

IPMA

International Project on Mathematical Attainment

Project Aims

This was a longitudinal, international project on mathematical attainment, which monitored the progress of pupils from their first year in primary school (or in some cases nursery school) onwards and involved:

- collecting all relevant information, including
 - methods of teaching
 - curriculum content
 - resources used
 - training provided
- observing lessons
- interviewing teachers and pupils.

We aimed to provide local (i.e. country-level) and international recommendations for good practice in

- teaching style
- mathematics curriculum each year and sequencing of topics,
- recruitment, training and support of teachers
- assessment in mathematics
- use of IT to enhance mathematics teaching
- setting and streaming of pupils.

The project began in September 1998 with a pilot phase and was completed in July 2006. There were six meetings of country coordinators held in Exeter, London, Budapest and Lund, during which the above aspects were discussed, information exchanged and test results analysed. Country reports, data analysis, discussion and findings are available at the *IPMA* web site: <http://www.ex.ac.uk/cimt/ipma/>
Final summary recommendations agreed on by all country coordinators are listed overleaf.

Participating Countries

The following countries participated:

Brazil, China, Czech Republic, England, Estonia, Finland, Greece, Hungary, Ireland, Japan, Poland, Russia, Singapore, South Africa, Ukraine, USA, Vietnam

but some joined the project later than others.

The project was directed by Professor David Burghes at the Centre for Innovation in Mathematics Teaching (CIMT), formerly at the University of Exeter but now at the University of Plymouth.

Testing

The tests, which pupils took yearly, were designed to assess progress on key mathematical topics and concepts. Further questions were added each year to the original questions. In this way, there were sufficient new and relevant questions to assess progress, but there were always some questions on the test papers which were accessible to children who progressed more slowly.

Questionnaires, Observations and Interviews

Detailed *Country*, *School* and *Teacher* questionnaires provided details of both early years and primary education relating to mathematics and took into consideration factors such as:

- schemes of work
- teacher training (preservice and inservice)
- differentiation (setting and streaming)
- resources used
- use of IT, including calculators
- attitude to mathematics.

We gained a unique insight into *pupils'* progress in mathematics throughout their primary education. Important aspects of the project were lesson observations and teacher and pupil interviews.

Research Monograph: IPMA

Country coordinators have written chapters on their progress and findings and have also contributed to a DVD showing clips of what they consider to be good practice in mathematics teaching in their countries.

The monograph is published by Muszaki Konyvkiado, Budapest, and is one of a series of 4 monographs on *Mathematics Teaching and Learning Worldwide*. See the IPMA web site for details.

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IPMA KEY RECOMMENDATIONS

School Policy

- Pupils should start formal primary school at age 6.
- Pupils who are not quite ready should be able to spend an extra year in Kindergarten before moving to primary school.
- Seating at desks/tables should be conducive to whole-class, interactive teaching, with
 - easy eye contact between the teacher and pupils
 - pupils able to get to the front of the classroom and board easily (to demonstrate and explain their solutions, etc.)
 - the teacher should be able to get to all pupils easily to monitor and help with individual work.
- IT, including interactive whiteboards, should be used only when they will enhance teaching and learning, and computer work should be integrated into lesson plans and schemes of work.
- Classroom assistants should be used to give extra support to weaker pupils during individual work and/or extra support should be available outside normal lesson time.
- Pupils should have their own set of pencils, workbooks, rulers, instruments (and manipulatives in the early years), etc.
- Teachers should, where possible, stay with their class for 2 or more years to provide continuity.
- Agency supply cover should not be used when teachers are absent.
- National tests and school league tables are not appropriate during the primary age phase.

Curriculum

- Mathematics should be an integrated course, built on strong mathematical foundations from an early age; for example, fractions, decimals and percentages should be taught together and related to the number line.
- Schools should have an integrated scheme of work which operates throughout primary and leads directly into the secondary phase.
- There should be consistency in approach throughout the school, with teachers being aware of what has been taught in earlier years and what will be taught in later years.
- There should be a relatively slow but rigorous start (using zero from the beginning) but with rapid progress in the later years of primary, building on the initial foundation and progressing towards abstract thinking.
- A spiral curriculum should be implemented, continuously revising and adding to concepts and relating topics to real life contexts and to pupils' experiences whenever possible.
- Problem-solving and investigations should be used alongside practice of skills and techniques.
- Trial and error methods should be discouraged as a first strategy for solving problems.

Teaching

- Teachers should have high expectations of what pupils can achieve and clear objectives for lessons.
- Lessons should usually have pace and variety, often incorporating a number of activities and using resources effectively.
- Most activities should have an introduction through whole-class, interactive teaching, followed by individual or paired practice, then whole-class interactive review, discussion and correction of mistakes.
- Teachers should use humour, be friendly, give praise when deserved or encouragement to do better next time.
- Lessons should be exciting and interesting.
- Creativity and logical thinking should be encouraged and praised, with alternative methods discussed and evaluated.
- Teachers should give clear directions but allow time for pupils to explain their thinking and listen to what pupils say.
- Pupils (of all abilities) should regularly demonstrate in front of the class, writing on the board, drawing diagrams and explaining their reasoning.
- Correct notation and language should always be used by both teachers and pupils.
- Lessons should be well-prepared, including prepared board work, with all necessary teacher and pupil resources close at hand.
- All pupils should be actively involved throughout the lesson, being both challenged and supported, with regular monitoring of individual work (including the use of small boards for pupils to display answers as quick feedback to the teacher).
- Common mistakes should be discussed with the whole class and pupils should be encouraged to correct their own errors.
- More able pupils should be encouraged to help others, to create their own questions and to attempt challenging extensions.
- Visual aids, including number lines, manipulatives and models, should be used by the teacher and pupils.
- Calculators should be used sparingly but correctly, and ICT used only when it is more effective than normal practice.
- Homework should be optional in primary years but always interactively reviewed at the start of the next mathematics lesson.

[Recommendations for individual countries and for Teacher Training can be found in the Research Monograph mentioned overleaf.]