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IPMA

International Project on Mathematical Attainment

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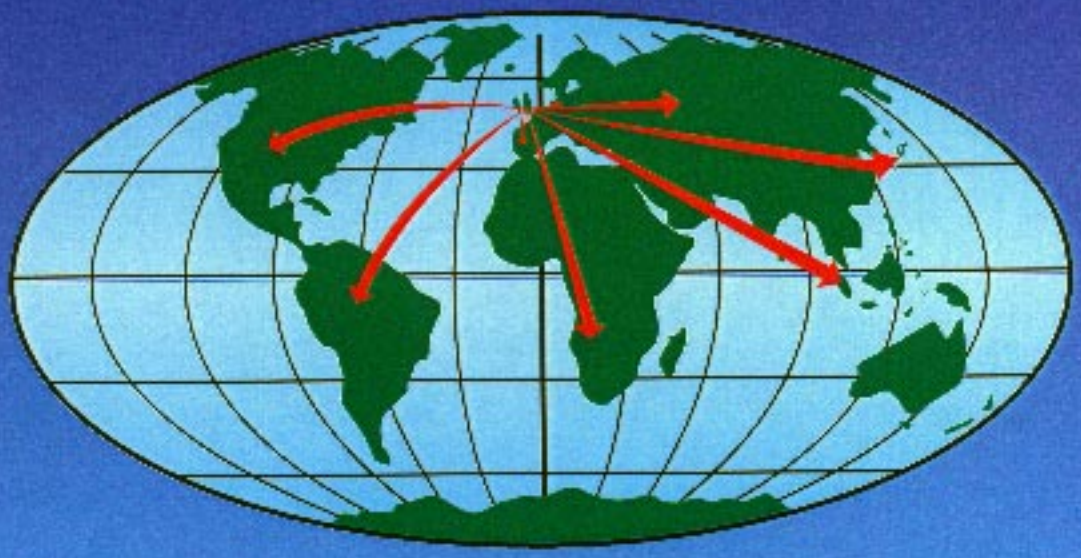

CENTRE for INNOVATION in MATHEMATICS TEACHING

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IPMA

International Project on Mathematical Attainment

REPORT on the First Meeting of Country Coordinators

Latimer, England, 19–21 February 1999

Introduction

The aim of this project is to monitor the mathematical progress of children from the first year of compulsory schooling throughout primary school and to study the various factors which affect that progress, with the ultimate aim of making recommendations at an international level for good practice in the teaching and learning of mathematics.

The project and the costs of this first meeting of interested countries has been funded by *PricewaterhouseCoopers in the UK*, a global professional services firm. We are very grateful for the interest they have shown in mathematics education worldwide.

Fourteen countries were represented at the weekend meeting (see **Appendix 1**) and all participants contributed to, and learned from, discussions on a wide range of topics which highlighted the diversity of practice currently apparent in the teaching of mathematics in primary schools. One surprising feature to emerge from the discussions was the state of flux in the education systems of the majority of countries represented, even those such as Hungary, Japan, Czech Republic, Poland and Singapore which have performed well in international testing in mathematics in the recent past.

Many of these changes have either just taken place or will take place in September 1999, including the implementation of the National Numeracy Strategy in England, so there could not be a more opportune time to undertake such an in-depth, longitudinal study.

All participants completed a *Country Questionnaire* before attending the conference and the discussions centred on a summary of their responses (see **Appendix 2**), expanding and explaining the brief facts contained therein and identifying possible areas of interest on which the study might focus. What follows is a brief report of the discussions which ensued, highlighting the most interesting aspects.

IPMA: Aims, Objectives and Procedures

The general methodology was discussed and agreed upon. Each participating country would test at least two cohorts of pupils on immediate entry to the first year of compulsory education and the same pupils would be tested again at the end of the first, and every following, school year. These tests, ranging from Test 0 (taken at age 5+) to Test 6 (taken at age 11+) would be cumulative; the first test taken would depend on the age of the pupils when they enter primary school, ranging from Ireland (entry age 4+) where Test 0 will be taken at the end of the pupils' first year, to Finland (entry age 7+) where pupils would start with Test 2, as would the last (e.g. many Hungarian pupils leave Primary school at age 10+). Despite a few questions in the later tests which some countries do not teach in their national curriculum, there was general agreement on the content.

There would also be questionnaires for teachers and for pupils (from Y3). The most important part of the project would be school visits by the country coordinators, involving lesson observations and interviews with teachers and pupils.

Each country would produce regular reports which would be disseminated through an *IPMA* site on the internet, possibly password protected. It was agreed by all countries that data from teacher and pupil questionnaires should be shared, as would data on question responses but that the purpose of the project was **not** to produce a league table of attainment, rather a study of teaching methods, curriculum content, sequencing of topics and when they are introduced.

Finally, some further ideas for possible areas of study were suggested, including:

- percentage of pupils having private lessons,
- assessment methods and the meaning of grades (marks, descriptive levels, etc.) used,
- interaction among pupils themselves,
- management of investigations and problem solving,
- tracking teachers as well as pupils,
- differing systems of internship/probation required for newly qualified teachers.

Teaching Philosophy

The diversity of teaching methods was highlighted and discussed, with video clips of maths lessons from around the world acting as a focal point. Each coordinator gave a brief summary of the style of teaching most commonly seen in their country, a cultural or historical explanation of why it came to be and any changes envisaged for the future.

During the 1970's and 1980's in England there was a strong move away from teacher-led exposition to individual or differentiated group work and even self-study, where pupils learned at their own pace with the teacher acting more as a manager than a teacher. However, recent efforts have been made to redress this situation, with a significant push towards more whole-class, interactive teaching.

In Holland, for the past 10 years all mathematics has been taught through context and is known as *Realistic Mathematics*. There are four different optional schemes which schools can follow but in reality they are all very similar. The teaching style is very interactive and children are encouraged to discuss with each other. Some different approaches are suggested, such as using empty number lines, etc., but teachers generally tend to follow the textbook closely, with exercises containing mostly open-ended questions. There are 2-yearly national tests, from which teachers can assess the standard of attainment of their pupils.

In contrast to Holland, in Singapore concepts are taught first, followed by lots of practice but with little context. The teacher does 99% of the talking in highly structured lessons in order to complete daily objectives. Much of the learning relies on homework and there are remedial (taught) or enrichment (extra work) classes after school. It was thought that less than 40% of pupils receive private tuition, which other countries regarded as surprisingly high. There is close tracking (computerised) of every pupil and parents will receive a phone call from the school at the first hint of a problem. Although the teaching can sometimes be monotonous and boring, it is always focused and adheres to the philosophy of *Concrete, Pictorial, Abstract (CPA)*. Recently, parent-teacher associations have been started up to ensure even closer contact between school and home.

Japan is very similar to Singapore in its teaching methodology, with much emphasis placed on hard work and didactic teaching. Recently there has been a move to encourage parents to become more involved in their children's education, with parents/teachers meetings being held in schools (sometimes on Sundays).

The former Eastern Block countries, Czech Republic, Hungary, Poland and Russia in the past followed a similar teaching philosophy based on a cognitive methodology which resulted in highly interactive whole-class teaching, with pupils working at the board in front of the class in every lesson. In Russia, there are now about 100 schools where 6 or 7 different experimental teaching methods are being implemented and studied for effectiveness. In Poland, many pupils now have private lessons after school and the whole education system is in flux. In the Czech Republic, the new National Curriculum covers only 4 pages so every teacher has to produce his/her own scheme of work and decide on which methodology to use. The most important change in all these countries is the lack of finance available for education and it will be interesting to see whether they maintain their previous high standards of attainment in the future.

The Scandinavian countries, Finland and Norway, have mixed ability classes to a late stage and focus on social, rather than academic, goals. In Norway, the methodology used is *Create/Use/Do/ Understand (CUDU)* and new concepts are connected to known knowledge, with a focus on common mistakes or misconceptions. There is much integration of maths into other subjects and there is a current debate on whether to abandon maths as an academic subject in its own right. The Finnish National Curriculum also covers only 4 pages (for primary and secondary) and teachers are expected not only to produce their own schemes of work but also to make changes every 4 years. However, in practice there is much reliance on commercially published text books.

Ireland is very middle of the road when it comes to its teaching philosophy but the calibre of its students is very high mathematically. Teachers keep a profile of pupils from the age of 4 years when children start school and there is much reliance on homework from the start.

Teacher Training

It was obvious from the discussions that the entry qualifications of student primary teachers varies immensely, ranging from no qualifications (i.e. secondary school maths only) in mathematics to 'O' level to 'A' level to a maths degree. Not only does the duration of courses vary but so too does the time spent in schools. In Holland, students on the 4-year course spend one day per week in schools for the first 2 years, whereas Japanese students spend only 4 weeks of their 4-year course in schools. In Singapore there are three routes into primary teacher training but all students will have at least 'O' level Mathematics.

In the USA, maths requirements for primary teaching are determined at the state level, although institutions providing teacher training often have requirements that exceed state minimums. Although areas of the USA have a shortage of primary teachers, in others there is a surplus.

Most secondary mathematics teachers in Greece do not have any pedagogical background, having undertaken a 4-year mathematics degree only in mathematics departments and the few courses on educational issues offered are optional. Moreover, their inservice training is very limited and is approached mainly through a number of short courses without connection to practice. This is the subject of current debate and a new law has been established where it is necessary for a teacher to have a certificate of participation in an one-year program aiming to help them to develop pedagogical knowledge. Mathematics education for primary school teachers is characterised mainly by teachers' difficulties with the mathematics content.

The primary teacher training course in Ireland is mainly a 3-year course and the PGCE route is used only if subject teachers are scarce but it does attract the highest qualified graduates. Students go into schools in pairs and in the last part of the course they experience other optional educational situations. Inset is mainly on new subjects in the curriculum, such as ICT, environmental issues,

etc. There is no problem with mobility of teachers, as on the whole teachers are happy to stay in their posts for several years.

In Russia and Poland, the period of training is 5 years, after which most teachers are expected to achieve a Masters degree, whereas in Finland the period of training is from 4 to 6/7 years, depending on the students, but all teachers achieve a Masters degree (including primary school teachers). In Russia, all mathematical topics are integrated into just 'Mathematics' but there is a continual development of thinking on how best to teach the subject.

Hungarian students are required to give a lesson before a committee, which awards part of the final grade.

In England all teacher training has become far more school-based with, for example, students on a 1-year PGCE (after completing a relevant first degree) spending two terms out of three in schools. However, most primary teachers still train through a 4-year B.Ed. route, during which a significant proportion of time is spent in schools, and end up with QTS (Qualified Teacher Status).

National Curriculum

With the exception of the USA, all countries had a National Curriculum but the amount of detail they contained varied from minimal – 4 pages in the Czech Republic and Finland – to the lesson by lesson guide in Greece, where textbooks and a teaching manual are given free to all schools. Poland is at a stage of great change in its education system and currently there are three national curricula on the teaching of mathematics being implemented, so it will be interesting to see whether its education system does stabilise and where the pendulum will rest.

In Singapore, secondary schools are ranked by inspectors who are usually successful school principals and not, as is often the case in England, retired or failed teachers. Sometimes at the beginning of the school year, good schools have queues of parents and children waiting to be accepted!

Information and Communication Technology

Ireland and Finland were the only countries where almost all primary schools are connected to the internet (and in Helsinki almost all pupils even have e-mail addresses). However, in most other countries work had already started on achieving the same aim. By the year 2002, pupils in Singapore will be spending 30% of their time on computers but calculators will still not be allowed in Primary schools. Schools will be equipped so that there will be one computer per two pupils but as yet no research has been done on the effective use of ICT.

In the USA calculator policy is set at the local level, with use strongly encouraged in some areas and prohibited in others. Computer use in maths teaching also varies. Calculators are banned in national examinations in Japan, so their use is actively discouraged in lower primary schools.

The UK has recently announced a big push for the use of ICT in **all** teaching, both primary and secondary. All teachers will be trained in its use through National Lottery funding and there is even an ICT national curriculum for teacher training. Calculator use is still a controversial issue, although the latest government advice is for very limited use in the first 4 years of education.

Inservice Training

A recent law would require every teacher in Hungary to renew his/her diploma every 7 years, but the new ministry is now reverting to a voluntary system, with the promise that the more inset

courses attended, the more increments there will be in salary. All inset courses are now accredited (by the Hungarian Accreditation Committee) but the coordinator felt that because of such a variance in quality level and because there are so few (valuable) mathematics educational inset courses available for primary teachers, that perhaps a better scenario for the self-development of teachers would be for them to take extra lessons with gifted or SEN pupils after school.

In Japan each new teacher has a mentor in the school, is often observed by this mentor during the first year and also attends lectures at local education centres. There are obligatory inservice courses at the local education board during the fifth and tenth years but courses in other years are optional. About 900 teachers (primary and secondary) attend 3 universities specialising in education for a 2-year Masters degree at the end of which they are rewarded by an advanced teaching certificate and an increase in salary.

Five days before the conference, a new system of INSET was formed in Poland. There has been a decrease in population, so all primary teachers must now teach all subjects in primary schools, where previously there were specialist subject teachers. Teachers currently earn the equivalent of £600 and inset courses cost about £400 but teachers are worried about the future and are willing to pay the cost, as many of them are now on yearly contracts!

In Norway, teachers are expected to spend 2 or 3 hours per week after school for preparation of lessons. There are 40 hours of compulsory INSET per year, paid for by the local commune but further education courses have to be paid for by the teachers themselves.

All compulsory inservice in the UK takes place during school hours and so necessitates the use of supply cover in schools. Many teachers attend other courses (after hours or at weekends), with fees often being paid for by the school and significant numbers study part-time at their local university for a Masters degree.

Key Problems

Part G in **Appendix 2** gives an overview of the many problems facing education, particularly primary education, in the participating countries but each coordinator was also asked to highlight what they considered to be the most important issue currently being debated in their country. Here are their responses:

Brazil	Pupils changing school, which is now very common
England	Mathematical competence of primary teachers
Finland	Why are we good at reading/writing but not at mathematics?
Greece	Educational reform and the new curriculum
Hungary	Lack of finance
Holland	How to help SEN pupils in mainstream classes with our 'realistic' maths schemes.
Ireland	Implementation of the new curriculum
Japan	Will the recent cut in the number of hours of maths teaching result in falling standards? Maths educationists fear it will.
Norway	Streaming – when should it start?
Poland	Educational reform and the new curriculum (with teachers on yearly contracts)
Russia	Lack of finance prevents research into effective teaching methodologies at a time of innovation in primary schools.
Czech Republic	We are good at maths but why don't our pupils like it?

Singapore	Mathematical competence of primary teachers
USA	Maths content knowledge and understanding of concepts by primary teachers; educational reform has resulted in 'Maths wars' (particularly about effective teaching methodologies) in some areas of the country.

Publicity

It was agreed that details of the project, including reports, questionnaires, tests, etc. should be made available for others to see on the internet. The address now being used is:

http://www.ex.ac.uk/cimt/ipma/menu.htm

It was thought that it would be possible for other interested countries to participate on the basis of the information provided.

APPENDIX 1

List of Participants

England	Kate Pilgrim representing	*PricewaterhouseCoopers*, London
	Professor David Burghes (Project Director)	CIMT, School of Education, University of Exeter
	Liz Holland	CIMT, School of Education, University of Exeter
	Margaret Roddick	"
	Frank Tapson	"
Brazil	Prof. Ednéia Consolin Poli	Department of Education, University of Londrina
	Prof. Martha Marcondes	"
Czech Republic	Dr Miroslav Bélik	J. E. Purkyne University, Usti nad Laben
	Dr Stepan Pelikan	"
Finland	Anu Pietila	University of Helsinki
Greece	Barbara Georgiadou	University of Patras
Holland	Hans Harmsen	Kohnstamm School, Hilversum
	Rob van Elswijk	"
Hungary	Professor Tibor Szalontai	Bessenyei College, Nyiregyhaza
	Rita Szalontai	
Ireland	Noreen O'Loughlin	Mary Immaculate College, University of Limerick
Japan	Professor Masataka Koyama	Faculty of Education, Hiroshima University
Norway	Professor Trygve Breiteig	Kristiansand University
Poland	Dr Irena Skipor-Rybacka	Adam Mickiewicz University, Poznan
Singapore	Dr Berinderjeet Kaur	National Institute of Education,
	Dr Koay Phong Lee	Nanyang Technological University
Russia	Prof. Eugeny Smirnov	Mathematics Faculty, Yaroslavl State Pedagogical University, Yaroslavl
USA	Dr Denisse Thompson	Department of Secondary Education, University of South Florida