PD5 • Developing questioning

Purpose

To encourage participants to reflect on:

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

Materials required

For each participant you will need:

- Sheet PD5.1 – *Effective and ineffective questioning*;
- Sheet PD5.2 – *Open mathematical questions*;
- Sheet PD5.3 – *Making up your own questions*;
- mini-whiteboard;
- felt tip pen.

Supporting materials

To support this session, you may wish to use:

- extracts from the DVD-ROM *Thinking about learning/Thinking about questioning*;
- PowerPoint presentation in *Materials/Professional development* on the DVD-ROM. This will be useful when running the session and includes slides of the aims, and of appropriate handouts and tasks.

Time needed

From 1 to 2 hours.

Suggested activities

1. Why ask questions?

Ask participants to discuss some reasons why teachers ask questions.

> Teachers nearly always know the answers to the questions already, so why ask them?

There are many possible reasons, including the following:

- to interest, engage and challenge;
- to assess prior knowledge and understanding;
- to stimulate recall, mobilise existing knowledge and experience in order to create new understanding and meaning;
- to focus thinking on key concepts and issues;
- to help learners extend their thinking from the concrete and factual to the analytical and evaluative;
- to lead learners through a planned sequence which progressively establishes key understandings;
- to promote reasoning, problem solving, evaluation and the formation of hypotheses;
- to promote learners' thinking about the way they have learned.

(*Teaching and Learning in Secondary Schools:* Unit 4: Questioning. DfES 0344/2003, p. 2)

2. Effective and ineffective questioning

Ask participants to share and discuss some of the mistakes they make when asking questions.

Give each participant a copy of Sheet PD5.1 – *Effective and ineffective questioning*. This suggests some characteristics of effective and ineffective questioning. Ask participants to discuss these. Which are the most difficult to implement? Which are the easiest?

Show the DVD-ROM film sequence *Thinking about learning/Thinking about questioning/Overview* and ask the group to identify examples of effective questioning stating what aspects of the questioning were particularly helpful for the learners and why.

You can see longer sequences of teachers asking questions with both large and smaller groups in the three examples in this section on the DVD-ROM.

3. Developing different types of questions

Give each participant a copy of Sheet PD5.2 – *Open mathematical questions*.

Using the table in PD5.2 as a structure, ask participants a variety of questions. Use mini-whiteboards for those that begin 'Show me'.

Give each participant a copy of Sheet PD5.3 – *Making up your own questions* and ask them to devise some questions of their own. These should relate to a topic that they are about to teach.

Ask participants to take turns at asking their questions to the rest of the group.

BLANK FOR NOTES

Sheet PD5.1 – *Effective and ineffective questioning*

Characteristics of ineffective questioning	Characteristics of effective questioning
Questions are unplanned and have no apparent purpose.	Questions are planned carefully, and are related to the objectives of the session.
Questions are mainly closed, allowing only one set answer.	Questions are mainly open, allowing many possible answers.
If a question is not answered immediately, the teacher answers the question, moves on or asks another question.	The teacher never answers their own question. The teacher allows a sufficient 'wait time' after asking a question. Learners are allowed to discuss in pairs before answering.
Questions are mainly of the 'guess what is in my head' variety. The teacher knows the answer they want to hear and ignores or rejects answers that do not conform to this.	Questions allow a variety of responses and these are all treated equally seriously. All answers are accepted and are noted down for discussion.
Questions are poorly sequenced. Difficult questions are asked without building up to them.	Questions are well graded in difficulty. Sequences of questions gradually increase in difficulty.
When a question is answered correctly, the teacher says 'well done' (judgmental) and moves on.	When a question is answered correctly, the teacher says 'thank you' (non-judgmental) and continues to ask the question to other learners. Probing follow-up questions are prepared, e.g. 'Can you explain why?'
Only a few learners participate. Others feel vulnerable and are afraid to answer in case they are wrong, or others ridicule them.	A climate is created where all learners feel they can safely contribute. Learners are encouraged to write answers on mini-whiteboards and present these simultaneously. Teachers choose particular learners to answer and choose questions at an appropriate level.
The teacher ignores incorrect answers.	The teacher follows up incorrect answers, asking other learners 'Do you agree? Explain why.'
All questions originate from the teacher.	Learners are encouraged to ask their own questions.

Sheet PD5.2 – *Open mathematical questions*

Creating examples and special cases	Show me an example of…	• a square number. • an equation of a line that passes through (0,3). • a shape with a small area and a large perimeter. • a real life problem where you have to calculate 3.4 ÷ 4.5
Evaluating and correcting	What is wrong with the statement? How can you correct it?	• When you multiply by 10 you add a nought. • $\frac{2}{10} + \frac{3}{10} = \frac{5}{20}$. • Squaring makes bigger. • If you double the radius you double the area.
Comparing and organising	What is the same and what is different about these objects?	• Square, trapezium, parallelogram. • An expression and an equation. • $(a + b)^2$ and $a^2 + b^2$. • $y = 3x$ and $y = 3x + 1$ as examples of straight lines. • $2x + 3 = 4x + 6$; $2x + 3 = 2x + 4$; $2x + 3 = x + 4$.
Modifying and changing	How can you change…	• this recurring decimal into a fraction? • this shape so that it has a line of symmetry? • the equation $y = 3x + 4$, so that it passes through (0,–1)? • Pythagoras' theorem so that it works for triangles that are not right-angled?
Generalising and conjecturing	This is a special case of…what? Is this always, sometimes or never true? If sometimes, when?	• 1, 4, 9, 16, 25. • Pythagoras' theorem. • The diagonals of a quadrilateral bisect each other. • $(3x)^2 = 3x^2$.
Explaining and justifying	Explain why… Give a reason why… How can we be sure that… Convince me that…	• $(a + b)(a – b) = a^2 – b^2$, by drawing a diagram. • a rectangle is a trapezium. • this pattern will always continue: $1 + 3 = 2^2$; $1 + 3 + 5 = 3^2$… • if you unfold a rectangular envelope you will get a rhombus.

Sheet PD5.3 – *Making up your own questions*

Creating examples and special cases	Show me an example of…	
Evaluating and correcting	What is wrong with the statement? How can you correct it?	
Comparing and organising	What is the same and what is different about these objects?	
Modifying and changing	How can you change…	
Generalising and conjecturing	This is a special case of…what? Is this always, sometimes or never true? If sometimes, when?	
Explaining and justifying	Explain why… Give a reason why… How can we be sure that… Convince me that…	