

## Questioning and reasoning

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

### Into the classroom

The following suggestions describe one possible approach to using the problems with pupils. This may take one or two lessons, depending on the class.

#### Introduce the problem, and give time for individuals to think

**5 minutes**

Issue each pupil with just one of the three problems.

Explain that in this lesson you are expecting everyone to think things through and to contribute:

*Today I am going to make sure you have plenty of time to think. I will give you a problem and I want you to think about how to get started with it for a few minutes. I will then ask for your ideas. There is more than one good way of doing this!*

*No hands up, I will tell you when I want answers and who is to answer.  
Now here's the question I want you to think about ...*

Explain how pupils are expected to start work on the problem:

#### **Sharing petrol costs.**

*Read through the problem. How can we get started on this problem? What is known and what is unknown? What assumptions should we make? Remember I don't want answers yet; I want to know your ideas for getting started. You have exactly 1 minute to think starting now!*

#### **Multiplication Grids.**

*Read through and think about the problem on your own for a couple of minutes. Then I'll ask you to share ideas in pairs or threes. Then I am going to ask the question "Have you any ideas for getting started?"*

#### **Aircraft turn-round time.**

*Look at all the jobs that need doing before a plane is turned round and ready to fly again. You have a minute to discuss with the person sitting next to you how you might go about finding the shortest turn round time – starting now.*

#### Collect initial ideas on the board

**5 minutes**

After the 'thinking time', pose the problem again then use the alternatives to questioning to generate discussion. (Record this part for later discussion if possible).



*Right let's get started, what did you think about, Jav?*

*Thanks for that explanation, Jav.*

*Does anyone have any comments on Jav's ideas?*

*Yes I can see that, what else might we think about Sarah?*

*We've talked about three good ideas so far; does anyone have anything really different?*

Note that these questions are general and strategic. Do not comment on the specifics of the responses at this stage, even if pupils press you to tell them what is 'best' or who is 'right'. Instead, simply record these ideas on the board, or get the pupils to do this as they explain. That way the ideas will be there for the class to consider as they start to solve the problem. Remind them that although they have heard several strategies that will help them get started, that they should choose just one of them to start with.

Explain what pupils should do when they are stuck:

*If you get stuck, think about the ways of tackling the problem we have talked about. Maybe you could try another one? Remember this lesson is about thinking and reasoning things out, so sit quietly and think about what you could do, then you could talk to a friend about what you are thinking. You are on your own, get going!*

Now set a target, reminding them to think about the reasons they make decisions as they work:

*Right, now I'm giving you twenty minutes to work on the problem by yourselves. Then I'm going to ask you some questions about what you have done and why you think the ideas you tried worked or didn't work.*

### Pupils work on the problem

20 minutes

Allow pupils time to engage with the problems. When they ask questions, ask them a question that offers strategic guidance rather than technical help. Use [Handout 3](#) for ideas.

For example:

*Which way did you decide to use to start? Why?  
What have you found out? How did you do that?  
What didn't work? Why? What might work?*

*Think things out for yourself or between you – only call in the professional when you have tried everything else.*

### Whole class discusses the approaches being used

10 minutes

When most pupils have made significant progress with the problem, ask the pupils about the way that they are working. (It may be helpful to record this part for later discussion).

*We are going to review progress so far.  
I don't want answers I want strategies and ideas.  
I want to know what you have done so far. What have you tried that didn't work?  
Why didn't it work?  
What have you tried that seems to be successful?  
(5 sec pause for thinking)  
Right let's start with the first question – what did you try that didn't work and why?*

When exploring the unsuccessful ideas remember to ask "What was the unhelpful idea here? What would have made it work?" You are making sure that the pupils know its fine to make mistakes and take wrong turns when solving problems but it's the successful ideas that you want, so after a few minutes ask for them.

**Sharing petrol costs:**

*What assumptions made the petrol money sharing much easier? Can you justify your ideas?*

**Multiplication Grids:**

*What ideas are helping you to put the right numbers in the right places on the grid?*

**Aircraft turn-round time:**

*What representations helped you to organise your approach?*

The idea is to provide models that will help pupils to make more progress on the problem. Make sure that the pupils listen to the ideas given. Ask the next pupil to comment on how similar or different their idea is to those offered previously, rather than take isolated answers.

**Pupils have a second go at the problem****10 minutes**

Encourage pupils to return to the problem and continue working on it using some of the ideas that have been shared.

**Whole class reports on their reasoning****10 minutes**

Ask pupils to take turns at presenting their reasoning to the class.

*What ideas did you have that worked? Tell us why they worked.*

Focus on the thinking rather than the answers. Make sure they know there is no one right answer to these problems. Ask questions such as:

*What was it about Sam's ideas that enabled her to solve the problem easily?*

*Why might you not use the same solution as Sam?*

*What did Josh do that was particularly inventive or different?*

*What ideas did Nils have that you could use?*

If you want to set homework, the pupils should now have a series of ideas that would help them both finish of the problem and explain how they did it. The lesson was about thinking and reasoning so asking the pupils to explain what they tried and why is more important than just achieving an answer.