Mathematics Enhancement Programme

Extension to Feeder Primary Schools

PROJECT OUTLINE

Sponsored by

PricewaterhouseCoopers

with support from

The Gatsby Charitable Foundation, Esso, British Steel,
The Garfield Weston Foundation, The Mercer's Company

Centre for Innovation in Mathematics Teaching, University of Exeter

1 Introduction

The *Mathematics Enhancement Programme (MEP)* aims to raise standards in mathematics by promoting a more teacher-focused teaching philosophy, together with the provision of suitable teaching resources. This teaching philosophy is based on the continental model, best practised in mathematically high performing countries such as Hungary and Poland, where whole-class, interactive teaching is prevalent from nursery schools onwards.

As in our secondary project, we will be advocating a teaching style which:

- puts the teacher as the focus of the learning;
- encourages correct, precise, orderly spoken and written mathematics;
- places greater emphasis on whole-class, interactive teaching with less differentiation and less individual work;
- promotes mental maths, including knowledge of basic addition and multiplication facts.

The project is compatible with the Governments's national numeracy strategy as outlined in the publication, *Numeracy Matters*.

2 Implementation of Recommendations in Secondary Schools

In 1996, we initiated our secondary implementation project, based on the *MEP* teaching philosophy. We are currently working with 100 secondary schools in England and Wales, focusing on raising the mathematical attainment of pupils in Y10 and Y11, the final two years of compulsory schooling up to GCSE.

This implementation project involves regular inservice with our teachers (based on using videos of good practice from Hungary), together with comprehensive resources based on the Singapore framework:

- *Pupil Texts* – basic facts and concepts, examples, exercises, answers,
- *Practice Books* – exercises for homework, including many GCSE questions from all the exam boards,
- *Teacher Support* – schemes of work, background notes, lesson plans, activities, overhead transparencies, mental tests, revision tests and answers to the *Practice Books*.

Initial reaction from pupils, teachers and parents has been very positive (see ***Interim Report***) and we are now extending this to Years 7–9, with encouragement to provide pupils with a smooth progression from feeder primary schools into our secondary schools.

3 Extension to Feeder Primary Schools

Many of our secondary schools have been keen to implement similar teaching strategies in their feeder primary schools. Indeed, if we really are to enhance mathematics teaching to the full, it is imperative that coordinated action is taken from an early age.

We have been particularly influenced in our thinking by the Hungarian approach to teaching mathematics. Hungary has always performed well in international mathematics tests and has a long history of mathematical excellence.

Our initiative is also based on recognising that effective mathematics teaching is essentially age-independent. The highly focused, interactive lessons seen in Hungary have the same main characteristics, whether in nursery, primary or secondary. The key to success is in keeping *all* children on task with meaningful and relevant activities.

The proposed project has a number of key components, as outlined in the sections below.

A Implementation

In the first instance (for implementation in 1998/9) we have recruited 10 secondary schools and their feeder primary schools to this extension project. Each secondary school has provided a centrally trained coordinator for its feeder primary schools.

A key aim of the project is to enhance attainment in mathematics both through the recommended teaching style (see **Section B**) and by coordination across the primary/secondary interface (see **Section C**). We expect the local coordinator to organise inservice support meetings, dealing with the teaching philosophy, use of resources and mathematical competency (see **Section D**). These meetings will involve staff in the participating feeder primary schools and therefore will provide an opportunity for sharing ideas and discussing problems. In particular, we will encourage cooperation and collaboration, leading to a smooth transfer of pupils from primary to secondary mathematics.

We hope that a whole-school approach to teaching will be implemented by teachers of *all* year groups but in 1998/9 the main thrust in terms of resource support will centre on:

- Reception
- Year 1

with teaching resources and lesson plans being developed for teachers in Y1.

Our intention is to continue to provide **free** resources for the children in this first cohort, and also for a second Y1 cohort starting in September 1999,as they progress through primary school. However, this is dependent on continued support from our sponsors, which is of course in part dependent on the initial success in implementing this strategy and the progress made by our pupils.

Next year, we hope that the initiative will be offered to some of the other *MEP* secondary schools and their feeder primary schools providing that, as with schools involved this year:

- the secondary school provides the coordinator;
- no supply costs are incurred;
- all their main feeder primary schools agree to join;
- they are open to external evaluation.

B Teaching Mathematics

Although we do not wish to be dictatorial, there are some key elements which we would want all participating schools to follow:

(1) Teaching Style

Our recommended teaching style is based on best practice seen in mathematically high performing countries such as Hungary and Poland.

Central to the philosophy are the following requirements of the teacher:

- being the focus of the learning, orchestrating activities throughout the lesson;
- ensuring participation from all children in the class;
- creating an atmosphere of enthusiasm and purpose;
- raising expectations;
- monitoring the progress of all children;
- keeping all children on task,

together with using a variety of associated strategies, including:

- more whole-class, interactive teaching,
- correct, precise use of maths, both spoken and written,
- encouraging mental maths and using number cards for instant response,
- less differentiation in tasks set but more differentiation by outcome,
- children working at the front of the class, e.g. on the board,
- individual mistakes used as teaching points for the whole class,
- clear objectives and structure to all lessons,
- extra practice for children falling behind,
- individual help for children with behavioural problems or learning difficulties.

(2) Scheme of Work

This is clearly specified for Years 1–6 and is part of a complete Y1–11 plan, with associated written and mental tests.

There is also a focus on numeracy skills in the early years but maths is treated as an integrated subject rather than subdivided into separate topics.

The scheme of work is partly based on the sequencing of topics as seen in Hungary, where there is a slow but sound development of mathematical concepts based on a thorough understanding of mathematical logic. This is particularly important for the long term mathematical success of your pupils.

Of course, the scheme is also influenced by the topics required for the National Curriculum and the national tests at Key Stages 1 and 2.

Particular attention in Reception and early years is paid to developing the skills of:

- concentrating,
- listening,
- communicating,

following strategies used in the Hungarian *Kindergarten*.

(3) Blackboards/Whiteboards

We expect each classroom to have adequate board facilities which can be used by both teachers and pupils. We particularly recommend the use of squares painted on boards to make it easier for you and your pupils to write on the board and to encourage neatness.

(4) Seating Arrangements

From Y1 onwards we would expect the seating arrangements for maths lessons to be such that there is a clear focus on the teacher and the black board/ whiteboard. We recommend traditional seating arrangements: in pairs at desks facing the board.

(5) Timetable

We expect maths to be timetabled daily and as early in the day as possible, with extra practice lessons later in the day for both the whole class and individuals identified as needing particular help.

(6) Lessons

We expect lessons to start usually with quick-fire mental arithmetic followed by key activities and sufficient individual practice. Videos of good practice in Hungary and the UK illustrating our recommended approaches will be provided for inservice support.

(7) Key Facts and Skills

Addition and multiplication facts should be learned and practised until there is instant recall (in line with the scheme of work); and key skills such as rounding up/down, adding multiples of 10, multiplying by 2 and 10 will be emphasised.

(8) Resources

We are keen to follow the Hungarian approach, including the use of resources such as:

- practice books*
- number lines for each classroom – for display and use *
- number, sign and shape cards (for quick responses to mental work and for making mathematical statements on desks)*
- number lines for individual use*
- play money
- coloured counters and sticks
- number strips/rods (or plastic cubes which stick together)
- dominoes

* These will be provided initially for Year 1 classes.

As outlined in *Section A*, full teaching resources will also be provided in 1998/9 for teachers of Year 1. These will be based on translated Hungarian workbooks and a comprehensive *Teacher Support*, including

- **notes on the lesson plans**,
- **lesson plans**,
- activities
- termly tests.

(9) Mathematical Presentation

We would encourage both pupils and teachers to lay out their written maths in a neat and orderly manner and to use correct, precise, mathematical language.

(10) Calculator Use

We would **not** expect calculators to be used in the classroom at all until pupils have a firm grasp of number concepts (and even then used only for appropriate tasks). This is in line with the new advice which has recently been given by the Secretary of State to QCA.

C Coordination and Inservice

The project in each cluster of feeder primary schools is coordinated by the appointed secondary teacher who will be responsible for the implementation of the project. They will be expected to act as the catalyst, intervening, monitoring and trouble-shooting when necessary. We would, however, want to stress that you are welcome to contact the central team (CIMT) at any time by telephone, post, fax or e-mail, with queries and problems.

The inservice required will include:

- an introductory session for all teaching staff outlining the teaching philosophy;
- further meetings in 1998/9 to discuss teaching strategies and to share ideas (we expect teachers in each cluster to meet regularly);
- other sessions to focus on mathematical competency (see *Section D* below).

We also expect each school's mathematics coordinator to have overall responsibility for the motivation in their school and to liaise with other local coordinators. In particular, we feel that it is crucial that all teachers are able both to share ideas and to see each other teaching and we expect the maths coordinator for each school to ensure that this actually happens.

D Competence in Mathematics

We would expect all staff in participating primary schools to undertake a self-assessment analysis of their mathematical needs (using either computer-based material developed with funding from *ESSO* or a paper-based equivalent).

Once these needs have been identified, the local coordinator from the *MEP* secondary school, together with the primary school mathematics coordinators, will provide a plan of action which might include:

- self-study material, in the form of *Help Booklets,* for particular topics (we will provide material centrally for this),
- after-school sessions on topics of particular importance or difficulty (normally taken by the local coordinator).

This is a potentially threatening area and it should be stressed that we intend to tread very carefully and sympathetically. We do not want to alienate anyone but just, if needed, enhance their own mathematical capabilities.

This will provide a better background for the enhanced pupil attainment that we wish to encourage.

E Parental Involvement

We are keen to involve parents where this is practical and beneficial. The Hungarian approach advocated above provides a sound beginning in number work and a *Parents' Guide* to what is required (and why it is being taught) will be developed for each year of work This will include an overview, examples and sample exercises, particularly for topics which are likely to cause problems (for pupils and parents).

F Business Volunteers

For some clusters (3 in the first instance) *PricewaterhouseCoopers* will provide volunteers, at least one for every primary school, who will visit their schools on a regular basis (e.g. once a week) at a time when maths is being taught so that they can:

- provide support to teachers in the teaching of mathematics, particularly with pupils needing individual help;
- appreciate some of the problems and difficulties encountered in primary maths teaching and provide support in finding solutions to these;
- make suggestions, where appropriate, for improving mathematics teaching and practice within the school;
- monitor the effect of *MEP* and identify areas where we should be providing additional support.

PricewaterhouseCoopers believes that through its staff involvement, the firm will be supporting an important aspect of education, as it is only through high quality education that the nation will be able to continue to succeed in the global market of the future.

G Evaluation

It is important to recognise that this project is being implemented as one of a number of initiatives taking place which aim to enhance significantly attainment in mathematics. This project should not be seen as competing with other initiatives but rather as being complementary, particularly to the forthcoming *National Numeracy Strategy*, but with a number of unique features:

- the use of Hungarian-style resources,
- the involvement of business volunteers from *PricewaterhouseCoopers*, with the support of *PricewaterhouseCoopers*, an international business advisory firm;
- an emphasis on teacher competency in mathematics,
- the bringing together of all the main feeder primary schools for each participating secondary school.

It is important that these and other aspects are evaluated carefully. This evaluation will consist of both a *quantitative* element, with yearly assessment to measure progresss (see **International Project on Mathematical Attainment (IPMA)**) and a *qualitative* element (including the use of yearly *Teacher, School* and *Class Questionnaires*) in order that particular successes or failures can be rigorously analysed.

There will also be an overseeing consultative committee to ensure that the evaluation and dissemination of findings can be placed within a national framework.

4 Summary

This is an ambitious project which aims to enhance significantly the mathematical attainment of pupils by adopting the *MEP* teaching philosophy and using specially prepared resources.

It complements the forthcoming *National Numeracy Strategy*, providing the mechanism to reach the ambitious targets which are being set for Key Stage 2, but also providing a thorough understanding of the foundation of mathematics suitable for continued enhancement in secondary school mathematics and indeed skills for lifelong learning.