

Module overview

In the Case Studies, as in life, the situations are unstructured and the problems that arise have many alternative solutions. Pupils need to learn to *represent* and then *analyse* such situations using mathematics, *interpret and evaluate* the results, and *communicate* and *reflect* on their findings. This module is designed to help you consider how you can integrate and develop these Key Processes into your teaching.

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



- Look at a situation: Where is the maths?
- Look at the KS3 Key Processes
- Discuss some pedagogical implications
- Observe a lesson
- Plan a lesson using one of the problems.

Into the classroom

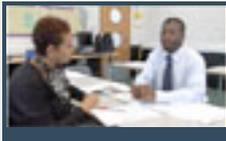
1 hour



- Introduce the situation then ask pupils to identify problems
- Simplify and represent the problem
- Review the representations pupils use
- Analyse and solve the problems
- Pupils communicate and reflect on their different approaches
- Review the Key Processes that pupils have been through

Follow-up session

1 hour



- Reflect on the lessons, and the ways maths emerged
- When should we introduce mathematical techniques?
- Integrating Case Studies into a scheme of work
- What about the tests?

Resources Needed

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|  Handout 1 | Building a school with bottles in Honduras |
|  Presentation | BottleSchool (PowerPoint - optional) |
|  Handout 2 | The modelling cycle |
|  Handout 3 | The modelling cycle: questions to ask yourself |
|  Handout 4 | Building a school with bottles: the Key Processes |
|  Handout 5 | When should we introduce mathematical techniques? |
|  Handout 6 | Typical maths activities in the Case Studies |
|  Handout 7 | Types of problem used in the Case Studies |
|  Handout 8 | What about the tests? |
|  Handout 9 | Photographs for mathematical discussion |
|  Handout 10 | Some mathematical questions on the photographs |
|  Handout 11 | Suggested further reading |

BOWLAND MATHS

Professional development

Introductory session

The Case Studies and Mathematics

'Where is the maths in these Case Studies?'

Activity 1

Look at a situation: Where is the maths?

15 minutes

It is not always easy for pupils to see any connection between the real world and mathematics lessons. As a result, they don't use the mathematics they learned in secondary school, even though thinking with mathematics could help them understand the world better – and make better decisions. The module begins with a real life context and looks at the mathematics that can arise from it.



Look at the photographs called *Building a school with bottles in Honduras* on [Handout 1](#). This is presented as a context - no problems are posed.

Make a list of things you notice about the situation.
What mathematical questions occur to you?

You might begin by asking questions that start:

- How many ...?
- What would happen if?

Now set yourself a problem and use mathematics to tackle it.

Activity 2

Look at the KS3 Key Processes

15 minutes

[Handout 2](#) - *The modelling cycle* shows the steps involved in modelling a real life situation. This flowchart shows the Key Processes used in the KS3 Programme of Study for mathematics (See: <http://curriculum.qca.org.uk/subjects/mathematics/keystage3/>).



Try to relate the work you have just done to *the modelling cycle* flowchart on [Handout 2](#). How well does it fit?

Simplify and represent the situation:

- What specific problems did you pose?
- What simplifications and representations did you create?
- What choices did you make of information, methods and tools?

Analyse and solve the model you've made:

- What variables did you use?
- What information did you collect, or estimate?
- What relations between them did you formulate?
What did you need to calculate, and how?

Interpret and evaluate the results:

- What did you learn about the situation? Were the results plausible?

Communicate and reflect on your findings:

- How could you best explain your analysis to someone else?
- What connections can you see to other problems?

Activity 3**Discuss some pedagogical implications****5 minutes**

When pupils ask "Why are we doing this in maths?" they are reflecting a limited view of what mathematics is all about. Traditional styles of teaching can reinforce the impression that mathematics consists of little more than numbers and routine calculations. As the Key Concepts in the Programmes of Study for Mathematics shows, however, our aims are much broader than this. We are attempting to develop:

Competence in selecting and communicating appropriate mathematics.

Creativity when posing questions, constructing knowledge, tackling the unfamiliar.

Critical awareness and understanding of the applications, implications and limitations of mathematics.



- How can you help *pupils* to become more aware of the Key Concepts in the Programmes of Study?
- How can you help *pupils* become more aware of the importance of the Key Processes shown in the modelling cycle on [Handout 2](#)?
- Should you explicitly discuss these goals with pupils?
- Should you gradually introduce pupils to the modelling cycle in pupil-friendly language?

Activity 4**Observe a lesson****10 minutes**

Now watch Frank's lesson on *Building a School with plastic bottles*. As you watch the lesson, ask yourself:

Which Key Processes can you see in the work of these pupils?

Can you see them:

**Simplifying and representing the situation?**

- What problems did they identify?
- What simplifications and representations did they create?
- What choices did they make of information, methods and tools?

Analysing and solving the model they've made?

- Which variables did they consider?
- What information did they collect, or guess?
- What relationships did they formulate?
- What calculations did they make?

Interpreting and evaluating the results?

- What did they learn about the situation?
- Were their results plausible?

Communicating and reflecting on the findings?

- How did they explain their analyses?
- What connections did they see to other problems?

Activity 5**Plan a lesson using one of the problems****15 minutes**

Now it is your turn to plan a lesson using the *Building a School* situation.

Discuss how you will:

- introduce the situation to pupils;
- introduce the idea of the modelling cycle;
- organise the classroom and the resources needed;
- answer the question "Why are we doing this in maths?";
- conclude the lesson in a way that gives pupils a better understanding of the nature of mathematical processes.

It is helpful to present the lesson using a data projector. In addition, it is helpful to have a supply of the following resources available for working on the problems that arise:

- Some sample 1 litre plastic bottles
- Rulers or tape measures,
- Circular counters or coins (for working out how bottles pack together),
- Isometric dotted paper (to help with drawing and counting).
- Some copies of [Handout 3](#): *The modelling cycle: questions to ask yourself* for pupils to use and discuss.

Photographs provide a powerful way of bringing real world contexts into the classroom. On [Handout 9](#) we have provided additional photographs that may be used to stimulate further mathematical work. You may prefer to collect your own, or use some from the resources suggested in the further reading at the end of this module. [Handout 10](#) contains some possible mathematical questions based on these photographs. What additional questions can you come up with?

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 lesson, and a suggested lesson plan, can be found in the *Into the classroom* session.