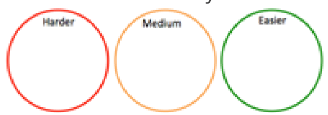
ELEMENT 4.1

Domain 4 - Personalise and Connect Mathematics Learning

Element 4.1 - Build on learners' understandings

The following suggestions for practice are extracts from the 'Transforming Tasks' module on the Leading Learning resource:

Strategy	**From Closed to Open**
Technique	**Different perspectives:** Have students explore different points of view.

Level	Before	After
Primary	Answer these questions: 4 x 3, 7 x 3, 9 x 3 etc up to 12 x 3	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?
Secondary	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 with the students who presented that grouping. Summarise the connections that have been made.

How do you think the technique Different perspectives might support *Element 4.1 - Build on learners' understandings?*

There are many ways to articulate this relationship. One response to this question has been provided on the next page.

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How does the technique Different perspectives support *Element 4.1 - Build on learners' understandings?*

When students share and examine their different perspectives, they naturally bring their current understanding to the question. This supports the teacher to identify the students' prior learning and respond appropriately, hence building on the learners' understanding.

In the Primary Years 'after' task, students who identify a question as 'harder' often hold this belief because they do not see any connections to an easier problem. For example, some students will identify eight threes as a hard question and will explain their perspective using reasoning along the lines of; it's lots of threes and that's hard to count /work out/ remember. Knowing this perspective allows the teacher or other students in the Community of Inquiry to build that learners understanding through sharing a different perspective about calculating eight threes.

In the Secondary Years example, students who can only sort these questons into 'fractions questions' or 'decimals questions', reveal the limit of their understanding about the relationship between fractions and decimals. Sharing this perspective allows the teacher or other students to build the learners' understanding through sharing a different perspective.

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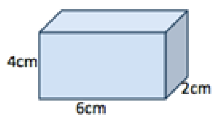
The following suggestions for practice are extracts from the 'Transforming Tasks' module on the Leading Learning resource:

Strategy	From Closed to Open
Technique	**Many Entry Points:** Have students work backwards by providing the outcome first.

Level	Before	After
Primary	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 cubes?
Secondary	**Calculate the volume of this rectangular prism.** 	The volume of the object is 24cm^3. What shape could the object be and what are its dimensions? OR The volume of a rectangular prism is 24cm^3. What could its dimensions be?

How do you think the technique Many entry points might support *Element 4.1 - Build on learners' understandings?*

There are many ways to articulate this relationship. One response to this question has been provided on the next page.

Element 4.1 - Build on learners' understandings

How does the technique Many entry points support *Element 4.1 - Build on learners' understandings?*

When there are multiple entry points to a problem, students will often enter at a level than most suits their current understanding. This provides the teacher with the opportunity to notice and respond to the students' thinking and design questions that will challenge students to move to a higher level. For example, in the Secondary Years prism example, students could access this volume problem by:

- rearranging and recording the position of 24 centimetre cubes
- drawing images to support them to think about building layers of cubes to make a total of 24
- using an understanding of the formula for volume of a rectangular prism (_ x _ x _ = 24) and applying a 'trial and improvement' approach to generating three digits that multiply together to make 24
- as above, but applying a methodical process to identify all combinations
- applying an understanding of the formula, factors of 24 and a methodical process to establish combinations efficiently
- as above, but extending to include dimensions that are not integers etc.

Once the student has accessed the problem, using their existing understanding, the teacher can challenge the student to take the next appropriate step(s).

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Element 4.1 - Build on learners' understandings

The following suggestions for practice are extracts from the 'Transforming Tasks' module on the Leading Learning resource:

Strategy	From Closed to Open
Technique	**Many solutions:** Ask questions which have many solutions. Stretch thinking by adding or removing constraints.

Level	Before	After
Primary	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.
Secondary	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?

How do you think the technique Many solutions might support *Element 4.1 - Build on learners' understandings?*

There are many ways to articulate this relationship. One response to this question has been provided on the next page.

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How does the technique Many solutions support *Element 4.1 - Build on learners' understandings?*

'Adding constraints' is the element of 'many solutions' that facilitates 'Building on learners' understanding's.

The Secondary Years example, uses a combination of removing constraints initially, to promote creativity, then after setting the initial question constraints are added to challenge students to explore solutions that were not included in their initial response, but represent a suitable step. Teachers can be intentional about using constraints that support students to 'see' a new possibility. For example, if students have only identified positive gradient solutions the teacher could add the constraint that the gradient cannot be positive.