy for a times table, secure home help and maximise student motivation.

Extension prompt: Require at least three different strategies for each times table and then ask them to justify which is the best one, or whether a variety work best within the same tables. Once times tables are mastered, progress to square numbers/roots, prime/composite, etc.



This student drew the connection between the 5 times tables and the analogue clock. Since he knew many of the corresponding numbers on the clock, e.g. that at 4 it is 20 minutes, he realised that he automatically knew many of his five times tables already!

email: maths@toptenresources.com

Fractions Unit Launch

1 of 40 Lessons in the Fractions Unit Years 3-6

FRAC 1.1 FRACTIONS IN OUR WORLD

Outside maths: Walk around the school with students pointing out fractions, e.g. one out of four squares, one basketball court out of three in the school, etc.

Hook: ***Bring in an object for maths:*** Tomorrow you need to bring in objects that we can use for our own fraction gallery walk in class. Use the visual (right) as an example.

YouTube: Also show this YouTube showing fractions in our world – they're everywhere! https://www.youtube.com/watch?v=8hmb0FyGe4Y

PART ONE: Students locate fractions around the classroom then school, recording them visually and using straightforward language.
E.g. This is one of ten books in the *Diary of a Wimpy Kid* series.
The defence zone is one of three parts of the netball court.

Template for the walk is included in the unit plan.

Fractions in our world NAME_____

OUTSIDE MATHS! Thing and drawing	...out of...	Two words	As a fraction

Modelling and Questioning: Model the line in between the numerator and denominator as meaning 'parts of' or 'out of'. Also read fractions from top to bottom, e.g. ¼ as "1 out of 4." Teach students to read numbers in the denominator like you are in a race (ordinal numbers), e.g. 1 fourth, 2 thirds, 6 eighths. This is necessary as English uses this arbitrary language instead of saying fractions as literally 'four out of eight' as in other languages.

- What is a fraction? (Equal parts of a whole *or* parts of a group of things).
- Which fractions are not said as ordinal numbers? (A whole, half). Why?

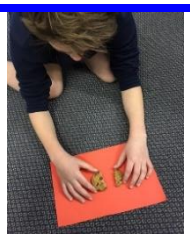
PART TWO: Students set up their objects from home on their desks. Then students walk around the room, recording their peers' objects as fractions in straightforward language (three out of four of the nail polishes are blue), proper worded form (three fourths) and standard form (¾).

Extension: Figure out equivalent fractions using arrays. E.g. 4 out of 12 balls in our sports tub are soccer balls ones. If you draw 12 circles using 4 rows, you can see 1 in 3 of them are soccer balls! So it's the same as one third!

4/12 = 1/3

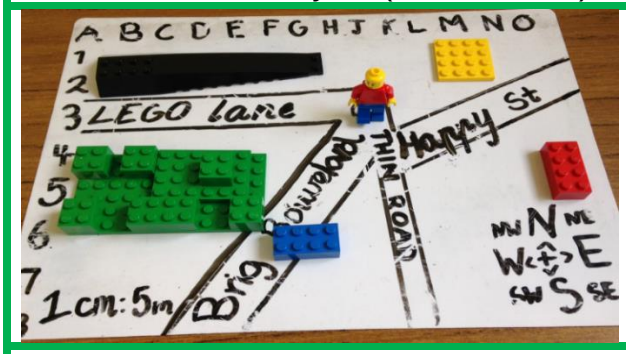
Summation: Students publish the answer to their own objects on small labels (as shown above), everyone then verifies their respective answers.

PART THREE: Just before eating time, ask students to split any possible parts of their lunch into fractions. Discuss. Assuming you are hungry, would you prefer me to eat ¼ or ½ of your sandwich? How much of his drink has ____ consumed so far? Then watch the YouTube clip (left) as a whole-class reflection.



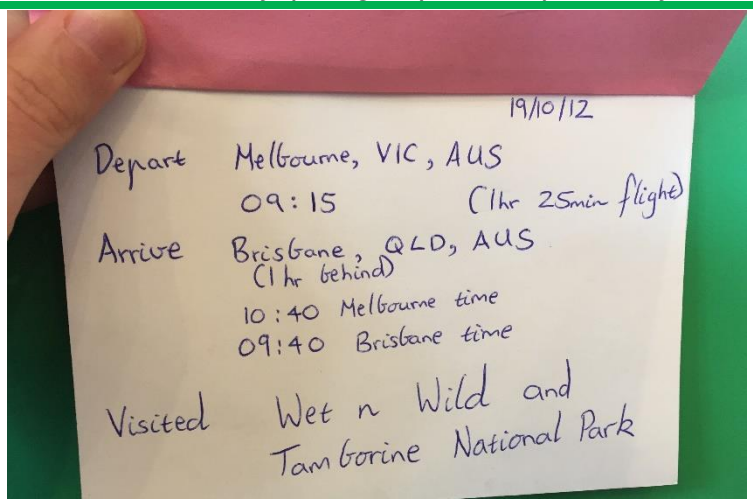
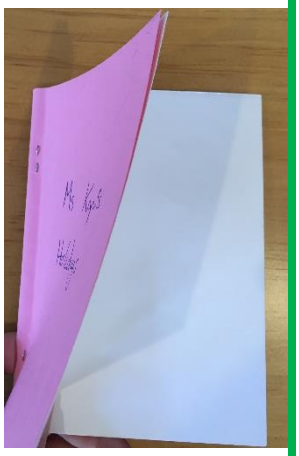
Location Unit 3-6: Step 6 – Produce maps with coordinates, keys, cardinal directions, scales and create directions to landmarks

1 of 30 Lessons in the Location Unit Years 3-6

MAP 6.8	FULL UNIT REVISION APPLIED INVESTIGATION: LEGO MAPS
Hook: The previous day announce: We're making LEGO maps tomorrow, so bring in your LEGO for maths! The next day briefly Google search 'Legoland' and view the Google images. Discuss how LEGO is often used to models real landmarks and cities. Discuss maps in this way, as small models of large, real-life things.	**Students create their own map using LEGO, applying the full range of mapping skills learnt over the preceding lessons in the unit.** Use a mini-whiteboard or a grid book page as the base for their map. **Modelling:** Make a model map as a class. Start by setting up coordinates: - Should we use 'I' as a letter? (Easily confused with 1). - Where should we start the letters? (See the photograph below for the problem with starting letters in the same column as the numbers). Add street names, take amusing class suggestions. Add a compass rose, invite students to contribute the points. Then add LEGO pieces that serve as key landmarks, and as you do so, on a small piece of paper beside the whiteboard, record what the landmarks are using symbols within a key/legend. Once students reach this point with their own map, do each of the following in stages: ***Coordinates and Key/Legend:*** On their key/legend, also record the coordinates of each landmark, e.g.  : Lava Pit (O4, O5). ***Cardinal directions/compass points:*** Students place a LEGO man (or any small figurine) in the middle of their map, and describe what landmarks are N, NE, E, SE, etc. of their person. E.g. Mr LEGO is NW of the Lava Pit. ***Scale:*** If Lego Lane was a real street and Mr Lego moved one centimeter, what would that really be (1m, 5m, 50m)? Decide on and label your scale.  ***Real-life link:*** As a class, type a destination into ***Google Maps***, e.g. a house down the road from your school. As you walk, listen to the instructions on the phone/iPad: What do they say? Directions need 3 elements: compass points, street names and distances. E.g. Turn *left/NE* onto *Happy Street* for *35m*. ***Directions: Start orally*** with a like-ability partner moving the figurine in response to each instruction, e.g. Go West on Lego Lane for 50m. ***Lastly, proceed to a written series of directions*** for a partner to follow with a 'mystery' destination. Remember to include the origin. Set out directions in a list format with a new line for each new instruction (like dialogue for narratives). **Support:** Record directions in cm (no scale). Use coordinates, e.g. Move from J3 to G3. Stick to oral directions (no writing barriers) with a like-ability partner. **Extension:** Challenging scale, e.g. 1cm: 50m. Note fractions, e.g. 0.5cm = 25m. Convert the distance travelled over each route into km.
Follow-on: Now combine as a class to create a LEGO map of the entire school. Discuss and determine positioning, significant landmarks, true north, a reasonable scale and more!	

Time Unit 3-6: Step 8 – Work with Time Zones in Real-Life Contexts

1 of 25 lessons in the Time Unit Years 3-6

T 8.2	PLAN YOUR DREAM HOLIDAY – PART TWO: INTERNATIONAL
Today, you are planning your dream holiday! If you do a great job, present it to your parents with a persuasive letter and see if you can convince them to book it. Even if they say no, you can keep it for when you turn 18 and you'll have your travel plans ready to go!	**Students 'travel' overseas, applying their skills from the previous task designs in the unit to figure out arrival times for flights and time zones at their departure and destination points.** Students create a little booklet which is their 'passport' by folding A4 pages into quarters and stapling these together (example in the photograph below). **Modelling:** Applying yesterday's session on time zones, show students a model travel passport outlining what to record for each destination: - Departure city - Time of departure (in that city's time zone) - Destination city - Duration of their flight (show students how to use one online flight website – designate an approved carrier for the class such as Qantas). - Any changing time zones *(e.g. Brisbane is 1hr behind Melbourne* – figure this out Googling: Google 'time in ____', compare it to the time in current city). - Arrival time (calculate this using your departure time and the duration of your flight). Record this in the original time zone and the new one *(e.g. arrived Melbourne time 10:40, Brisbane time 09:40)* - Finally, students record two to three landmarks/attractions they'd like to visit in that city (using TripAdvisor), then fly elsewhere and repeat.   ***Cross-Content Link:*** Chart their journey on a printed map of the world.

Support: Focus only on calculating arrival time based on the flight's duration and departure time, not accounting for time zone changes. E.g. Departed Adelaide at 9am, arrived in Perth at 12:20pm. Sit near an ICT-capable partner for technical assistance. Use sentence examples such as 'duration of flight Adelaide to Perth' in Google and any departure time.

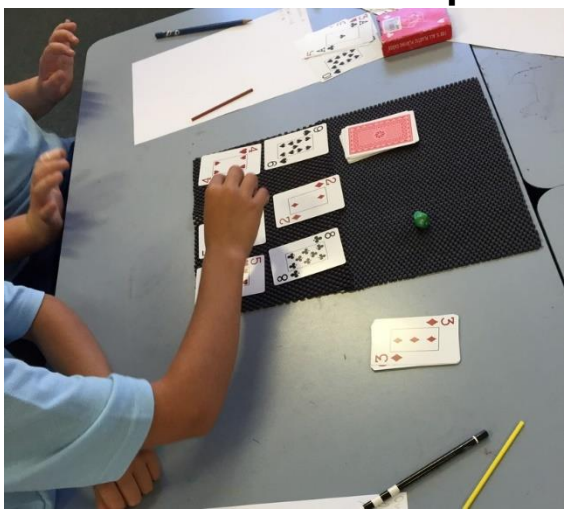
Extension: Record all times in 12 and 24-hour formats. Enable them to research cheaper flights (not with the designated class carrier), then figure out the most economical.
Also figure out how much money they saved compared to the rest of the class who had restricted airline choices.

These are JUST short samples –

The Top Package contains OVER 400 LESSONS with Hooks, Teacher Modelling, Photographs, Extensions/Supports and Assessments, including:

Card and Dice Games

Easy set-up warm-ups related to each concept



At the start of each unit

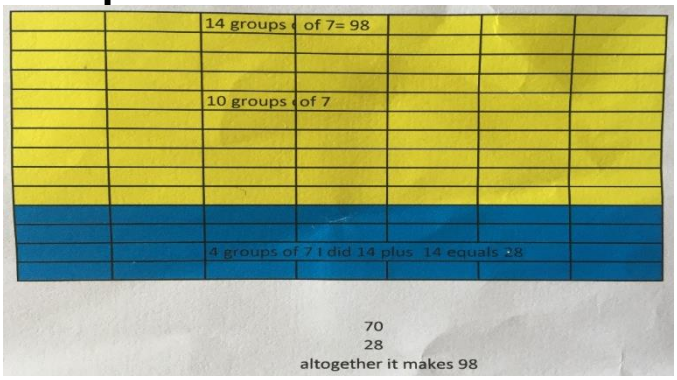
Big Concepts in Authentic Contexts

Long Jump for Measurement and Decimal Concepts in Real-Life

Measurement 3-6 Unit

21st Century Learning

Microsoft Excel to Practise Partitioning Arrays and Using Known Multiplications to Solve Unknown Ones

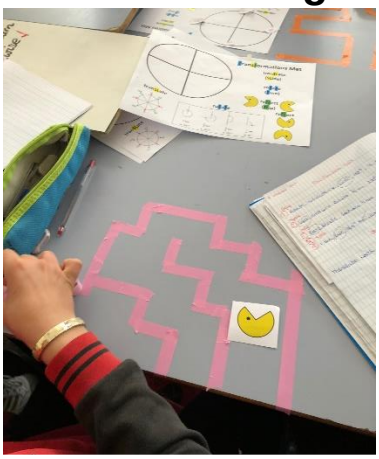


Pacman for transformations (flip, slide, turn)

Digital Learning integrated throughout all units

Joyful Learning

Mini Golf Maths to Add Small Numbers Using Efficient Strategies



Describe movements using the language of translate (left/right, N/E/S/W), rotate (degrees, clockwise/anticlockwise) and reflect

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Teaching Tips and Intervention at Relevant Points within the Units

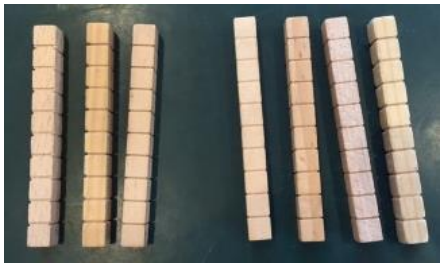
Place Value Intervention

Ensure students can subitise: Instantly ***see*** small numbers.

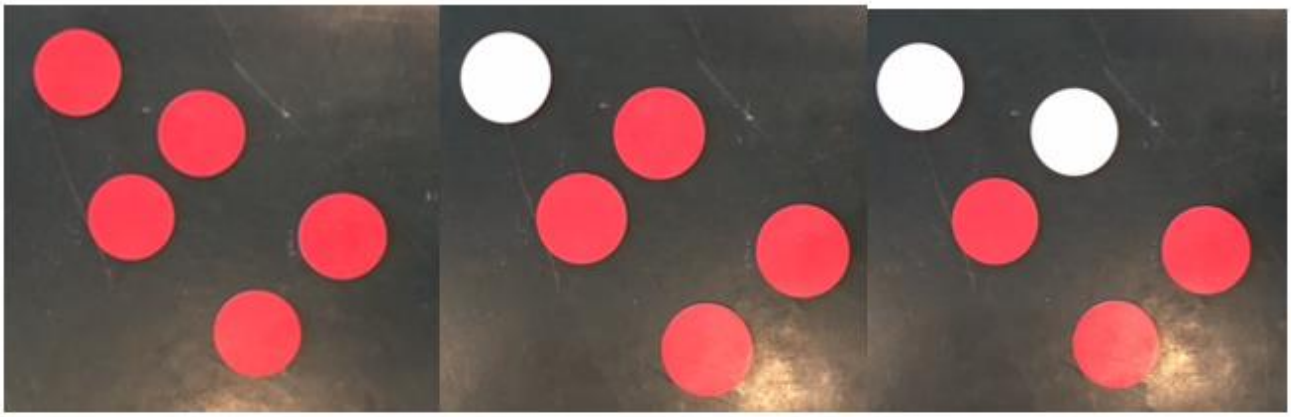
I can ***see*** 3, I don't need to count it.

Super hero eyes! ***See*** the numbers, don't count them.

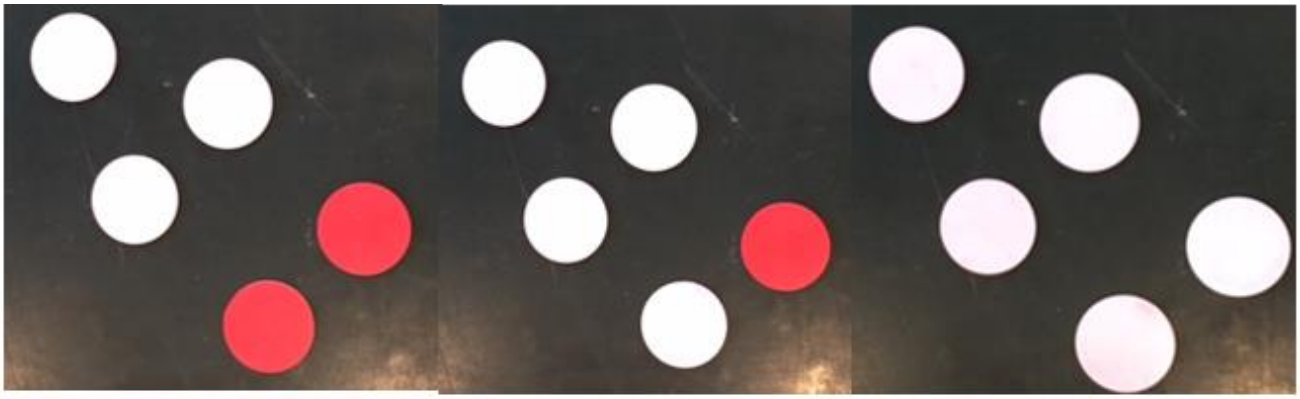
Ensures this continues with MAB blocks: "I'll grab 70 as 3t and 4t, NOT 1 at a time!



Partition: Break numbers into parts, e.g. combinations that make 5:



5 and 0 makes 5 | 1 and 4 makes 5 | 2 and 3 makes 5



3 and 2 makes 5 | 4 and 1 makes 5 | 0 and 5 makes 5

Alert! If you have students who still cannot do this, they are probably still finger-counters. Even though these skills should be solid by the end of grade 1, if a student has not grasped them, you need to address these FIRST. There are high schoolers who still count all under their desks because these skills were never fully consolidated in primary school. Yet, these are the foundational building blocks for most efficient strategies in all concepts.

Whole-School, Developmentally Sequenced Assessments

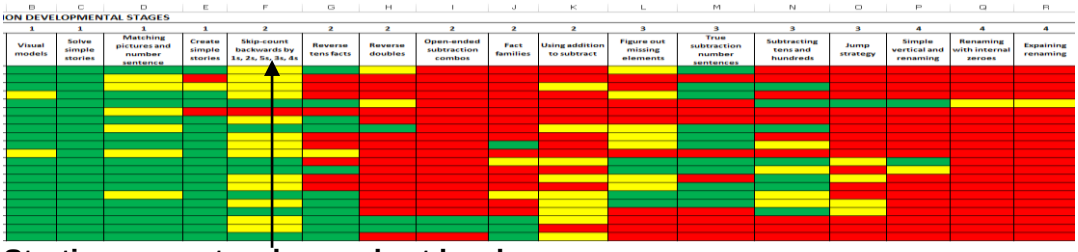
Assessments align to the developmental steps in each unit and can be consistently utilised across every grade level ensuring that all teachers know their main cohort's most critical points-of-need and developmental gaps, including any gaps from the early years that will prove to be road-blocks later:

PlACE VALUE DEVELOPMENTAL STEPS

	1	1	1	1	1	2	2	2	2	3	3	3
Name	Order numbers up to 100	Partition tens and ones	Numbers in digits up to 100	1 more and 1 less up to 100	10 more and 10 less up to 100	Numbers in words up to 1,000	Basic number lines	Largest to smallest up to 1,000	Counting patterns	Numbers in digits up to 9,999	Use blocks to draw numbers	Expanded form

SPREADSHEETS WITH FORMULAS:

Short pre-unit assessments easily identify both the class cohort's and each individual's exact zone of proximal development:



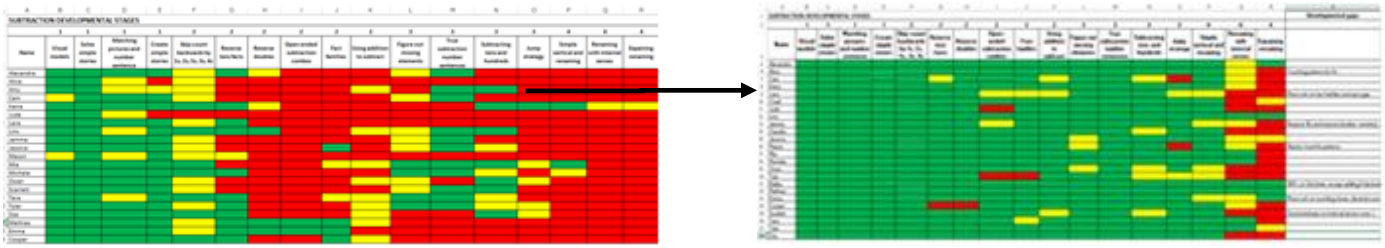
Starting zone at a class-cohort level

Teachers can also easily identify:

- Which students need **LESSON SUPPORTS** (students with *more* red developmental steps)
- Which students need **LESSON EXTENSIONS** (students with *more* green developmental steps)

Ongoing assessment opportunities are highlighted throughout the units.

Celebrate progress and value-add (growth mindset), as opposed to raw scores:



Pre-test to Post-test Cohort: Easy-to-use Formula-Loaded Spreadsheets

The spreadsheets with formulas determine the value-add and progress made by cohorts and by each individual student. Communicate this to each student for reflection, further work and celebration: "Alice – you made +12 progress from the pre-test, that's INCREDIBLE!"

Post-assessments explicitly highlight skills to revisit for class cohort areas of need.

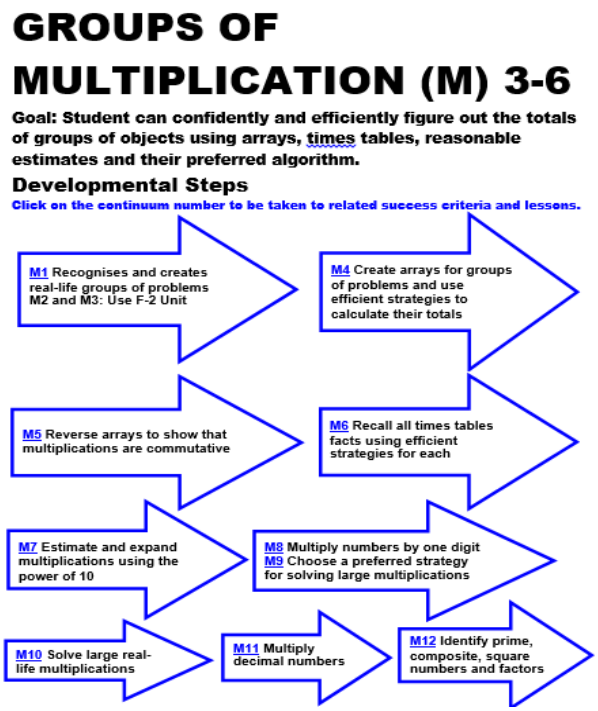
Created and Refined by Numeracy Leaders

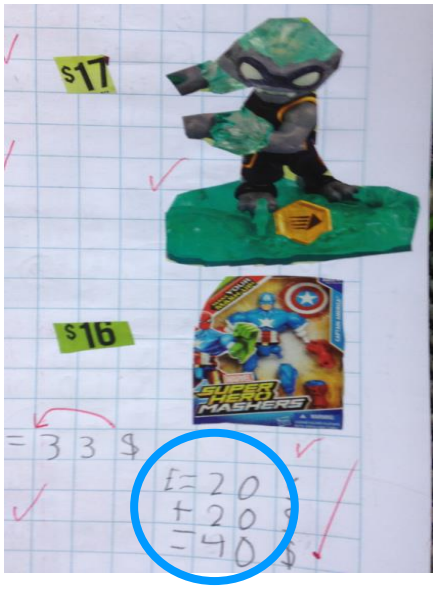
Sequential Skill-Building

Each unit sets out the key developmental steps for that topic in concise, graduate-teacher-friendly language:

Lessons are organised according to the developmental continuum from year 3 to slightly beyond year 6.

Teachers can choose from a series of 3-7 lessons of progressive difficulty that fall under each key developmental step to ensure students master each skill through multiple exposures to different contexts.

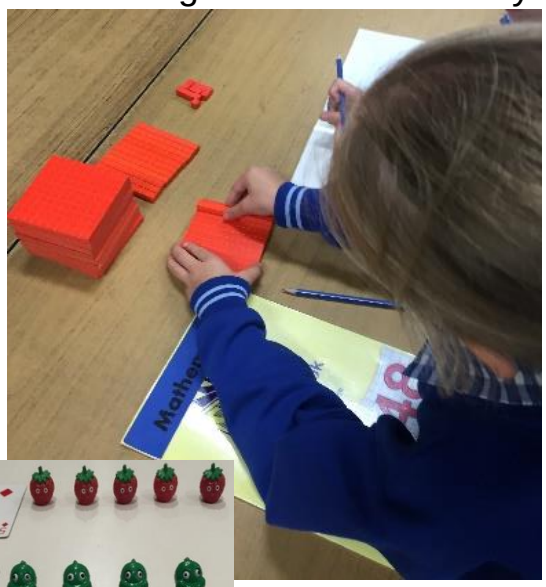




Best Practice Approaches to Key Concepts

Lessons develop problem-solving and mental maths skills using hands-on, materials-based contexts. For example, during addition, estimation is emphasised as opposed to a robotic application of the vertical algorithms.

Students are given the opportunity to build (rather than just memorise) mathematical conceptions, and therefore truly understand the basic building blocks of numeracy.



The often neglected missing part concept ('think addition' or 'spot the gap' strategy) is emphasised as a key developmental step for difference between/subtraction situations, starting with materials, small numbers and visual representations. This ensures that students do not use a vertical algorithm, for an equation such as 80 – 78, but instead use their reverse ten facts and understanding of difference between.

Unit-Specific Mathematical Vocabulary Anchor Charts

Warm-Up Games at the Start of Each Unit

Shortened version for the sample pack:

Tens Facts – warm-ups front-load challenging concepts, build fluency in previous steps and target common developmental gaps for year 3-6 cohorts

Name	Task
Tens thieves	Students start with three empty ten frames each and a die. They fill their tens frames with counters using the number rolled. But, as the game goes on, they can 'steal' a tens frame from their partner if they can fill it, e.g. partner's tens frame has 4, they roll 6 and steal it. The first to fill exactly three tens frames (without going over) wins. However, if they go over any of their frames, they cannot collect that rolled number. E.g. Student A has 3 frames, the 1st has 5, 2nd has 7, 3rd has 9, she rolls 5 so fills the 1st frame – but if she had rolled 6 she would miss a turn.
6 Pack	Pull out an array of 3x2 cards face-up. Collect cards that make 10, which can include more than 2 cards, e.g. Student collects 3, 3 and 4. Restock the '6 pack' and their partner has a go. Repeat until deck runs out.
Calculator 10	One students types a number into the calculator (less than 10) and the other types in the missing part to equal 10.
Go 10	Play 'Go fish' and aim to get a pair that adds to 10 instead of an identical pair.

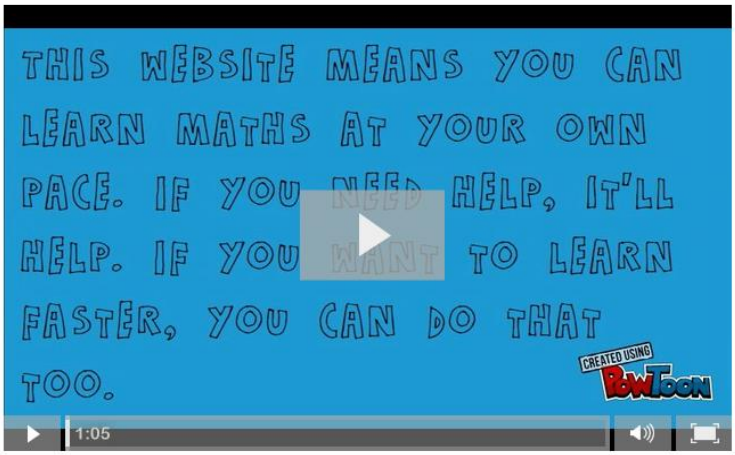
The package also includes additional resources, project-based investigations, extension variations, an intervention planner and more.

Unlimited Access to our Flipped Learning Partnerships Website for Students and Families

Practical Parent Support Tips

Engaging Home Learning Linked to Classroom Concepts

WELCOME NEXT AGENTS! HERE'S YOUR BRIEF



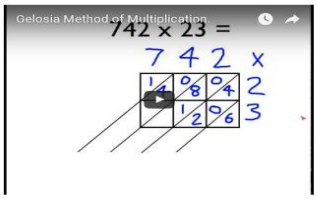
Selectively Chosen Support Clips from YouTube, Khan Academy and Practice Games for Each Developmental Step

1. ADDITION AND SUBTRACTION FROM PICTURES AND ON NUMBER LINES
2. WRITE WORDED ADDITION AND SUBTRACTION PROBLEMS
3. FACT FAMILIES
4. DOUBLES AND REVERSE DOUBLES
5. FRIENDS OF 10
6. BUILD TO 10 AND 100
7. ADDITION AND SUBTRACTION NUMBER SENTENCES
8. ADDING AND SUBTRACTING LIKE LIGHTNING
9. ADD AND SUBTRACT 10, 100 AND 1,000 USING PLACE VALUE
10. ALWAYS ESTIMATE FIRST
11. SPLIT STRATEGY
12. JUMP STRATEGY

A Range of Different 5/6 Multiplication Methods for Students to Trial and Choose their Preferred Strategy

LATTICE/GELOSIA MULTIPLICATION

Most students' absolute favourite.



Extremely popular with students and families

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