BOWLAND MATHS
Professional development

Questioning and reasoning

'How do I get my pupils to think, reason and explain?'

Module overview

This module considers:

- characteristics of questioning that encourages pupils to listen, think and reason;
- ways in which you might encourage pupils to provide extended, thoughtful answers, without being afraid of making mistakes;
- the value of modelling reasoning by 'thinking aloud' with your class.

This guide is intended for use alongside the *Bowland Maths DVD* or website, which include a short introductory video for each of the activities, longer videos of lessons and teacher discussions and links to all the handouts and ICT-based problems.

Introductory session — 1 hour

- Think about why we ask questions.
- Compare 'effective' and 'ineffective' questioning.
- Observe a lesson
- Plan a lesson for effective questioning

Into the classroom — 1 hour

- Introduce the problem and give time for individuals to think
- Collect initial ideas on the board
- Pupils work on the problem
- Whole class discusses the approaches being used
- Pupils have a second go at the problem.
- Whole class reports on their reasoning

Follow-up session — 1 hour

- Report and reflect on the lesson
- Solve a problem, "thinking aloud"
- Watch some teachers "thinking aloud"
- Plan questioning and "thinking aloud" for future lessons

Resources Needed

Handout 1	Thinking about why we ask questions
Handout 2	Comparing 'effective' and 'ineffective' questioning
Handout 3	Characteristics of effective questioning
Handout 4	Problems to try
Software	Multiplication grids (optional)
Handout 5	Planning for effective questioning
Handout 6	Comments on the problems
Handout 7	Suggested further reading

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Introductory session

Questioning and reasoning

'How do I get my pupils to think, reason and explain?'

Introduction — The importance of questioning

Question and answer is perhaps the most common form of interaction between teachers and pupils. Teachers use questions for many reasons: to gain pupils' attention, to monitor their understanding or to promote thinking and reasoning.

Pupils do not always appreciate the intentions behind the teacher's questions. This is seen for example, when they try to guess 'the right answer' rather than give a thoughtful explanation.

In this module, we therefore use tasks that don't have a single 'right answer' and look closely at how careful questioning can be used to promote thinking, reasoning and explaining.

Activity 1 — Think about why we ask questions — 5 minutes

There are many different types of questions and they serve many different purposes.

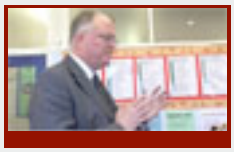
- What different types of questions are there?
- What different purposes do your questions serve?
- Which types do you use most frequently?

List your ideas on Handout 1.

There are, of course, many possible reasons for asking questions, 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;
- to help pupils see connections between different parts of mathematics or with different contexts.

Activity 2 **Compare 'effective' and 'ineffective' questioning** **15 minutes**



Record your ideas on the following questions on Handout 2.

- What are the common mistakes *you* tend to make when asking questions?
- What are their effects?
- What types of questions encourage thinking and reasoning?
- Give some examples that you have recently used.

Now look at Handout 3. This describes some characteristics of effective questioning.

- Reflect on the implications of these ideas for your own practice.

The following is a list of some of the more common mistakes that teachers make:

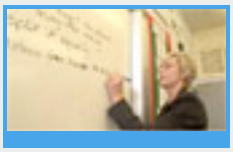
- Asking too many trivial or irrelevant questions.
- Asking a question and answering it yourself.
- Simplifying the question when pupils don't immediately respond.
- Asking questions of only the brightest or most likeable pupils.
- Asking several questions at once.
- Only asking closed questions that allow one possible answer.
- Asking 'guess what is in my head' questions, where you know the answer you want to hear and you ignore or reject answers that are different.
- Judging every pupil response with 'well done', 'nearly there' 'not quite'. ('Well done' can discourage alternative ideas being offered)
- Not giving pupils time to think or discuss before responding.
- Ignoring incorrect answers and moving on.
- Using simple questions as a way to make explanation seem interactive.
- Asking in a manner that makes pupils afraid to respond.

Research shows that effective questioning displays the following five characteristics:

- The teacher plans questions that encourage thinking and reasoning.
- Everyone is included.
- Pupils are given time to think.
- The teacher avoids judging pupils' responses.
- Pupils' responses are followed up in ways that encourage deeper thinking.

Handout 3 elaborates each of these points.

Activity 3 — Observe a lesson — 20 minutes



Have a go at the *Sharing petrol costs* problem on Handout 4.

Now watch Gwen's lesson, which uses this problem.

As you watch the video clip consider the following questions:

- How does Gwen use questions?
- How does she respond to the wide range of answers?
- What is she trying to achieve with her interactions?

Later, you may wish to come back and watch Jeff's lesson using *Aircraft turn-around time* or Chris's lesson using the *Multiplication grids* software.

Activity 4 — Plan a lesson for effective questioning — 20 minutes

Choose one of the problems from Handout 4 to try with your class.

Use the prompts on Handout 5 to plan a lesson that will promote thinking and reasoning.

- How will you organise the classroom and the resources?
- How will you introduce the questioning session?
- Which ground rules will you establish?
- What will be your first question?
- How will you give time for pupils to think before responding?
- Will you need to intervene at some point to refocus or discuss different strategies they are using?
- What questions will you use in plenary discussions during or towards the end of the lesson?

Because you are focusing on the questions that you use and the way that the pupils answer those questions we suggest that you audio-record some whole class questioning in your lesson for discussion in the follow-up session

In a group professional development session, it is helpful if each participant chooses the same problem, as this will enable you to have a good discussion afterwards.

There are comments on each of the problems on Handout 6.

This is the end of the *Introductory session*. After you have tried out your lesson with your own pupils, return for the *Follow-up session*.

Resources to support the lessons, and suggested lesson plans, can be found in the *Into the classroom* session.