

# Teaching and learning 2

## Objectives

By the end of this session teachers will:

- have considered some ways to begin and end lessons;
- be able to identify features of effective oral and mental work in mathematics;
- have developed some ideas for oral and mental starters.

## Resources

### For the trainer

- Computer with data projector, Microsoft PowerPoint and Presentation 5.ppt
- Whiteboard or flipchart
- Video recorder linked to a large screen
- Video clip 2: Examples of oral and mental starters
- *Sample lesson plans for mathematics: Grades 1 to 12*

### For each teacher

- *Teacher's pack*  
Handouts 5.1–5.3
- *Sample lesson plans for mathematics: Grades 1 to 12*

## Session outline

<b>Beginnings and ends of lessons</b> Slide 5.1 Handout 5.1	Whole group presentation Task 1: Beginnings and ends of lessons	15 minutes
<b>Features of good oral and mental work</b> Slide 5.2	Whole group presentation and discussion Task 2: Visualisation activities	25 minutes
<b>Looking at oral and mental starters</b> Video clip 2 Handout 5.2	Video clip 2 and Task 3: Examples of oral and mental starters Whole group discussion	20 minutes
<b>Ideas for oral and mental starters</b> Slides 5.3–5.4 Handout 5.3	Task 3: Identifying examples of oral and mental starters Paired work Whole group discussion Summary of key points	20 minutes

## Beginnings and ends of lessons

15 minutes

Welcome everyone back and make introductions. Deal with any domestic or administrative matters.

Refer to the *Teacher's pack*. Point out the programme for the second day, the evaluation form for completion at the end of today's sessions and the reduced copies of the slides at the back of the pack.

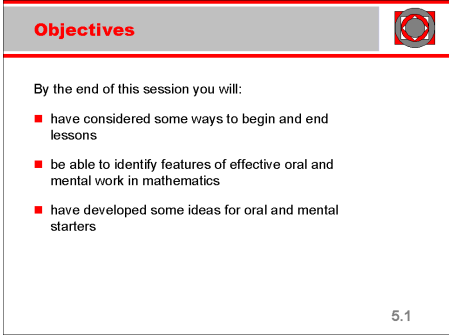
Explain that the second day of this workshop focuses on effective teaching and learning, and that this is the second of four sessions on this theme. Use **slide 5.1** to introduce the objectives for this session.

Before the session starts, brief any interpreter about the key points of the session.

Check that each teacher has a copy of the sample lesson plans.

Set up the video recorder in readiness.

Load **Presentation 5.ppt**.



The slide is titled 'Objectives' and features a small icon of a red circle with a white center. The text on the slide reads: 'By the end of this session you will:' followed by three bullet points: 'have considered some ways to begin and end lessons', 'be able to identify features of effective oral and mental work in mathematics', and 'have developed some ideas for oral and mental starters'. The slide number '5.1' is located in the bottom right corner.

Remind everyone that when effective teachers plan their teaching they divide material into manageable units and teach in a well-considered sequence. Each lesson necessarily has a start to focus students' attention, a middle in which the main material for the lesson is taught and learned, and a well-rounded end. In a good lesson, there is a smooth flow through the episodes of teaching input and learning activities so that momentum is maintained throughout, students remain interested and the objectives of the lesson are met.

### Task 1: Beginnings and ends of lessons

Ask everyone to work in mixed school groups of three or four, using **Handout 5.1**. They should discuss and jot down two or three examples of what a teacher can do to make a good beginning to a lesson, and then how to bring a lesson to a rounded conclusion. Ask them to draw on their own subject experience.

Allow 4 or 5 minutes for discussion of the beginning of a lesson, then remind everyone to move on to discussing the end of the lesson, allowing a further 4 or 5 minutes.

Bring the groups together and take feedback. Go round the groups in turn, asking for one example from each group. Comment briefly on the examples as they are given, drawing on your own experience.

#### Background notes for trainers

**Beginnings**, for example:

Students enter the room and start to work on a challenging problem posed on the board, with discussion of their initial thoughts on the problem taking place after 5 or 10 minutes.

The teacher says: 'Close your eyes and imagine ...' then gives a description of objects, people or shapes that move. Students then sketch what they see.

Students are asked to describe, explain, express or justify a point of view on a relevant issue. first to a partner then to the whole class.

Students are asked to brainstorm what they know about a topic, e.g. numbers between 100 and 200, prime numbers, world currencies, circles, quadrilaterals, metric measurements, ...

**Ends**, for example:

Students evaluate something that they have done in the lesson.

The teacher draws together what has been learned, summarises key facts, ideas and vocabulary, and stresses what needs to be remembered.

The teacher helps students to generalise something from examples generated earlier in the lesson, and make links to other work in the subject or other subjects.

The teacher goes through an exercise students did individually during the lesson, so that he or she can question students about it, assess their work informally and rectify any remaining misconceptions or errors.

Two selected groups of students give their solutions to a problem, which the teacher helps the class to compare and contrast.

Remind everyone that this session, Session 5, is about starters, Session 6 will focus on the main teaching activity and Session 7 on the consolidation phase.

## Features of good oral and mental work

25 minutes

Say that the standards include frequent references to ‘mental methods’ of calculation. These are very important and will be developed steadily from Grade 1 to Grade 9 or 10. However, oral and mental work, involving speaking, listening and thinking skills, is much broader than recalling facts and doing mental calculations. It includes visualisation and problem solving activities across number and algebra, geometry and measures, and data handling.

### Task 2: Visualisation activities

Demonstrate three or four short activities involving visualisation, reading out a selection from the list below. Explain to the group that they should either close their eyes or look down and that they should not speak while you are talking, even when you ask questions. Equally, they should not write or sketch anything unless you specifically ask them to do so.

- 1 Imagine the number five hundred and thirty-two drawn in the air in front of you.  
Which digit is in the middle? Which is on the left? Which is on the right?  
Replace the middle digit with a four. What number can you see now?  
Swap over the middle digit with the one on the left.  
What number can you see now?  
Remove the middle digit and push the other two together so that they are next to each other. What number can you see now?*
- 2 Imagine you have some squared paper on the table in front of you.  
Imagine colouring an L-shape on the paper.  
It is just one square wide.*

*How many edges does it have? How many corners does it have?  
What sort of polygon is it?*

Pause at this point and ask teachers to discuss one or two questions in pairs before answering. Put these questions to the pairs.

- For which grade are these activities suitable? Which standards would they link to?
- When in a lesson would you use activities like these?

Continue as before with the next two visualisation activities.

**3** *This time, you will need some imaginary quick drying paint.*

*Imagine a cereal packet standing on the kitchen table.*

*Paint the front of the packet red. Now paint the back red.*

*Paint the top and bottom of the packet red and the other two faces blue.*

*Now study the packet carefully.*

*How many edges has the packet altogether?*

*How many of these edges are where a red face meets a blue face?*

*How many edges are where a red face meets another red face?*

*How many edges are where a blue face meets another blue face?*

**4** *Imagine three very long straight lines.*

*Now fix the lines so that they all cross (intersect) at the same point.*

*How many angles can you see at this point? Count them to yourself.*

*Now arrange the lines so that they cross (intersect) in three different points.*

*What shape do they enclose?*

*Concentrate on the enclosed shape. Roughly how big is each interior angle?*

*Concentrate on one of the points of intersection.*

*How many angles surround this point? Are any of them equal?*

Pause again, ask the teachers again to discuss in pairs before answering, and repeat the two questions above.

Explain that the main ways of ensuring that oral and mental skills are maintained and developed are through carefully planned:

- interactive lesson starters;
- teaching activities in the main part of lessons;
- key questions in the consolidation phase of the lesson.

Say that oral and mental starter activities that engage the whole class through well-directed questioning can be very successful. The short visualisation activities that they have just experienced would all be suitable as lesson starters but could also be used in the consolidation phase of a lesson. None of them require any resources but other activities may require the use of particular equipment, or a diagram or an overhead projector transparency. Say that later in the session they will be looking at some of these.

Acknowledge that, from time to time, students need to be tested on their mental recall and calculation skills, but that mental arithmetic tests should be relatively rare and should not be the main focus of oral and mental work.

Show **slide 5.2** to highlight the possible uses of oral and mental starters in mathematics lessons.

### Use oral and mental starters to:



- ensure the lesson gets off to a purposeful start and sets a brisk pace
- rehearse previously taught skills in a variety of lively ways
- focus on skills needed in the main part of the lesson
- enable informal assessment of students' progress to inform the next part of the lesson

5.2

Emphasise these points in relation to the four points on the slide.

- Using number puzzles (cross-number puzzles, arithmagons, magic squares with algebra, graphs that will need explaining) on the board can be a good settling activity as students arrive, followed by a discussion of the strategies that they used to solve the puzzle.
- Lively, varied interactive starters engage students' attention. Students do not learn effectively by mere repetition; they need to have methods explained in alternative ways to enhance their understanding and hence their retention.
- Pre-empting problems and rehearsing skills at the start of the lesson can help students to tackle work without interruption later on in the lesson. For example: practise the cancellation of fractions as preparation for work on probability, or do calculations such as  $12 \div 0.5$  before calculating coordinates for points on the graph  $y = 12/x$ .
- Informal assessment ensures that the lesson can be pitched at an appropriate level and that students' knowledge and understanding can be consolidated and extended. It also provides an opportunity for misconceptions to be noted and rectified during the main part of the lesson. Where relevant, this can include informal assessment of homework.

## Looking at oral and mental starters

20 minutes

### Video clip 2 and Task 3: Examples of oral and mental starters

Tell participants that you are now going to show a selection of oral and mental starter activities on video.

Ask everyone to note, while watching the video, any examples of the features listed on **Handout 5.2** of their *Teacher's pack*.

Show **Video clip 2**, Examples of oral and mental starters.

Allow time after the clip has finished for brief discussion in pairs, then take feedback, drawing out one example for each of the features.

You will need to explain the context of the lesson. The film was made in various schools in England. The students in the clip are from Grades 6, 7 and 8.

## Ideas for oral and mental starters

20 minutes

### Task 3: Identifying examples of oral and mental starters

Show **slide 5.3**, which lists different types of oral and mental starters.

### Types of oral and mental starters



- Recalling mathematical facts
- Explaining mental calculation strategies
- Using approximations to estimate
- Applying number facts and calculation skills in real-world situations
- Estimating or converting measurements
- Linking the laws of number and algebra
- Visualising shapes, movements and constructions
- Drawing inferences from data in a variety of forms
- Using correct mathematical terms
- Generalising, reasoning and proving

5.3

Refer everyone to **Handout 5.3** in their *Teacher's pack*. Ask them, in pairs, to use their *Sample lesson plans for mathematics: Grades 1 to 12* to identify one example of a starter activity for each of the types highlighted. Suggest that they start by looking at the lesson plans for the grades that they teach, and that they should also draw also on their own ideas.

After about 10 minutes, take some feedback to spread ideas among the group.

Show **slide 5.4** to summarise characteristics of good oral and mental work.

### Good oral and mental work:



- is lively and challenging, engaging all students throughout
- is interactive, drawing responses with a skilful mix of open and closed questions
- uses these responses to assess students' learning
- uses resources effectively to illustrate and model ideas
- consolidates students' knowledge, skills and understanding and moves them on, building on what they know to derive new facts or introduce new ideas
- expects students to explain how they arrive at their solutions, and to use mathematical terms correctly

5.4

Go through the slide, relating the following points to the six points on the slide.

- Oral and mental work must be stimulating for students and suitably differentiated so that all are able to access the work.
- A mix of open and closed questions helps to maintain pace and keep students involved.
- With open questions, responses can be used to assess which elements need further teacher input.
- Oral and mental work needs to have clear learning objectives and be carefully planned. The use of resources such as a counting stick, number fans or 'loop' cards can help to stimulate students' participation.
- Consolidating work is important but teachers also need to ensure that they extend their students' knowledge, skills and understanding.
- Students often give very good teaching points when explaining their answers. However, it is important to make sure that students are encouraged to refine their explanations, using correct mathematical vocabulary and notation, and develop increasingly efficient ways of working.

Conclude by saying that the next session will focus on teaching the main part of the lesson.

Encourage teachers from different schools to pair up and work together.

Closed questions have one correct answer, e.g. 'What is  $2x$  multiplied by  $6x$ ?'  
Open questions have more than one correct answer, e.g. 'Which two expressions have a product of  $12x^2$ ?'