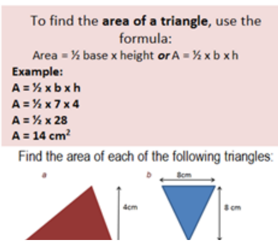
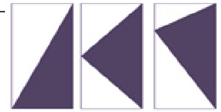
ELEMENT 4.1

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 Tell to Ask
Technique	**Socratic questioning:** Have students work backwards by providing the outcome first.

Level	Before	After
Primary	Multiplying by decimals is easy, just follow these two steps: 1. First, multiply the numbers normally, ignoring the decimal points. 2. Then, count the total number of decimal places in both numbers, and put that many decimal places in the answer.	Using a calculator, work out answers to questions a, b, c and d: a. 6 x 0.5 b. 3 x 0.5 c. 8 x 0.5 d. 5 x 0.5 e. 6 x 5 f. 3 x 5 g. 8 x 5 h. 5 x 5 Discuss 1. What do you notice about the solutions to these questions? Are the solutions larger or smaller than the value being multiplied by 0.5 Is that surprising? Will that always be the case? Could you test that out? 2. Why do you think that x 0.5 might be like finding half of the amount? 3. What do you think will happen if you multiply by 0.25? What makes you think that? How could you test that idea? 4. Do some more thinking about multiplying by decimals by asking your own 'what if?' questions. 5. What ideas do you have now about multiplying by decimals? Do other people think the same or differently to you at the moment? 6. Look at the first questions that you tried (a, b, c, d). How do the questions (e, f, g, h) relate to them? What connections can you see between the answers to these two sets of questions? Use your observations to think of a way to make multiplying by decimals easier. Does your idea work if there are two decimal places in the question. For example, 6 x 0.05?
Secondary	Area of a Triangle: To find the area of a triangle, use the  To find the **area of a triangle**, use the formula: Area = ½ base x height *or* A = ½ x b x h **Example:** **A = ½ x b x h** **A = ½ x 7 x 4** **A = ½ x 28** **A = 14 cm²** Find the area of each of the following triangles: a 4cm b 8cm 8 cm	 **What do you notice about these three shapes?** Which triangle do you think coveres most/least of the area of the rectangle? Why do you think that? How sure do you feel at the moment? Look at the first picture - How much of the rectangle do you think the tirangle covers? What led you to that belief? How could you check that out/convince me? How much of the rectable area do you think the triangles in the other two pictures cover? How could you check your thinking out/ convince yourself /convince me? Would it help if you could cut the pictures up and move pieces around? Try that if you think it will help you. How does the area of the triangle relate to the area of the rectangle in these three pictures? Would that always be the case with triangles? How could you check that thinking out? Examples of Socratic questions can be found online: http://courses.cs.vt.edu/cs2104/Summer2014/Notes/SocraticQ.pdf

How do you think the technique Socratic questioning 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 Socratic questioning support *Element 4.1 - Build on learners' understandings?*

Tasks that use Socratic questioning to support students to make connections between superficially unrelated ideas is one technique for building on learners' understanding. For example, in the Primary Years questions, the 'after' task supports students to see that multiplying by a decimal, relates to calculating a fraction of a quantity and sometimes, a decimal calculation can be more easily computed if thought of as a fraction calculation. This example builds on students' understanding of fractions and integrates their existing skills with the new learning about decimals. In the 'before' task the new learning about decimals is not connected to prior learning.

In the Secondary Years example, the 'after' task supports students to build on their existing understanding about calculating the area of a rectangle, through extending their understanding to a triangle.

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

Strategy	**From Tell to Ask**
Technique	**Explore before explain:** Ask students to try their ideas first.

Level	Before	After
Primary	Example 1: Calculate 45 ÷ 3 $3\overline{)4{}^{1}5}$ = 15 Example 2: Calculate 72 ÷ 4 $4\overline{)7{}^{3}2}$ = 18	How can you divide larger numbers? Think about what you understand about division. Work with a partner, to have a go at one (or both) of these questions: Calculate 45 ÷ 3 Calculate 72 ÷ 4 Check your answers with a calculator.
Secondary	Example Simplify: $\frac{a}{2} + \frac{2a}{3}$ $= \frac{a \times 3}{2 \times 3} + \frac{2a \times 2}{3 \times 2}$ $= \frac{3a}{6} + \frac{4a}{6}$ $= \frac{3a + 4a}{6}$ $= \frac{7a}{6}$ Questions: 1. $\frac{b}{5} + \frac{5b}{10}$ 2. $\frac{c}{2} + \frac{2c}{7}$	Use your skills with adding fractions, to challenge yourself to work with fractions that include variables. Work with a partner, to have a go at these two questions. 1. $\frac{b}{5} + \frac{5b}{10}$ 2. $\frac{c}{2} + \frac{2c}{7}$ Prompts: • How would you usually add fifths and tenths? • Would it help if you tried some fraction addition without variables? • Would it help if you drew a diagram?

How do you think the technique Explore before explain 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 Explore before explain support *Element 4.1 - Build on learners' understandings?*

When students are challenged to explore possible approaches to a new type of problem they bring their current skills and understanding to the problem, provided they are not 'paralysed by fear' of being wrong. Students are more likely to start (and make progress with) an unfamiliar problem if they approach it with a growth mindset. They are more likely to 'stick with' an unfamiliar problem if they know the teacher values their thinking and reasoning, not just a correct solution. Teachers can support the development of a growth mindset approach through making clear statements about expectations. For example, 'This is a new type of problem, so I'm not expecting you to already know exactly what to do, but I do expect you to have a go, to try some different ideas and share your thinking and challenges.' When teachers provide students with the opportunity to 'explore before the teacher explains' and students feel safe to 'have a go', the teacher is able to both observe and build on students' understanding.

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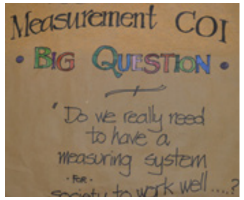
The following suggestions for practice are extracts from the 'Transforming Tasks' module on the Leading Learning resource:

Strategy	From Tell to Ask
Technique	**Use dialogue:** Ask students to interact and build meaning through learning conversations.

Level	Before	After
Primary	The teacher asks: • Why do we measure things? • What things do we measure? • What do we measure with?	The teacher asks: **Do we really need to have a measuring system?**  Community of Inquiry(COI)/Philosophy for Children(P4C) discussion. Listen to and respond to each other's ideas/questions/wonderings. Possible prompt questions to initiate discussion: • What's a measuring system? • Is one type of measurement more important than another? • What form of measurement could we live without/did we live without? Why change? • Could we estimate measurements in cooking? Would we still need a measuring system to do that? COI process can be found online eg http://museumvictoria.com.au/education/community-of-inquiry/
Secondary	Teacher: "I've noticed that some people are trying to add fractions by adding the numerators, then adding the denominators." $\frac{b}{5} + \frac{5b}{10} = \frac{6b}{15}$ This does not lead to the correct answer. The way to add fractions is: Start by finding the lowest common denominator...	What do you think? Does: $\frac{b}{5} + \frac{5b}{10} = \frac{6b}{15}$ Discuss your thinking with a partner. Think about these questions: 1. Do you think that $\frac{6b}{15}$ is more or less than $\frac{5b}{10}$? Would you expect that? 2. Could you test this for different values of b? If possible, discuss your ideas with another pair who thinks differently to you. 3. Share your ideas with the class. Has anyone changed their mind about $\frac{6b}{15}$ being the solution? Ask someone who has changed their mind to share their thinking about why they did that. What are other possible solutions? How could we test the accuracy of our ideas?

How do you think the technique Use dialogue 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 Use dialogue support *Element 4.1 - Build on learners' understandings?*

When students engage in purposeful dialogue with each other, it is possible for them to build each others' understanding. However, it is also important to appreciate that students can compound each other's misconceptions. This highlights the crucial role of the teacher in listening to student dialogue, identifying examples of understanding and misconceptions and then drawing together and clarifying thinking. Alternatively the teacher can create groups of students who hold different views and through challenging them to convince each other of their process/idea it is sometimes possible for students to resolve their misconceptions during such dialogue.