ELEMENT 3.2

Domain 3 - Develop Expert Mathematics Learners

Element 3.2 - Foster deep understanding and skillful action

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 3.2 - Foster deep understanding and skillful action?*

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

ELEMENT 3.2

Domain 3 - Develop Expert Mathematics Learners

Element 3.2 - Foster deep understanding and skillful action

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

How does the technique Different perspectives support *Element 3.2 - Foster deep understanding and skillful action?*

Sharing and examining different perspectives is one way to support the development of new connections. Connections support the development of deeper understanding. For example, 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. Students who identify eight threes to be easier often explain their reasoning by describing its connection to another fact. Students might describe eight threes as 'double, four threes', or 'six less than 30'.

When teachers use different perspectives to drive opportunities for students to make new connections, they support the development of deep understanding.

ELEMENT 3.2

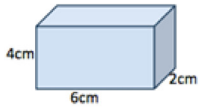
Domain 3 - Develop Expert Mathematics Learners

Element 3.2 - Foster deep understanding and skillful action

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 3.2 - Foster deep understanding and skillful action?*

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

ELEMENT 3.2

Domain 3 - Develop Expert Mathematics Learners

Element 3.2 - Foster deep understanding and skillful action

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

How does the technique Many entry points support *Element 3.2 - Foster deep understanding and skillful action?*

When there are multiple entry points to a problem, students will often enter at a level than most suits their current understanding. This provides teachers with the opportunity to notice and respond to students' thinking and design questions that 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.

Teachers foster deep understanding and skilful action in their students when they support them to begin to use a more sophisticated approach.