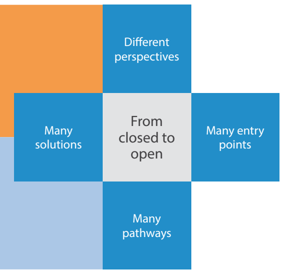
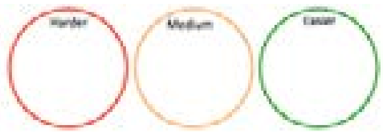
GOAL – Getting the students doing the thinking in Mathematics

Transforming tasks strategy: From closed to open



Technique	Before	After	Reflection: Why and how?
Different perspectives Our thinking can change beyond one point of view.	Answer these questions: 4x3, 7x3, 9x3... etc	Think about how you would sort the following multiplication questions into three levels of difficulty: Harder, medium, easier: 1 x 3, 2 x 3, 3 x 3 etc up to 12 x 3  • Deal out the x3 cards and work in a group to place each card in the place that best describes its difficulty for you. Do you all agree? • Take turns to move a card to a different section if you think it has a different level of difficulty for you. Explain why you find it hard/easy. Did anyone find their opinion changed when listening to the ideas and reasoning of others?	WHY would you… have students share their different perspectives about these questions? To understand that there are different valid ways of approaching a calculation that affect the perception of difficulty. A student who calculates solutions by starting at 1 x 3 and working through the times table, may believe 9 x 3 to be more difficult than a student who sees 9 x 3 as 3 less than 30. HOW does this develop powerful/expert learners? Students learn to consider and value others' viewpoints as a source for their learning.
Many entry points Thinking does not have to be linear. Have students work backwards by providing the outcome first.	1. Use unifix cubes to measure the length of your book. 2. How many unifix cubes do you need to balance a packet of pencils? 3. How many unifix cubes can be stacked in this box?	The answer is: 'I used 20 unifix cubes to measure it.' 1. What might I be measuring? Think of more possibilities. What else? What else? 2. Are all your examples the same type (eg length)? Can unifix cubes be used to measure those same objects in a different way? How? …How else? What could an object be if it was measured using 20 unifix cubes?	WHY would you… have students work backwards from the solution; 'I used 20 unifix cubes to measure it.' To challenge students to identify and creatively explore different possibilities rather than follow a directed instruction. HOW does this develop powerful/expert learners? Students learn to be collaborative and inquisitive when many entry points are invited. They come to understand that most problems can be approached in many different ways.
Many pathways There are many possible ways to complete a task.	Calculate 39 + 43.	Find at least two different ways to do the calculation 39 + 43 Share your methods with another student. Together, try to identify at least three different methods. • Identify which method is the most efficient for this calculation. • Identify which methods are best for mental calculation? • Identify if some methods would be better than others for addition sums with larger values.	WHY would you… have students explore multiple methods for solving 39 + 43? To challenge students to move beyond the method that comes most easily to them and require students to create new or varied approaches. This supports the need to analyse and evaluate the efficiency and accuracy of different methods, as students first need to have several different methods, before they can evaluate them. In this example, students could adjust and compensate, so the question becomes 40 + 42, or start with 43, add on 40 and subtract 1 etc... HOW does this develop powerful/expert learners? Students learn to be imaginative and logical as they explore many pathways to a problem. They are empowered by the resulting broader skill set.
Many solutions Open ended solution, but thinking stretched by constraints.	Work out: 4 + 6 =…… 5 + 7 = ………. 2 ½ + 4 ½ =……. 7 ¼ + 2 ¾ =………	The solution is 12. What could the question be? Aim to find at least 20 different solutions. Add the following constraints: 1. You can only use addition. 2. You can only use two values in your calculation. 3. Flipped calculations don't count as different solutions in this problem.	WHY would you... ask an open question and then add constraints? To change the emphasis from students as receivers of questions to students as creators of possibilities. But at the same time, using constraints to focus the student into creating solutions using thinking that is challenging them. In this example, the constraints, challenge students to use fractions and decimals. HOW does this develop powerful/expert learners? Students learn to be creative, flexible and innovative thinkers when they are challenged to explore many solutions.

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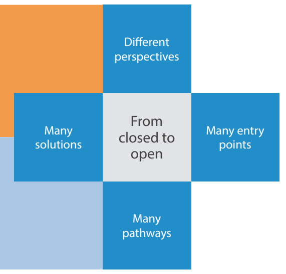
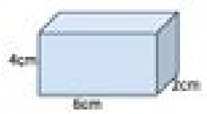
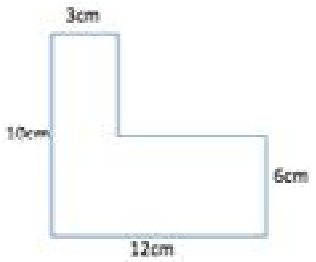
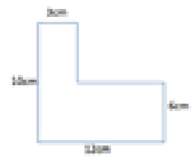
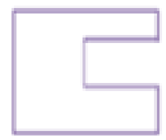


Technique	Before	After	Reflection: Why and how?
Different perspectives Our thinking can change beyond one point of view.	Answer these questions: Half of 32 0.25 x 68 ¼ of 48 ¼ of 32 32 x 0.5 ½ of 32 68 divided by 4 48 x 0.25	Individually, sort the following questions into at least two groups of your own choosing. Half of 32 0.25 x 68 ¼ of 48 ¼ of 32 32 x 0.5 ½ of 32 48 x 0.25 68 divided by 4 In pairs, share your individual thinking and try to find at least one more way to sort this collection of questions. Share your thinking with another pair. Share your thinking with the class. • Did anyone else sort the questions in the same ways as you. • Did anyone else sort the questions differently from you? • Why might they have sorted their questions like this? Check your thinking out with other students. Summarise the connections that have been made.	WHY would you… have students make connections and share their different perspectives about the connections that can be made? To understand that there are different valid ways of thinking about a calculation. A student, who doesn't appreciate that multiplying by 0.25 is the same as dividing by 4 or finding one quarter of that amount, will not group x 0.25 with ¼ of , but that student will benefit from trying to explain why other students have made that grouping. HOW does this develop powerful/expert learners? Students learn to consider and value others' viewpoints as a source for their learning.
Many entry points Thinking does not have to be linear. Have students work backwards by providing the outcome first.	Calculate the volume of this rectangular prism: 	The volume of the object is 24cm³. What shape could the object be and what are its dimensions? OR The volume of a rectangular prism is 24cm³. What could its dimensions be?	WHY would you… have students work backwards from the solution 24cm³? To challenge students to identify and creatively explore different possibilities rather than follow a directed instruction. To provide a greater range of entry points for students and greater scope to challenge students to progress to new learning. HOW does this develop powerful/expert learners? Students learn to be collaborative and inquisitive when many entry points are invited. They come to understand that most problems can be approached in many different ways.
Many pathways There are many possible ways to complete a task.	Calculate the area of this shape: 	Calculate the area of this shape in at least two different ways.  • Share your methods with another pair of students. Work together to try to identify at least three different methods. • Do you they think that one method was easier or more effective than another method? Why? • Would one of your methods be more efficient than another if the shape was like this one? Why/why not? 	WHY would you… have students explore multiple methods for calculating the area of the given shape? To challenge students to move beyond the method that comes most easily to them, and require students to create a range of approaches. This supports the need to analyse and evaluate the efficiency and accuracy of different methods, as students first need to have several different methods in order to evaluate them. The student could use a subtraction approach (eg (12 x 10) – (9 x 4)). Or they could even split the shape in to four triangles or two trapezium. HOW does this develop powerful/expert learners? Students learn to be imaginative and logical as they explore many pathways to a problem. They are empowered by the resulting broader skill set.
Many solutions Open ended solution, but thinking stretched by constraints.	Write the linear equation which has: a. gradient of 6 and a y-intercept of 3 b. gradient of 3 and a y-intercept of 2 c. gradient of 5 and a y-intercept of -2	Write down some equations that have a y-intercept of 3. 1. If you sketched the graph of your equations, which direction would they slope? Are there any solutions that slope the other way? (For example: downwards left to right, rather than upwards) 2. What if each equation that you write down must have a steeper gradient than the previous one? 3. What if the coefficient of x cannot be a whole number? 4. What if the equation isn't linear?	WHY would you... ask an open question and then add constraints? To change the emphasis from students as receivers of questions to students as creators of possibilities. But at the same time, using constraints to focus the student into creating solutions using thinking that is challenging them. HOW does this develop powerful/expert learners? Students learn to be creative, flexible and innovative thinkers when they are challenged to explore many solutions.