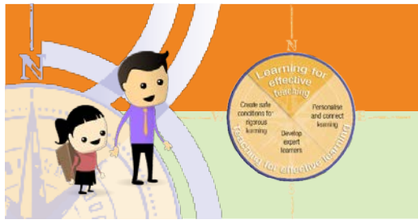
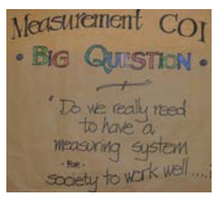
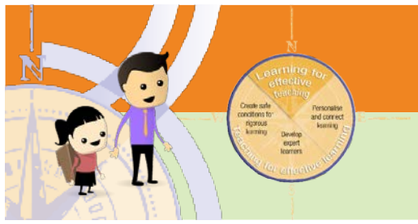


GOAL – Getting the students doing the thinking in Mathematics

Transforming tasks strategy: From tell to ask

Socratic questioning | Student voice | From **tell** to **ask** | Explore before explain | Use dialogue

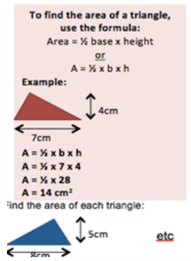
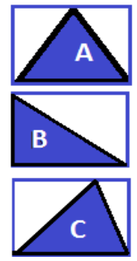
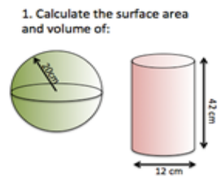
Technique	Before	After	Reflection: Why and how?
Socratic questioning Ask questions that help students dig deeper.	**Multiplying by decimals is easy, just follow these two steps:** 1. Multiply the numbers normally, ignoring the decimal points. 2. Count the total number of decimal places in both numbers, and put that many decimal places in the answer. **Calculate:** a. 6 x 0.5 b. 7 x 0.4 c. 5 x 0.07 etc	Use a calculator, to work out answers to the following questions: **a. 6 x 0.5** **b. 3 x 0.5** **c. 8 x 0.5** **d. 5 x 0.5** **Socratic questioning is a dialogue not written text.** Discuss using probing questions such as: 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? 1. Why do you think that x 0.5 might be like finding half of the amount? 2. What do you think will happen if you multiply by 0.25? • What makes you think that? How could you test that idea? 3. Asking your own 'What if?' questions about multiplying by decimals. 4. What ideas do you have now about multiplying by decimals? • Do other people think the same or differently to you at the moment? 5. 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? 6. 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? **e. 6 x 5** **f. 3 x 5** **g. 8 x 5** **h. 5 x 5**	**WHY would you… Ask questions that help students to dig deeper into their observations about decimal multiplication?** So students construct a connected understanding about decimal multiplication, through being challenged to notice connections that draw upon their existing understanding. **HOW does this develop powerful learners?** Students learn to respond to probing questions and to ask this type of question for themselves. Examples of Socratic questions can be found online (For example: http://courses.cs.vt.edu/cs2104/Summer2014/Notes/SocraticQ.pdf)
Explore before explain Ask students to try their ideas first.	Example 1: Calculate 45 ÷ 3 $3\overline{)45}$ → 15 Example 2: Calculate 72 ÷ 4 $4\overline{)72}$ → 18	**How might you divide a two digit number by a single digit number?** 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.	**WHY would you… have students explore possible approaches to division?** So students make connections to prior learning and creatively apply and extend it to new concepts, developing an appreciation that mathematics is more than recalling and using the processes created by others. **HOW does this develop powerful learners?** Students learn to be independent in initiating and directing their learning in unfamiliar situations.
Use dialogue Ask students to interact and build meaning through learning cconversations.	**Using units of measurement** • Why do we measure things? • What things do we measure? • What do we measure with? The teacher asks the class these questions and uses ' no hands up' questioning to elicit some responses.	**Using units of measurement** **Discuss:** Do we really need to have a measuring system? Use a dialogue protocol such as the Community of inquiry (COI) process. Listen to and respond to each other's ideas/ questions/ wonderings. **Give time for new questions and directions to arise from student dialogue. If necessary the following possible prompts could be posed:** • What do you think a measuring system is? • 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? 	**WHY would you… have students explore each other's opinions and understanding about measurement?** So students participate in a democratic process where they are all challenged to listen, communicate, make 'on balance judgements' and are supported to change their mind in response to the thinking that is shared by their peers. **HOW does this develop powerful learners?** Students learn to actively listen to their peers, be flexible and responsive, and communicate their ideas clearly.
Student voice Ask students to decide how they might do this best.	**Symmetry worksheet:** 1. Draw two items of clothing, one symmetrical and one asymmetrical. 2. Describe two objects from the natural environment, one symmetrical and one asymmetrical. 3. State two modes or transport, one symmetrical and one asymmetrical etc.	**Symmetry** How can you demonstrate your understanding of symmetry? Show your symmertry understanding by creating one of your own questions or choosing one from the following: • *Clothing. Symmetrical or not?* • *Nature. Symmetrical or not?* • *Transport. Symmetrical or not?* • *Symmetry- Necessary/unnecessary/useful or not?* (**Tip:** Don't limit your thinking to line symmetry. Consider rotational symmetry etc) 1. How will you find out? 2. How will you demonstrate your learning? 3. How will you check your thinking? 4. How will you work - individually, with a partner, or in a small group?	**WHY would you… promote student voice in learning by having students decide how they can best show their symmetry understanding?** So students analyse the expectations of the suggested symmetry questions and devise alternate questions and ways to share their learning that have personal meaning and connection. So students identify the way they learn best and take responsibility for creating an appropriate learning environment. **HOW does this develop powerful learners?** Students learn to be self-aware and take shared responsibility for designing ways that develop and demonstrate learning.



GOAL – Getting the students doing the thinking in Mathematics

Transforming tasks strategy: From tell to ask

Socratic questioning | Student voice | From **tell** to **ask** | Explore before explain | Use dialogue

Technique	Before	After	Reflection: Why and how?
Socratic questioning Ask questions that help students dig deeper.	**Area of a Triangle** To find the area of a triangle, use the following formula: 	**What do you notice about these three shapes?** **Enabling prompts:** • Which triangle do you think covers most/least of the area of the rectangle? Why do you think that? How sure do you feel at the moment? • Look at triangle A - How much of the rectangle do you think the triangle covers? • What led you to that belief? How could you check that out/convince me? • How much of the rectangle area do you think triangles B and C cover? • How could you check your thinking out/convince yourself/convince me? • Would it help to cut out 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? • Would that always be the case with triangles? How could you check that thinking out? 	**WHY would you… use Socratic questioning to establish the area of a triangle?** So students construct a connected understanding about area formulae, through surfacing and extending their existing understanding. **HOW does this develop powerful learners?** Students learn to respond to probing questions and to ask this type of question for themselves. Examples of Socratic questions can be found online (For example: http://courses.cs.vt.edu/cs2104/Summer2014/Notes/SocraticQ.pdf)
Explore before explain Ask students to try their ideas first.	**Simplify:** $\frac{a}{2} + \frac{2a}{3}$ $= \frac{a \times 3}{2 \times 3} + \frac{2a \times 2}{3 \times 2}$ $= \frac{3a}{6} + \frac{4a}{6}$ $= \frac{3a + 4a}{6}$ $= \frac{7a}{6}$ **Now try these:** 1. $\frac{b}{5} + \frac{5b}{10}$ 2. $\frac{c}{2} + \frac{2c}{7}$	**Challenge yourself:** Work with a partner to have a go at these new fraction problems. 1. $\frac{b}{5} + \frac{5b}{10}$ 2. $\frac{c}{2} + \frac{2c}{7}$ **Enabling prompts:** • How would you visually add fifths and tenths? • Would it help if you tried some fraction addition without variables? • Would it help if you drew a diagram?	**WHY would you…..have students explore possible approaches to adding algerbraic fractions before you explain?** So students make connections to prior learning and creatively apply and extend it to new concepts, developing an appreciation that mathematics is more than recalling and using the processes created by others. **HOW does this develop powerful learners?** Students learn to be independent in initiating and directing their learning in unfamiliar situations.
Use dialogue Ask students to interact and build meaning through learning cconversations.	**Adding fractions** Teacher: I've noticed that for Question 1 lots of you have written: $\frac{b}{5} + \frac{5b}{10} = \frac{6b}{15}$ You have totalled the numerators, then totalled the denominators. We can't add fractions this way. This is how we add fractions: (Teacher talks through an example)	**Adding fractions** Teacher: I've noticed that this is the most common answer to Question 1 : $\frac{b}{5} + \frac{5b}{10} = \frac{6b}{10}$ In groups of 4, use these questions to discuss how you might calculate: $\frac{b}{5} + \frac{5b}{10}$ 1. Do you think that $\frac{6b}{15}$ is more or less than $\frac{5b}{10}$? Would you expect that? 2. Test your thinking using different values of b. If possible, find a pair who thinks differently to you, and discuss your ideas. 3. Share your ideas with the class. Did anyone change their mind about the solution? Ask someone who has changed their mind to share their thinking about why they did that. 4. What are other possible solutions? 5. How could we test the accuracy of our ideas?	**WHY would you… use dialogue between students to explore a common misconception?** So students identify their own conceptual understanding and errors through listening, communicating and making 'on balance judgements' arising as a result of purposeful conversation. When an individual identifies that their original thinking is flawed, they are more ready to receive (or create) a new idea. **HOW does this develop powerful learners?** Students learn to actively listen to their peers, be flexible and responsive, and communicate their ideas clearly.
Student voice Ask students to decide how they might do this best.	**Assessment:** Surface Area Test 	**Demonstrate your understanding about calculating surface area** **Enabling prompts:** • Think of a context to apply this learning. • Think of all of the skills that you'd like to demonstrate. (Get your teacher or class to help develop this list). • Think about the possible resources that you could use. • Find connections to other maths' topics or other learning areas. **Think about:** • Do you want to develop your collaboration skills and work on a joint project or do you want to work independently? • Sharing your ideas with the whole group, in case someone else likes your idea too.	**WHY would you… have students decide how they can best show their understanding of volume?** So students devise an appropriate way to communicate their understanding about surface area reflecting on their understanding in ways that have personal meaning. **How does this develop powerful learners?** Students learn to take shared responsibility for designing ways that develop and demonstrate learning.