Community of Practice:

Session Title: Developing questioning

These materials have been designed to help you and your colleagues reflect on:

- the ***reasons*** for questioning;
- some ways of making questioning ***more effective***;
- different types of '***thinking questions***' that may be asked in mathematics.

Why ask questions? In their book Questions and prompts for mathematical thinking, 1998, Association of Teachers of Mathematics John Mason and Anne Watson suggest that teachers should ask questions

- To interest, challenge or engage.
- To assess prior knowledge and understanding.
- To mobilise existing understanding to create new understanding.
- To focus thinking on key concepts.
- To extend and deepen learners' thinking.
- To promote learners' thinking about the way they learn.

Can ***you*** think of other reasons ***you*** might ask questions in ***your*** class?

Mason and Watson have classified questions into two categories; **effective** and ***ineffective***

Ineffective Questions are….	**Effective Questions are…**
unplanned with no apparent purpose	planned and related to lesson objectives
mainly closed	mainly open
provide no 'wait time' after asking questions	allow 'wait time'
'guess what is in my head'	ones where the teacher allows collaboration before answering
poorly sequenced	carefully graded in difficulty
ones where the teacher responds immediately	ones where the teacher encourages learners to explain and justify answers
ones where only a few learners participate	ones where all learners participate e.g. using mini-whiteboards
ones where incorrect answers are ignored	ones where both correct and incorrect answers are followed up
all asked by the teacher	asked by learners too

Take an audit of the types of questions you ask in your classroom. Challenge yourselves to replace ineffective questions with effective questions.

In your groups decide

- When you will complete your audit
- When you will share
    - the results of your audit with each other
    - the targets for increasing the number of effective questions you ask

Plan to ask different types of questions, ones that require students to

- Create examples and special cases.
- Evaluate and correct.
- Compare and organise.
- Modify and change.
- Generalise and conjecture.
- Explain and justify.

Example of questions that require students to

1. **Create examples and special cases**

   Show me an example of:

   - a number between 1/2 and 3/4;
   - a quadrilateral with two obtuse angles;
   - a shape with an area of 12 square units and a perimeter of 16 units;
   - a number with 5 and 6 as factors
   - a set of 5 numbers with a range of 6
     …and a mode of 10
     …and a median of 9
   - a linear relationship

2. **Evaluate and correct**

   What is wrong with these statements? How can you correct them?

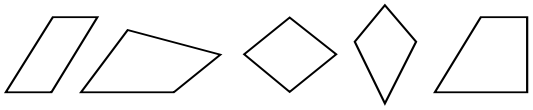
   - When you multiply by 10, you add a zero.
   - 2/3 + 3/5 = 5/8
   - Squaring makes bigger.
   - If you double the lengths of the sides you double the area.
   - An increase of x% followed by a decrease of x% leaves the amount unchanged.
   - Every equation has a solution

3. Compare and organise

What is the same and what is different about these objects?

- Square, trapezium, parallelogram.
- Cone, cylinder, sphere.
- 6, 3, 10, 8.
- 2, 13, 31, 39.
- Δ + 15 = 21, I think of a number, add 3 and the answer is 7, 4 Δ =24,

How can you divide each of these sets of objects into 2 sets?

- 1, 2, 3, 4, 5, 6, 7, 8, 9,10
- 1/2, 2/3, 3/4, 4/5, 5/6, 6/7
- 
- 121, 55, 198, 352, 292, 1661, 24642

4. Modify and Change

How can you change:

- the decimal 0.57 into a fraction?
- the formula for the area of a rectangle into the formula for the area of a triangle?
- an odd number into an even number?

5. Generalise and Conjecture

What are these special cases of?

- 1, 4, 9, 16, 25....
- Pythagoras' theorem.
- A circle.

When are these statements true?

- A parallelogram has a line of symmetry.
- The diagonals of a quadrilateral bisect each other.
- Adding two numbers gives the same answer as multiplying them**.**

6. Explain and justify

Use a diagram to explain why:

- 27 x 34 = (20 x 30) + (30 x 7) + (20 x 4) + (7 x 4)

Give a reason why:

- a rectangle is a trapezium.

How can we be sure that:

- this pattern will continue: 1 + 3 = 22; 1 + 3 + 5 = 32…?

Convince me that:

- if you unfold a rectangular envelope, you will get a rhombus

In your groups make up your own questions that require students to

- Create examples and special cases.
- Evaluate and correct.
- Compare and organise.
- Modify and change.
- Generalise and conjecture.
- Explain and justify.

Try out some of the questioning strategies suggested in a lesson with your class

- Come to the next session prepared to share your experiences
- Bring examples of the questions you asked and the students' responses to those questions