Bowland maths — Mission: Rainforest

Introduction

Is your class prepared to embark on a thrilling adventure: a secret mission deep into the rainforest to expose environmental threats?

'The game is very gripping. I look forward to playing it because it has that sense of adventure and I like that.' Year 7 pupil

'You do maths without realising what you are doing.' Year 8 pupil

'I like the sense of adventure. It's more exciting than a normal maths lesson!' Year 9 pupil

Overview

Deep in a tropical rainforest, a small team of undercover environmentalists are on a mission to investigate and expose the illegal activities being carried out by a multinational logging organisation, Log Inc, and the deforestation that is destroying the planet. It will be a dangerous mission requiring the environmentalists to use all their cunning and intelligence to monitor the damage whilst evading detection and collecting evidence for UN international inspectors.

Rainforest involves four 50- to 60-minute lessons, each with optional homework:

1 Establishing base camp
2 Logging activity
3 Sustainability
4 Escape

The mathematical learning emerges from the action. Each lesson involves a separate mission leading to non-routine problems for pupils to solve by working in small groups. The problems, some of which are open-ended, are designed to promote discussion, reasoning and thinking skills. Some parts of the lessons are optional so that you can tailor them to the time that you have available. Each lesson ends with a 'cliff hanger' intended to maintain pupils' interest and to lead into the optional homework.

The case study includes this introduction, four lesson plans, video and audio clips, slides, resource sheets presenting the challenges, and some possible solutions to the problems.

Mathematical content

The National Curriculum states: 'Mathematical thinking is important for all members of a modern society as a habit of mind for its use in the workplace, business and finance; and for personal decision-making. Mathematics is fundamental to national prosperity in providing tools for understanding science, engineering, technology and economics. It is essential in public decision-making and for participation in the

knowledge economy… Mathematics equips pupils with uniquely powerful ways to describe, analyse and change the world. It can stimulate moments of pleasure and wonder for all pupils when they solve a problem for the first time, discover a more elegant solution, or notice hidden connections. Pupils who are functional in mathematics and financially capable are able to think independently in applied and abstract ways, and can reason, solve problems and assess risk.'

Mission: Rainforest gives pupils many of these opportunities. As they solve the problems, pupils will need to use a range of process skills: planning and organising, exploring and discovering relationships, analysing and reasoning, representing and interpreting, and reflecting and communicating.

The mathematical content in Rainforest is suitable for pupils who are confident with level 5 of the National Curriculum, and some of the content at level 6**. It should suit pupils of above average attainment in Year 7, and average or above average attainment in Years 8 and 9**. In particular, pupils will need to be able to calculate with decimals and percentages; find perimeters, areas and volumes and convert between units of measurement; use coordinates, find the midpoint of a line segment, make and interpret scale drawings and draw simple plans and elevations.

The teacher's role

Rainforest is an opportunity for pupils to apply and use skills that they have previously been taught and to see connections between mathematical topics. The lessons are best used consecutively to maintain momentum but you will need to **prepare pupils in advance by teaching or refreshing any mathematical skills that will be new or that they have not used for some time.**

After introducing the case study, organise the class in groups of about four pupils, who could stay together throughout the lessons. Your role as the teacher is **to lead the development of the story and introduce the challenges, then encourage the groups to decide for themselves how to resolve them. At the end of each lesson, lead a whole-class discussion, helping the groups to share their problem-solving strategies and to evaluate their progress.**

If your pupils are not accustomed to solving unfamiliar problems, you may need to forewarn them that they could be challenged by the case study, because the problems are not 'five-minutes-or-less' activities. They may well get stuck at some point. They need to know that this is a normal part of problem solving and that working out how to make a start is an important skill. Clarify in advance how much help you will offer as the story unfolds, and when. **Feed in hints only when and if pupils get stuck without telling them exactly what to do so that they merely follow the steps you have outlined.** Advise the groups to brainstorm to generate ideas, to explain and consider each proposal carefully so that everyone in the group can verify whether or not it works, and to try a variety of approaches. You can also pose suitable questions or prompts to stimulate their thinking, pair groups to learn from each other and take whole-class feedback at any point.

In the final problem of the case study try to make sure that all pupils in the class succeed so that they end the case study feeling a real sense of achievement.

Resources needed

The Rainforest materials include:

- these introductory notes
- four lesson plans, with slides and resource sheets presenting the problems, including optional homework tasks
- video and audio clips
- where applicable, solutions to the problems.

The resource is easy to operate and is designed for use in a normal maths classroom. The only technical equipment required is an interactive whiteboard (IWB) or whiteboard, one laptop (for you to use to load and navigate around the resource), a data projector and speakers. Pupils will also need calculators, rulers, squared paper and interlocking cubes.

The launch page features links to the introduction, the lessons and solutions. Clicking on the 'Lessons' button leads to a sub-menu for Lessons 1 to 4. Click on an individual lesson to access the lesson notes, resource sheets and audio and video clips for that lesson. These are numbered in the order needed in the lesson. All the print resources can be either viewed on screen or printed out.

Each lesson plan starts with a narrative explaining the storyline, followed by a description of the problems, the skills linked to the mathematical content, and a list of the video, audio and print resources for the lesson. These notes are on a shaded background. The rest of the lesson plan is a guide to the possible flow of the lesson, questions to ask and ways of adapting activities for pupils of differing abilities.

For the lessons and homework a maximum of **13** resource sheets need to be printed, either one copy per pair or one per pupil.

Pupils will also need calculators, rulers, squared paper and interlocking cubes.

Adapting the lessons

Mission: Rainforest is designed to be adaptable, giving you the freedom to modify lessons to match pupils' ages and abilities and the school timetable.

All the lesson plans make suggestions for differentiation, with ideas for simplifying or extending the main problems or providing alternatives.

Since lessons vary in duration from one school to another, in all the lessons some activities are optional. These can be omitted if lessons are less than 50 minutes, or if pupils take longer than you expect to solve the problems.

The resource sheets for each lesson include a selection of shorter and longer tasks or problems, all related to the storyline. You can choose from these as you wish.

For example, they can be used as:

- supplementary problems for any groups that solve the main problem quickly, or for schools where the lesson is longer than an hour
- alternative problems to provide further differentiation in lessons
- introductory or follow-up work
- optional homework.

Alternatively, if you want the class to tackle all the activities in a lesson, you could split a lesson over two teaching periods. For example, the second lesson of the case study explores issues of deforestation and carbon off-sets by helping pupils to relate the use of rainforest timber to their everyday lives, such as eating burgers, reading newspapers and being driven in a car. There are probably enough supplementary multi-step problems for this lesson to sustain work over two lesson periods, provided that pupils are left to make their own decisions about approaches. This lesson is also a particularly good opportunity for persuasive writing in cross-curricular work with the English department.

Cross-curricular opportunities

Subject	Topic
Geography	Map work; interactions between people and their environments, including causes and consequences of these interactions, and how to plan for and manage their future impact
English	Imaginative and persuasive writing to develop ideas, themes, imagery, settings and/or characters when writing to imagine, explore and entertain; debate on deforestation issues; report writing, e.g. for a radio news broadcast
ICT	Use of spreadsheets; taking and editing close-up digital photographs of tropical plants; using email to send a report; Internet research into illegal logging
PE	Gymnastics; navigating an obstacle course, including a 'bridge'
Science	Variation and classification of rainforest plants and animals
CDT	Designing and making a bridge structure to carry a maximum load
Art	Painting and drawing impenetrable forest

Assessment

Bowland Maths provides useful assessment materials and also two CPD modules specifically on assessment on the Bowland Maths website (**http://www.bowlandmaths.org.uk**).

You can use the Mission: Rainforest lessons to build a picture of your pupils' understanding and skills, choosing suitable criteria at levels 5 and 6. For example, assess whether pupils are able to:

Level 5

- show understanding of situations by describing them mathematically using symbols, words and diagrams
- draw simple conclusions of their own and give an explanation of their reasoning

- recognise and use number patterns and relationships
- use known facts, place value, knowledge of operations and brackets to calculate, including using all four operations with decimals to two places
- solve problems involving the conversion of units and make sensible estimates of a range of measures in everyday situations
- use and interpret coordinates

Level 6

- interpret, discuss and synthesise information presented in a variety of mathematical forms
- break a problem into smaller parts and structure problems that need several steps
- use logical argument to establish the truth of a situation
- visualise and use 2D representations of 3D objects
- calculate volumes and surface areas of cuboids.

Useful websites

Tropical rainforests, including deforestation statistics
rainforests.mongabay.com/defor_index.htm

Illegal logging
www.greenpeace.org/international/campaigns/forests/threats/illegal-logging
www.illegal-logging.info/uploads/cserge.pdf

Sustainable logging
rainforests.mongabay.com/1011.htm

River crossing puzzles
www.mathfair.com/rvrcrossing.html

Professional development

Bowland Maths also includes Professional Development materials to help teachers develop the skills needed for the case studies and for the new Programme of Study. There are seven modules which cover the main pedagogical challenges for this type of investigative problem solving. Each module is activity based; it is built around problems similar to the case studies, but short enough to fit into a single lesson. For an outline of the Professional Development modules, go to:

http://www.bowlandmaths.org.uk/pdmodule.htm

Pupils' reactions

'I want to do more of these because they were fun and got our brain working.'

'My favourite bit was having to work out calculations because it helps us learn more about maths.'

'More fun than doing sums off a board.'

'It was challenging and different to a normal maths lesson.'