MiMa Mathematics in the Making
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Teacher training course

October 2014
**MiMa Teacher Training Course**

The project *MiMa – Mathematics in the Making* aims to help primary school students to develop a stronger interest and competence in mathematics, also enhancing their social and civic skills, and so contributing to an increase in students’ chances of success both in school and in life. Ten hands-on activities have been devised for the students to explore in their classrooms. Each can lead to an exhibition, created by the students, showing the results of their explorations.

This Teacher Training Course serves a simple introduction to the thinking behind the project and its implementation.

**Organisation of the course**

The course represents 12 hours of teacher learning. It is divided into six modules each covering two hours of study time. There are a variety of different delivery patterns, some of which might include some distance learning. For example, modules 1, 2 and 3 might occur as a single day-long event followed by a similar pattern for 4, 5 and 6. Alternatively, a series of six evening sessions could be held with one module being studied each evening. Other models are also possible depending on local circumstances.

**Modules**

The six modules are as follows:

1. Introduction
2. Outdoor activities
3. Working in 2 dimensions
4. Exploring polyhedra
5. Number and logic
6. Making an exhibition
1. Introduction

Distribute copies of the *Guidelines for the Implementation of the MiMa Methodology*. Read paragraph 2.1. Teachers share their existing experiences of using hands-on activities. They discuss together the extent to which their experiences match the claims made in paragraph 2.1 and reflect on any discrepancies.

Deliver input related to the content of paragraphs 3.4, 3.5, 3.6, 4.2 and 4.3 drawing on the background research behind these.

Distribute the Toolkit and the video. Show the video to give an overview of the MiMa activities.

Briefly described the intended ideas for the exhibition.

2. Outdoor activities

Three of the MiMa activities make significant use of the outdoor environment. This session will focus on these three activities.

*Making a maths trail*

Through this activity children apply their existing knowledge and extend it, exploring mathematics in their own local area. They will produce a mathematics trail together with supporting resources aimed at encouraging others to explore the mathematics around them.

*Modelling the solar system*

Children will replicate the inner solar system in their playground based on a scale of $1$ $391$ $900$ $000:1$ or $1.391 \times 10^9:1$. The model of the sun will have a diameter of approximately $1$ m. The scaled models of the sun and inner planets will be made in three dimensions and will be placed in their correct orbits to the same scale. If extended to include the outer planets, the children will also need to use some public facilities in the school neighbourhood (such as a coffee-shop or a garden). It is likely that some of the teachers will find some of the mathematics in this activity challenging. Support for the mathematics behind the activity is provided in the *Toolkit*.

*Sundials*

The children will make two simple sundials: a horizontal one based on a rectangle and calibrated by them and a raised one which is pre-calibrated and based on the compass. They may then research and design a sundial of their own.

Allow approximately half an hour to explore each activity drawing on the *Toolkit* and giving the teachers themselves a hands-on experience of some of the mathematics involved in each activity. Finish the session with a discussion comparing the strengths of the three different activities and sharing any problems that the teachers foresee in using them with their students.
3. **Working in two dimensions**

Two of the MiMa activities focus on working in two dimensions. This session will focus on these two activities.

*Frieze patterns*

This activity promotes the learning of the symmetries (isometric operations) of rotation, translation, reflection and glide reflection while constructing a frieze. Students will explore the composition of these operations so that seven different types of frieze will be built. It is likely that some of the teachers will find some of the mathematics in this activity challenging. Support for the mathematics behind the activity is provided in the *Toolkit*.

*Many colourful triangles*

This project concerns the equilateral triangle. First, an equilateral triangle is produced in a very simple way by folding paper. Then, by placing several triangles next to each other, new shapes, patterns and tilings are formed, the features of which are explored and analysed by the children.

Allow approximately three quarters of an hour to explore each activity drawing on the *Toolkit* and giving the teachers themselves a hands-on experience of some of the mathematics involved in each activity. Finish the session with a discussion comparing the strengths of the two different activities and sharing any problems that the teachers foresee in using them with their students.

4. **Exploring polyhedra**

Three of the MiMa activities offer a range of different tasks all related to thinking about polyhedra. This session will focus on these three activities.

*A mathematical football*

The children will explore which Platonic solids are possible. They will then make a number of cardboard models which will allow them to uncover the structure of a football as the truncation of an icosahedron.

*Exploring cuboids*

The children will explore direction and movement in 3-D by exploring cuboids and their 2-D representations. They will transfer 3-D understanding of the directions up and down, forward and back, right and left to 2-D plane images of a skeleton cuboid using a simple piece of software. They will also explore nets of cuboids.

*Mathematics of the beehive*

The children will make various cardboard models that allow them to discover the relationship between the cube, the rhombic dodecahedron and the shape of the cells of a beehive.

Allow approximately half an hour to explore each activity drawing on the *Toolkit* and giving the teachers themselves a hands-on experience of some of the mathematics.
involved in each activity. Finish the session with a discussion comparing the strengths of the three different activities and sharing any problems that the teachers foresee in using them with their students.

5. **Number with logic and probability**

Two of the MiMa activities involve thinking about number, one in the context of logical thinking and the other in the context of probability. This session will focus on these two activities.

*Experiments with dice*

Through several different interactive and activity-oriented experiments with regular and special dice, the children gain experiences with the mathematical concept of probability. The focus is on the development of a non-regular dice and a board game, which will be presented to interested visitors in the final exhibition.

*Logic mazes*

This activity involves designing logic mazes. Initially this can be done as a classroom based activity using either a spreadsheet or more practically using paper/card or other suitable materials. The eventual aim is to design and make at least one large scale one for the playground or another suitable venue.

Allow approximately half an hour to explore each activity drawing on the *Toolkit* and giving the teachers themselves a hands-on experience of some of the mathematics involved in each activity. Follow this with a discussion comparing the strengths of the two different activities and sharing any problems that the teachers foresee in using them with their students.

Use the last half hour of the session as a time when the schools decide which of the activities they are going to use with their own students in their schools.

6. **Making an exhibition**

Introduce the idea of making an exhibition by drawing on the final section of the *Toolkit*.

Each teacher selects one of their chosen activities and thinks in detail what the associated exhibition might look like. If more than one teacher chooses a particular activity, encourage them to work together and share their resources. Drawing on the materials they themselves have produced during modules 2, 3, 4 and 5, they create a mini exhibition. These are then shared and discussed.

Deliver some input on the thinking behind the students' explaining their work to others, drawing again on *Guidelines for the Implementation of the MiMa Methodology* paragraphs 3.4 and 4.3.

Finally, drawing on all the work so far, discuss the implications of *Guidelines for the Implementation of the MiMa Methodology* paragraphs 5.1, 5.2 and 5.3.
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