

## *Mathematics Enhancement Programme*

### TEACHING SUPPORT

#### **GENERAL OVERVIEW**

This initiative, the *Mathematics Enhancement Programme, Primary Project (MEP Primary)*, has been developed by the Centre for Innovation in Mathematics Teaching (CIMT) at Plymouth University to enhance the mathematical progress of students in primary schools. It is based on the evidence of good practice from our international longitudinal primary project (IPMA), where we tracked the mathematical progress of cohorts of students in the primary phase of education in a number of countries including Hungary, Japan, Singapore, Russia, Ireland and England.

We have carefully studied the criteria for success and translated this into a comprehensive course for Primary Schools in the UK. The development of this course has been greatly influenced by the Hungarian approaches to teaching and learning and also by good practice in other countries including those listed above. MEP aims to support the following **KEY STRATEGIES** for effective mathematics teaching and learning:

1. **Lesson** well prepared (teacher knows the lesson plan well and is aware of problems/difficulties that are likely to occur), resources are at hand, board prepared in advance, students have their own resources on desk.
2. **Seating:** every student has direct eye contact with the teacher and can get to the board quickly and easily.
3. **Whole-class interactive teaching** predominates, with planned intervals of individual and paired work. All students on task and all given the chance to demonstrate, answer, explain, suggest to the class.
4. **Friendly, non-confrontational atmosphere** where students learn from and support others and have fun! Mistakes used as teaching points. Encouragement given to those who have difficulty and praise given when deserved. Students are encouraged to appreciate the good work of others.
5. **Spiral curriculum** with continual revision; learning by heart encouraged, with progression in small, logical steps.
6. **Visualisation** and **manipulatives** are used in the early years and with less able students. Relating contexts to students' experiences where possible, demonstrating on a number line and modelling to help understanding.
7. **Exercises** reviewed interactively with the whole class at the time. Students give the solutions, not the teacher, and rest of the class agrees/disagrees or suggests alternative solutions. Students are expected to correct their own work. Teacher gives hints only if the whole class is stuck.
8. **Challenges** or **extension work** set for able students, or they help less able neighbours; no one is inactive.
9. **Correct notation, layout** and **language** used at all times. Teacher acts as a model for students to follow (on board and orally), repeating/showing a student's explanation more clearly and succinctly where necessary.
10. **Good pace** and **varied activities** related to the concept being taught. Time limits set for individual/paired work. Time allowed for students to explain and for whole class discussion.

To support these strategies, the resources developed are based on

- *two Practice Books for each year (175 pages in total)*
- *detailed Lesson Plans for 4 out of every 5 pages (140 in total each year)*
- *Copy Masters for use with data projector (or to photocopy)*
- *Answers available on the website*
- *number lines, number cards and shape cards.*

These resources are all freely available online; printed Practice Books are also available from CIMT. There are interactive versions of Years 3 - 6 online. These can be used to help understanding, to give reinforcement and also to provide help when students miss lessons.

Yearly tests are available from CIMT ([russell.geach@plymouth.ac.uk](mailto:russell.geach@plymouth.ac.uk)); these provide a value-added measure of yearly progress.

CIMT website for all *MEP* Primary resources:

<http://www.cimt.plymouth.ac.uk/projects/mepres/primary/default.htm>

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### ***GUIDELINES for MEP Primary teaching***

The Lesson Plans provided are only samples. You may and should adapt the questions, activities, methods and ideas for your students according to their mathematical level and stage of development. You should also incorporate your own methods, ideas and questions into the lessons.

The main points we wish to emphasise in each lesson are:

#### **1. Preparation**

All lessons should be well prepared. Any resources should be close at hand, either on the teacher's desk or on the students' desks. We would advise that resources should be prepared beforehand (using colour to make them as attractive and clear as possible) and that only the number, sign and shape cards or number lines relevant to the lesson should be available.

#### **2. Mental work**

Students should count and carry out operations mentally, sometimes as a class, sometimes individually.

#### **3. Board work**

Students should be encouraged to come to the board to show a solution, convey an idea, etc. All students should become used to doing this as a matter of course and not be made to feel embarrassed if they do something wrong – impress on them that they have helped others not to make the same mistake.

#### **4. Oral work**

Students should be encouraged to use correct mathematical terms and should get used to reading aloud mathematical statements correctly, both individually and in chorus with the class.

#### **5. Demonstration**

In each lesson, students should work with manual aids (number cards, counters, sticks, rods, dominoes, items from their collection, etc.) whenever possible.

You should demonstrate the discussions/solutions at the board with real-life models, large drawings or enlarged pictures from the pack of copy masters.

**Note:** some of these masters need further work done on them by you (e.g. enlarging further onto card, colouring if you wish and cutting out) before reassembling. These can form a good bank of resources for use in other lessons.

#### **6. Discussion**

At least half the activities should be done as individual work, but followed by whole-class, interactive discussion. By this we mean that you should:

- stop the individual work clearly;
- ask several students to report on their work, their thought processes, what they wrote down, etc.;
- encourage students to argue, discuss problems and communicate, with competence;
- obtain feedback from them (and give them feedback) by asking questions such as: 'Who was right/wrong?', 'Who wrote/thought the same/something different?' (used as a diagnostic strategy in Hungary);
- make the students decide whether an answer, solution, opinion is correct or not and why, by asking questions such as: 'Who agrees/disagrees with this/that or him/her?';
- make students correct their mistakes, in both written and oral work;

- build up their confidence by praising and always having a positive attitude, while at the same time encouraging them to offer solutions to problems, criticise, discuss, communicate ideas, etc. using correct mathematical notation and speech.

**7. Monitoring**

You should monitor the students during individual work, taking note of those who are having problems (and help and correct for some of the activities).

**8. Atmosphere**

A kind, serene, humorous atmosphere, but slowly increasing expectations in work and behaviour would be the optimum!

**9. Interludes**

We have planned short, relaxing periods in the middle of lessons (play, song, verse, exercise, etc.) in Years 1 and 2 as at this age children can easily lose concentration after 20-25 minutes. As young children's fingers (joints) are not yet ready biologically for writing, exercises should also include fine motor movements as preparation. Sometimes a short rest (heads on hands on desks) with eyes closed could be useful.

**10. Writing equations**

Because of the tight spacing of lesson plans, sometimes equations have been written on one line, but we would encourage you to write each stage of the calculation on a separate line when writing on the board, keeping the '=' signs lined up as far as possible. For example, in the lesson plans a calculation might be written as:

$$\dots\dots\dots = \dots\dots\dots = \dots\dots\dots = \dots\dots\dots$$

but ideally we would prefer it to be spaced out on the board as

$$\begin{aligned} \dots\dots\dots &= \dots\dots\dots \\ &= \dots\dots\dots \\ &= \dots\dots\dots \end{aligned}$$

**11. Moving on**

Once about 80% of the students have understood a concept, move on! Do not wait for everyone to finish the exercise or get everything correct, as the concept will come round again and again.

**12. High attainers**

Students should never be inactive in a lesson; set extension work for those who finish quickly (e.g. they could design their own exercises similar to (or the reverse of) the one just completed or choose these students to explain to others who are struggling.

**13. Time limits**

Set time limits for individual exercises and keep to them! Do not expect all students to do every question in calculation practice or to complete all the columns or rows in a table. In most cases, it only needs one or two answers for the concept to become clear.

**14. Real-life contexts**

It is very important to use students' knowledge, customs and information from their home and 'out of school' lives and to build bridges between that life and what they have learned in school.

Use the playground, park, woods, market, shops, railway station, airport, countryside, etc. as contexts whenever possible.

Also, we have planned some thought-provoking logic problems to form a basis for the development of problem-solving skills and creativity.

### **15. Praise**

Praise should always be given when deserved, and not only by the teacher! The class should be encouraged to applaud too when they think someone has done good work or had a good idea. A reward system could be set up (e.g. using stars or stickers) but take care that it is not diminished by everyone receiving a reward every lesson!

*MEP lessons are hard work for students and teachers but they are intended to be fun too! Use humour and encouragement as much as possible, especially with students who make mistakes.*

CIMT general website:

<http://www.cimt.plymouth.ac.uk>

MEP Primary resources:

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