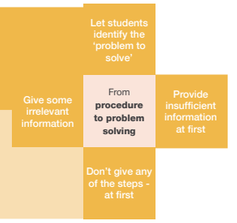
GOAL – Getting the students doing the thinking in Mathematics

Transforming tasks strategy: From procedure to problem solving



Technique	Before	After	Reflection: Why and how?
Students identify the 'problem to solve' Present a provocation and ask students to determine the problem to solve.	This giant model koala is so big that it has a shop built inside of it. How many times taller is the koala than the little girl? 	Look at the photo. What questions do you have? Sort your questions into mathematical and non-mathematical questions. Which mathematical question would you like to solve? 	**WHY would you… have students STOP, NOTICE, THINK, WONDER and share their wonderings about the image, in order to pose their own mathematical questions?** So students personalise and actively participate in their learning by asking questions about the things they notice. **HOW does this develop powerful/expert learners?** Students exercise curiosity and develop their capacity to think logically and creatively.
Provide insufficient information at first Give a perplexing problem and slowly provide information as needed.	This bucket holds 10 litres when filled to the top. The dotted line shows the water level in the bucket. How much water do you think is in the bucket? 	Approximately how much water do you think was poured over this man? What information do you need in order to find out? What else? Give clues or answers as appropriate in response to the questions asked. 	**WHY would you… give students the opportunity to identify what they need to know to solve the problem?** . So students use reasoning to question and construct their own strategy. **HOW does this develop powerful/expert learners?** Students become numerate, as they are challenged and supported to develop skills in identifying information needed to solve a problem.
Don't give any of the steps - at first Provide prompts and support to scaffold the learning as needed.	A movie ticket for one adult costs $12. A movie ticket for one child is three quarters of the cost for an adult. a. What's the cost for one child? b. What's the cost for four children? c. What's the cost for a family of two adults and four children?	A movie ticket for 1 adult costs $12. A movie ticket for a child is three quarters of the cost for an adult. What's the cost for a family of two adults and four children? **Source: NAPLAN question.**	**WHY would you… remove structured 'paved out' procedures and have students develop their own strategies for solving a maths problem?** So students identify the information required, and strategically organise the steps they need to take to solve the problem. **How does this develop powerful/expert learners?** Students become more resourceful and independent when they 'know what to try, even when they don't know what to do'.
Include some irrelevant information Give additional information that is not required to do the task.	What is the value of: 500 + 60 + 4	Which of these is worth 564? Tick all the correct boxes. 5 + 6 + 4 ☐ 50 + 60 + 40 ☐ 500 + 40 + 6 ☐ 500 + 60 + 4 ☐	**WHY would you… have students choose possible answers from a range of choices, including some common misconceptions?** So students consider, compare and evaluate possiblities from a range of options, to determine which ones would 'be worth 564'. **HOW does this develop powerful/expert learners?** So students discern between relevant and irrelevant information, and reveal the depth of their understanding of calculating the areas of triangles.

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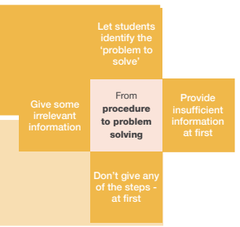
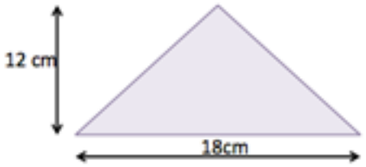
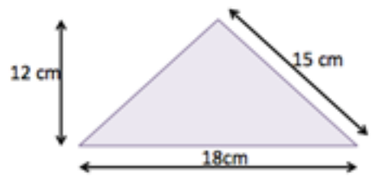


Technique	Before	After	Reflection: Why and how?
Students identify the 'problem to solve' Present a provocation and ask students to determine the problem to solve.	My four-wheel drive car is 240 cms wide. My city car is 165 cms wide. Express the ratio of the width of the four-wheel drive car to the city car. 	Look at the photograph. What questions come to mind? Sort your questions into mathematical and non-mathematical questions. Which mathematical question would you like to solve? 	**WHY would you… have students STOP, NOTICE, THINK, WONDER and share their wonderings about the image, in order to pose their own mathematical questions?** So students personalise and actively participate in their learning by asking questions about the things they notice. **HOW does this develop powerful/expert learners?** Students exercise curiosity and develop their capacity to think logically and creatively.
Provide insufficient information at first Give a perplexing problem and slowly provide information as needed.	In the year 2000, the London Eye, standing at 135m tall, became the world's tallest Ferris Wheel. The radius of the wheel is 60m. It travels at an average speed of 0.3m/s. Calculate: a. The diameter of the wheel b. The circumference of the wheel c. The time taken for one revolution of the wheel. 	In the year 2000 the London Eye became the world's tallest Ferris Wheel. Approximately how long do you think a journey on the London Eye might take? Convince me/someone who thinks differently to you. What do you need to know to be sure of your accuracy? 	**WHY would you… give students the opportunity to identify what they need to know to solve the problem?** So students use reasoning to question and construct their own strategy. **HOW does this develop powerful/expert learners?** Students become numerate, as they are challenged and supported to develop skills in identifying information needed to solve a problem.
Don't give any of the steps - at first Provide prompts and support to scaffold the learning as needed.	This design is drawn inside a regular hexagon. Calculate the marked angles. 	This design is drawn inside a regular hexagon. What is the size of the angle marked a? **Source: NAPLAN question.** 	**WHY would you… remove structured 'paved out' procedures and have students develop their own strategies for solving a maths problem about the angles of a regular hexagon?** So students identify the information required, and strategically organise the steps they need to take to solve the problem. **How does this develop powerful/expert learners?** Students become more resourceful and independent when they 'know what to try, even when they don't know what to do'.
Include some irrelevant information Give additional information that is not required to do the task.	Calculate the area of the triangle. 	Calculate the area of the triangle. 	**WHY would you… have students calculate the area of a triangle, and include irrelevant information about the length of a side?** So students critically consider information, rather than engaging in a routine procedure of using all the information that has been provided. The additional measurement challenges the student to consider which dimensions are necessary when calculating the area of a triangle and reveals false assumptions about the triangle being a right angled triangle. **HOW does this develop powerful/expert learners?** So students discern between relevant and irrelevant information to reveal the depth of their understanding of place value.