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of the International Commission on Mathematical Instruction

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Secretariat
Centre for Mathematics Education
University of Southampton
Southampton, SO9 5NH
England

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Editors: Keith Hirst and Geoffrey Howson
Centre for Mathematics Education
University of Southampton
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England.

INTERNATIONAL COMMISSION ON MATHEMATICAL INSTRUCTION

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EDITORIAL

The special theme of this issue of the Bulletin is 'Mathematics as a Service Subject'. We reprint linked extracts from the third volume in the ICMI Study Series (published by Cambridge University Press) and also give details of a further volume of 'Selected Papers' to be published by Springer-Verlag. Both of these books should appear in the first half of 1988. Do please order them for your library and make their existence known. Certainly earlier books in the series are proving very popular.

KEH, AGH.

ICME 6

Budapest, Hungary July 27 - August 3 1988

The Second and Final Announcement, together with registration form, has now been published. If you have not received a copy please write to

ICME6,
János Bolyai Mathematical Society,
Budapest, POB 240,
H-1368, HUNGARY.

Please make details of this Congress widely known.

As announced previously there will be a General Assembly of ICMI (for National Representatives) in the late afternoon of Tuesday 26 July, 1988.

ON THE TEACHING OF MATHEMATICS AS A SERVICE SUBJECT

The title of the study - Mathematics as a Service Subject - may shock. Mathematics is the most ancient of the sciences. Why should it be in the service of others, or worse still, in the service of technical activities? In reducing mathematics to a service rôle, does one not belittle its contents, its image? Let us immediately state that in our view 'mathematics as a service subject' does not imply some inferior form of mathematics or mathematics limited to particular fields. We mean mathematics in its entirety, as a living science, able - as history has ceaselessly shown - to be utilised in, and to stimulate unforeseen applications in very varied domains.

I <u>Everywhere there is a need for mathematics</u>

As is common knowledge, the chance fact that there was personal enmity between Nobel and Mittag-Leffler resulted in there being no Nobel prize for mathematics. But there are still Nobel prize-winners who are mathematicians. The Nobel prize for chemistry was awarded in 1985 to two mathematicians, H.H. Hauptman and J. Karle, for the development of methods for the determination of crystalline structures, based on Fourier analysis and probability. To quote W. Lipscomb, who presented the prize: "The Nobel prize for chemistry is all about changing the field of chemistry. And this work changed the field." Before that, G. Debreu and L.V. Kantorovič had been awarded the Nobel prize for economics for work which was also of a mathematical nature. Mathematics <u>cannot</u> be excluded from the family of sciences. It is an integral part of scientific thought, a necessary component of contemporary advances in all scientific fields.

That is not all. Mathematical concepts now surface at all levels of social life. Let us take three simple examples.

Each individual is now confronted with an avalanche of numerical data and constant changes of scale (from the price of goods and other purchases to the National Budget, from atoms to galaxies, from nano-seconds to geological time spans). The conceptual tools needed to master such data changes of scale exist: they are, at a fundamental level, numbers written in standard (exponential) notation and, at a higher level, geometric representations and data analysis. Changes of scale in the exploration of figures - a kind of intellectual zoom -

correspond to modern notions of measure and dimension. To understand our different environments, modern ways of 'calculating', and modern views of geometry and analysis offer remarkably well-adapted tools.

For the individual, for groups, and for humanity as a whole, the evaluation of risks (car accidents, nuclear accidents, geological catastrophes) has become a necessity and it alone enables us to make rational decisions. Probability is the means appropriate to such evaluations. The concept of probability allows us critically to examine data and suppositions. Acquiring an understanding of probability should be - and how far we are from attaining this goal - a key element in the development of general critical faculties.

In the fields of production and the service industries, information technology and automation have caused programming and 'control' to become essential activities. The conceptual tool adapted to programming is the algorithm, that is to say, a systematic procedure enabling us to solve a whole class of problems. Thus, an algorithm is a means of governing thought which is well adapted to the governing of machines.

Arithmetic and geometry, analysis, probability, algebra and in particular algorithmics have a totally different meaning today, and offer far more, than they did two centuries ago - a time when discussion still occurred on whether $^{-}2$ could really be called a number. Some modern concepts must now become part of common consciousness, and they must be integrated into higher and professional education if space cannot yet be found for them in the general school curriculum.

In higher education mathematics is now taught to a wide range of students - diverse on account of their backgrounds and also because of their specialisms and aspirations.

The topic of service teaching - in respect of a general concept of mathematics education - is vital for at least three reasons.

Numerically, it involves many mathematicians in higher education (in some institutions in Canada up to 80% of mathematics teaching is to students studying other disciplines).

Socially, it corresponds to the impact of mathematics on all aspects of everyday life.

Intellectually, it forces us to look at things from a new angle - for instance, to perceive that there are many routes by which one can come to mathematics.

Let us stress once again the social importance of this service teaching - its importance goes well beyond meeting an explicit social demand.

Demands from sundry disciplines are clearly very varied and depend not only on the disciplines studied but also on the level at which studies are taking place. One can distinguish two types of subject. In those disciplines of the first type - physics, astronomy, theoretical chemistry, parts of engineering science - certain essential concepts are mathematical in nature, data are treated in a quantitative way, numerical solutions are obtainable to given problems through the use of mathematics: it can be said that mathematics permeates the whole of the discipline. Within the disciplines of the second type - biology, economics, etc. - mathematics sheds light on certain concepts and is used to set up or exploit quantitative models, ofter far removed from reality. The attitudes of students towards mathematics tends to differ greatly according to the type of their major discipline. This gives rise to equally different pedagogical problems.

To sum up:

(a) More than ever, and increasingly so, mathematics interacts with other sciences and with technical activities in which science is strongly represented.

(b) A part - changing - of mathematics represents an integral part of the general culture of each age. In our time no individual should be deprived of this component.

(c) Mathematics as a service subject represents a very important activity within institutions of higher education, a very varied, very interesting and ill-understood activity.

(d) Explicit demands for mathematics to be taught as a service subject are already important and they are growing. According to career aspirations and choice of major discipline, mathematics appears sometimes as indispensable, sometimes as useful but of secondary importance. Ways of teaching must be adapted to match these different types of demand.

II What is changing, what is to be done, and why?

As in other sciences, the output in mathematics (as measured by published papers) is increasing exponentially.

Is the social assimilation of new knowledge on this scale possible? That is a big question which can also be posed for other sciences. Yet true scientific progress is the concurrent development of knowledge, its dissemination, and its assimilation by the public at large. The question then is to pass from development to progress. It concerns society as a whole and each individual in particular. It is not possible for everyone to know everything; but we should not believe that even today's specialised knowledge will remain permanently out of reach of most people.

Information technology has come into being at a most opportune time, for through it new ways of storing, processing and disseminating data have become possible. We therefore have new means of conserving and communicating acquired knowledge.

On the other hand, new technologies give rise both to new possibilities and new demands for mathematical research and for the teaching of mathematics.

Let us examine how the choice of subjects presents itself. It obviously depends upon the future profession of students and on the teaching they receive in their major disciplines.

There are two possible criteria. The first is to choose the subjects that one imagines will be those most useful in the course of the students' future professional life. The second is to teach what is immediately usable by students in their learning of their major discipline.

The second criterion is often what colleagues teaching the major discipline spontaneously demand: the necessary mathematics is that which we need, and it should be supplied at a speed to match the demands of our teaching. It can also correspond to the demands of students who seek a certain coherence between the mathematics teaching and those courses which are utilising mathematics. Such demands can, in many cases, induce mathematicians to improve the choice of topics which they teach, the order of presentation and the way in which they introduce or illustrate mathematical concepts. In can provoke a requestioning of certain habits and of traditional curricula. Nevertheless, it often leads to the formulation of impossible demands (for example, the chemist or physicist may wish to use functions of several variables long before the mathematician has been able to introduce them). Above all, its essential weakness is to ignore the first criterion.

It is this first criterion which should be the fundamental one. But it means that choice must depend upon a future of which we are ignorant. It is, therefore, hazardous and it necessitates, even much more than in attempting to satisfy the second criterion, that mathematicians work in close cooperation with colleagues working in the major discipline.

Confronted with these two criteria, the mathematician can legitimately take the initiative. Very often, what one can and must teach nowadays depends upon discoveries or formulations made in the last thirty years, and, therefore, unknown when many colleagues in other departments were students. The mathematicians are in a position, therefore, where it is up to them to formulate proposals.

The study on the influence of computers (ICMI Study 1) highlighted the rapid development of discrete mathematics and proposed its introduction into the curriculum. Recommendations to this effect have also been made by an ad hoc committee of the American Mathematical Society (see the paper by Martha Siegel). Jack van Lint succinctly presents in this volume a stimulating vision of what discrete mathematics can mean and how it can contribute to the solution of problems with very varied origins. It is a mathematical field which has never had more than a foothold in the curriculum yet van Lint's examples show how interesting such knowledge now is for engineers. It offers a new and interesting way in which to approach certain algebraic topics and aspects of the theory of numbers (in particular, permutation groups and finite fields).

The introduction of discrete mathematics may seem quite alien to the desire expressed by physicists, mentioned elsewhere, to see greater emphasis given to geometry. In fact, geometry - if we understand the term in its broad sense (see, for example, G. Châtelet's contribution to the Selected Papers) - applies to the discrete as well as the continuous. Its importance in physics, and in many other human activities, proceeds, classically, from what physicists call symmetries and mathematicians see as invariants under a group of transformations. According to Châtelet - who makes reference to very remarkable texts by Hamilton and Maxwell - fundamental geometric concepts express actions rather than visions. Thus, vectors, arrows, diagrams express actions as also do fibrations and parallel transports. The significance of geometric intuition is that it represents thought in action. Whatever the choice of geometric concepts to be taught, and this cannot be the same in physics, engineering and architecture, the active aspect of geometrical thought must be preserved.

So far as the choice of subject to teach to physicists is concerned, in particular analysis, the meeting clearly showed that merely enumerating desirable topics leads nowhere and that, on the other hand, it is possible to hold a constructive debate around fundamental questions: disparate subjects or unifying concepts, ad hoc procedures or powerful methods, fidelity to tradition or a modern approach. J.L. Bony openly pleads for unifying concepts and powerful modern methods. The examples he quotes are excellent, but they are only examples. The interest in this approach is not to determine a particular choice, but to establish a method by which one can choose.

It is a striking fact that non-mathematicians - even more than most mathematicians - insist on the power and value of a mathematical mode of thought. The idea is expressed equally forcefully by biologists ("never mind what you teach: teach students to reason well") and by engineers (see, for example, Aillaud, Pollak, Roubine). Let us mention, however, the reservation expressed by Tonnelat: 'Mathematical thinking is a good servant, but a bad master'. The ways of thinking acquired in the course of studies will, however, serve strictly to determine an individual's ability to update his/her knowledge in the years of professional life. By this we mean a kind of continuous retraining. Let us borrow an example from G. Aillaud: an engineer trained in combinatorial arguments will easily adapt to operations research, programming, expert systems, but he would be totally blocked should he wish to move from combinatorics to numerical analysis.

The consequence of this is that in the choice of subjects one must think not only of the knowledge we wish our students to acquire, but also of the modes of thought associated with those topics.

Again it is the experience of engineering departments which particularly attracts our attention to the other side of the coin (cf. Pollak, Siegel, Aillaud): the importance of knowledge itself, as distinct from the ability to make use of it. In the course of his professional life an engineer will rarely have to solve a mathematical problem, but he will frequently have to recognise whether a question confronting him is capable, or not, of being modelled, of being treated mathematically. As in any other science, the important thing for him is to know enough mathematics to be able to consult a mathematician and to derive the most benefit from this.

The consequence of this is that in the choice of subjects to be taught one must think not only of mathematical modes of thought, but of the large range of knowledge required to permit a professional to know what might be mathematically tractable.

Each professional activity demands a particular type of mathematical culture (mathematical literacy) which enables one to be an intelligent user of mathematics. This means an ability (i) to read the mathematics used in the literature of one's profession, (ii) to express oneself using mathematical concepts, (iii) to consult references or competent mathematicians should the need arise. In biology and the human sciences, for example, a need frequently experienced is to be able to use mathematics as a language to express the problems of the discipline. This concept of a mathematical culture or a type of familiarity with mathematics peculiar to each discipline or each profession seems to us better suited to present needs than that, frequently used, of a knowledge of a 'fundamental' range of techniques. Indeed, this knowledge of a range of basic techniques must be modified as mathematical culture is acquired: they are only fundamental with respect to a particular goal, and this end seems to us to be the mathematical culture in itself, varied and variable in the same way as activities and technologies.

Mathematical culture must unite these two distinct aspects: Mathematical modes of thought and a range of essential knowledge.

More fundamental, more practical, less technical; it seems to us that these trends should obtain as a general rule for the teaching of mathematics as a service subject.

III What is being done and could be done. With whom? How?

We have just written of technologies, of sciences, of subjects and of curricula. Yet at the meeting in Udine, the main part of the discussion centred on another aspect: teaching and learning methods, pedagogical experiences and problems, the relationships between teacher and students, and the social function of those engaged in service teaching.

The entry of students to higher education deserves special attention and Fred Simons' paper is devoted to this topic. Let us abstract from it a few topics which he describes.

It is a remarkable and somewhat paradoxical fact that first-year syllabi should be practically the same throughout the world for all service-teaching to students of engineering and the physical sciences. Yet students come to university with very different levels of attainment. Some of them, ill-trained during their secondary schooling, find themselves in difficulty on courses which their peers find accessible. Two solutions have been mentioned: imposing more strictly a minimum level of attainment on entry (a move which would often run against national traditions and mores) and organising special entry programmes. These last, 'booster', courses have given rise to some interesting experiments, but there appears to have been little done in the way of evaluation. In any case an essential effort is required to spell out the prerequisites to first-year teaching by giving precise indications on what subjects will be needed, when they will be used, and in what context. In some places, such clarification of prerequisites, together with the production of complementary documentation and the establishment of booster programmes has already occurred, and been welcomed by students and colleagues. This is also a useful way in which to help and influence secondary schools.

Numerically - whether in terms of the number of students involved, the number of lecturing hours, or the number of lecturers - the teaching of first-year service courses is of considerable significance. It is at this level that the most crucial factors common to all service-teaching commitments arise: student motivation and that of their lecturers. It is at this level that an ill-adapted course can so easily deprive students of an interest in mathematics and can conceal from them the true flavour of, and creativity inherent in, the subject. It is also at this stage that vocations can reveal themselves. This is then a time when the need to exercise 'pedagogical care' is uppermost. It is, clearly, a level at which considerable pedagogical research is needed. One can assume that students of mathematics enter university motivated to study the subject (although how long that motivation will last will depend very much upon the courses they are then given); but for those taking mathematics as a service subject it is usually necessary to create/foster motivation. Yet it is at this stage that lecture rooms are at their most packed - a time when the need for small classes and tutorial groups is at its greatest. Where sequential courses are not set out from the start, it is also the stage at which students will have the opportunity to opt for different career directions - and this brings a corresponding need for multivalent types of mathematics teaching. The first-year, too, is often the time when mathematics is used as a sieve to separate out the 'clever' from the 'dull' students. Assessment then becomes over-important with the result that students devote their major intellectual effort to cramming for the end-of-year examinations.

At the other end of the time-scale, continuing education is now a fascinating field in which there are already many valuable experiments to report. Yet it is still an insufficiently explored area. The account of the development of continuing education in Bell Laboratories is well worth studying (Pollak). Here, motivation is clear. But the teaching approaches most suitable for adults with considerable professional expertise will differ considerably from what is traditional practice for university academics. Students must be given the opportunity, and encouraged, to proceed at their own pace (books, papers, software) and the teacher should assume (more even than elsewhere) the rôle of expert and adviser. The provision of materials suitable for use on continuing education programmes is an urgent need.

The present position so far as motivation to study is concerned is often described in gloomy tones:

(a) users frequently demand a fantastic quantity of techniques, of tricks, while allowing mathematics only a ridiculously small fraction of the students' time;

(b) students bother only with examinations and prefer to learn and apply formulae rather than to develop their reasoning powers;

(c) students couldn't care less about what worried Fourier or what prompted the development of Hilbert spaces - that will not help them to pass the examination!

Perhaps then we should work towards a situation in which mathematics is taught so that:

(a) students should later be able to learn more mathematics by themselves;

(b) students can see how, where and when to apply the mathematics they know.

Let us consider the implications of this so far as the introduction of concepts, mathematical reasoning, the rôle of rigour, the relationship between theory and examples, modelling, and styles of teaching are concerned......

We hope that these excerpts from the introductory paper of Mathematics as a Service Subject will convince you of the need to obtain and study the book and its companion volume, Selected Papers on the Teaching of Mathematics as a Service Subject.

MATHEMATICS
AS A
SERVICE SUBJECT

Edited by A.G. Howson, J.-P. Kahane, P. Lauginie, E. de Turckheim

To be published by Cambridge University Press

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SELECTED PAPERS ON THE TEACHING OF MATHEMATICS AS A SERVICE SUBJECT

Edited by R.R. Clements, P. Lauginie, E. de Turckheim

To be published by Springer-Verlag

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ICMI STUDY SERIES

The Spanish translation of the '1990's' study has now been published as Las Matematicas en Primaria y Secundaria en la decada de los 90, Mestral Libros, ISBN 84-7575-207-1. Readers of Spanish may also be interested in a companion volume published by the same publishers, Aportaciones al debate sobre las Matematicas en los 90 (ISBN 84-7575-227-6), which gives the response of Spanish mathematics educators to the original '1990's' discussion document.

Arabic, Catalan and Japanese translations of School Mathematics in the 1990s (Cambridge University Press) are now in preparation, as are Arabic and Japanese translations of The Impact of Computers and Informatics on Mathematics and its Teaching, the first volume in the ICMI Study Series.

INTER-AMERICAN COMMITTEE ON MATHEMATICAL EDUCATION

At the 7th Interamerican Conference on Mathematics Education, held in Santo Domingo last July, the Assembly of National Representatives elected a new Executive Committee with Eduardo Luna, from the Dominican Republic, as President. Vice-Presidents are Fidel Oteiza, from Chile, and someone from the U.S.A. to be appointed by the U.S. National Commission. The Secretary is Angel Ruiz from Costa Rica and Members at Large are Martha Villavicencio, from Peru, Carlos Vasco, from Colombia, and, "ex-oficio", the past-President Ubiratan D'Ambrosio, from Brazil, and the ICMI Vice-President Emilio Lluis, from Mexico.

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(Readers are asked to notify the Secretary of any errors in this list)

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AUSTRIA	Professor F. Schweiger, Institut fur Didaktik der Naturwissenschaften, Universität Salzburg, A5020 Salzburg Hellbrunnerstr. 34, AUSTRIA.
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LUXEMBOURG	Professor L. Kieffer, 1 Rue JeanJaurès, 1836 LUXEMBOURG.
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MALAYSIA	Professor C.K. Lim, Department of Mathematics, University of Malaya, Kuala Lumpur, MALAYSIA.
MEXICO	Professor Emilio Lluis, Cincinnati 23, Cd. de los Deportes, 03710, D.F. MEXICO.
MOZAMBIQUE	Not known.
NETHERLANDS	Professor J.H. van Lint, Department of Mathematics, Eindhoven University of Technology, P.O. Box 513, 5600 MB-Eindhoven, NETHERLANDS.
NEW ZEALAND	Dr. G.H. Knight, Dept of Mathematics & Statistics, Massey University, Palmerston North, NEW ZEALAND.
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PAKISTAN	Dr. M.R. Siddiqui, University of Islamabad, 77 E. Satellite Town, Rawalpindi, PAKISTAN.
PHILIPPINES	Professor B.F. Nebres S.J., Ateneo de Manila University, P.O. Box 154, Manila, PHILIPPINES.
POLAND	Professor Z. Semadeni, Institute of Mathematics, Polish Academy of Sciences, ul. Sniadeckich 8, Warszawa 1, POLAND.
PORTUGAL	Not known.
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SINGAPORE	Dr. Cheng Kai Nah, Department of Mathematics, University of Singapore, Kent Ridge, Singapore 0511, SINGAPORE.
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SOUTH KOREA	Professor Han Shick Park, Faculty of Mathematics, Korea National University of Education, Chongwon-kun, Chungbuk, 320-23, SOUTH KOREA.
SPAIN	Professor Claudi Alsina, Departament de Matemàtiques I Estadistica, Escola Tècnica Superior D'Arquitectura, Universitat Politècnica de Catalunya, Avgda, Diagonal, 649, Barcelona 28, SPAIN
SWAZILAND	Mr. E.D. Bicknell, William Pitcher College, P.O. Box 1473, Manzini, SWAZILAND.
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Cochairmen:	Professor Ubiratan D'Ambrosio, Coordenador General dos Institutes, Universidade Estadual de Campinas, Caixa Postal 1170, 13100 Campinas, SP., BRAZIL.
	Professor Christian Houzel, Université de Paris-Nord, 11 rue Montecelli, 75014 Paris, FRANCE.
Newsletter	Professor Charles V. Jones, Department of Editor Mathematical Sciences, Ball State University, Muncie, Indiana 47306, U.S.A.

IOWME

The Executive Committee of ICMI recently took the decision to recognise IOWME as an affiliated study group of ICMI.

The International Organisation of Women and Mathematics Education came into being as a result of a meeting at ICME 3 in Karlsruhe in 1976 which discussed "Women and Mathematics".

Its purposes are:

1) to bring together those who are concerned with the subject of women and mathematics,

2) to circulate among members any research already available concerning women and mathematics,

3) to found branches in as many countries as necessary, and

4) to encourage further research into

   (a) why so few women study mathematics, and

   (b) what are the job possibilities for those who qualify.

At a meeting of IOWME held during ICME 5 in Adelaide, a need was expressed for some means of maintaining contact among IOWME members during the years between ICME congresses. Hence the decision to circulate a Newsletter twice annually, in April and October. The Newsletter contains:

discussion papers on topics which might form the focus of sessions on women and mathematics at the next ICME congress;

reports of activities, meetings, conferences, intervention programmes, or research projects related to women and mathematics education;

articles about the position and problems of women in mathematics or mathematics education in different countries, particularly developing countries;

information about new publications in the area of women and mathematics, with reviews if possible and information about where to obtain them.

Membership of IOWME has continued to expand amongst those concerned with mathematics education (men and women) and the impact of gender upon it. The issue is now regarded as a substantial and serious one and the contents of the Newsletter reflect this. The newsletter is circulated through the local IOWME Co-ordinators who are:

National Coordinators

Zelda Isaacson	Department of Teaching Studies, Polytechnic of North London, Prince of Wales Road, London NW5, U.K.
Sherry Fraser	EQUALS, Lawrence Hall of Science, University of California, Berkeley, CA94720, U.S.A.
Carole Lacampagne	Mathematics Department, University of Michigan-Flint, Flint, Michigan 48503, U.S.A.
Helen Wily	8 Chevron Place, Christchurch 4, NEW ZEALAND.
Gila Hanna	Department of MECA, Ontario Institute for Studies in Education, 252 Bloor Street West, Toronto, Ontario, CANADA M5S 1V6.
Pat Hiddleston	Principal, Durban Girls' College, 586 Musgrave Road, Durban 4001, SOUTH AFRICA
Rosaline Gobio Lamin	Bo Teachers College, Bo, SIERRA LEONE.
Maire Rodgers	University of Ulster at Coleraine, Cromore Road, Coleraine, Co. Londonderry, BT52 1SA, NORTHERN IRELAND.
Ruth Djordjevic	St. Vincents College, Rockwall Crescent, Potts Point, N.S.W. 2011, AUSTRALIA.
Ingegerd Palmer	Department of Mathematics, Royal Institute of Technology, S-100 44 Stockholm, SWEDEN.
Kirsten Tingleff	Classensgade 40, 3 2100 Kobenhavn, DENMARK.
Nitsa Movshovitz-Hadar	Department of Education in Science and Technology, Technicon, Haifa, ISRAEL 32000
Heleen Verhage	Research Group OW & OC, State University of Utrecht, t.a.v. Heleen Verhage, Tiberdreef 4, 3561 GG Utrecht, THE NETHERLANDS.

Christine Keitel-Kriedt	Technische Universität Berlin, Fachbereich 3 Mathematik, Strasse des 17 Juni 135, D-1000 Berlin 12, FEDERAL REPUBLIC OF GERMANY
Josette Adda	Université Paris 7, 2 Place Jussieu, Paris 75664 Cedex, FRANCE.
Magadlena Mok	City Polytechnic of Hong Kong, Argyle Centre, Tower II, 700 Nathan Rd., Mongkok, Kowloon, HONG KONG.
C.F. Oredugba	10 Ladele Close, Box 7694, Secretariat B.O. Ibadan, Oyo State, NIGERIA.
Prof. Hei-Sook Lee	Mathematics Dept., Ewha University, Seoul, REPUBLIC OF KOREA.

In addition IOWME has held meetings at the annual PME conference. This has provided an opportunity for members to exchange information and to discuss their research.

At ICME 6 in Hungary, IOWME will conduct four sessions as a Topic Area on Women and Mathematics as well as hold its business meeting, at which the next officers will be elected for the four year period.

The current officers are:

Convenor Leone Burton	Thames Polytechnic, Avery Hill Site, Bexley Road, Eltham, London SE9 2PQ, U.K.
Correspondent Erika Kuendiger	Faculty of Education, University of Windsor, 401 Sunset Avenue, Windsor, Ontario, CANADA N9B 3P4
Newsletter Editor Mary Barnes	Mathematics Learning Centre, University of Sydney, N.S.W. 2006, AUSTRALIA.

XXVIII INTERNATIONAL MATHEMATICAL OLYMPIAD, HAVANA, CUBA, 1987

Interest in International Mathematical Olympiads continues to grow. At the XXI IMO in London, in 1979, 21 countries participated. This year, 8 years later, twice that number took part. As usual, the IMO provided an opportunity for a number of countries geographically close to the host country to compete for the first time. Next Year's IMO, in Australia, will provide a similar opportunity in another part of the world.

Teams of six competitors were invited, with two accompanying adults. As usual, one of the adults acted as Leader for the team and joined the International Jury. The first task of the Jury is to select the six problems for the contest, confirm their wording, and see them translated into the languages of the competitors. The problems are divided into two groups. The competitors work the problems on two successive mornings and $4\frac{1}{2}$ hours is allowed for the three problems on each day.

Once they had completed their work on the problems the team members were entertained with a programme of recreational activities, swimming and sight-seeing. The teams were all accommodated in the V.I. Lenin school, which has residential accommodation. The school's design encouraged members of different teams to meet and mix with members of other teams.

While the team members were relaxing the Leader and Deputy were busy assessing the problem scripts. At an IMO teams work the problems in their own languages, and the scripts are first assessed by the team's Leader and Deputy. Standardisation of the assessment is achieved by teams of coordinators who check the first assessments, ensuring that marks are awarded on consistent principles.

The IMO is an individual competition, but inevitably there is much interest in each team's performance. This year the best team performance was Romania, with a total score of 250 points from a maximum of 252 - a record achievement. Individual prizes are awarded. This year First prizes were awarded only to those who scored full marks. In all, about half of the 236 competitors were awarded a prize. About 12 of the competitors were girls.

The beautiful Cuban weather contributed to everyone's enjoyment of the IMO, but, as usual, it was the warmth of the welcome from our hosts and their generous hospitality, that we shall remember.

The success of the IMO, evidenced by the increasing number of participating countries, brings with it some problems. The mathematics curricula of the various countries differ in many ways, so the problems selected may favour some countries and disadvantage others. Inevitably, the spread of achievement amongst the competitors has widened as more countries have joined. For the host country there are a number of possible difficulties.

Attendance at an IMO is by invitation. It is customary for each host country to invite all countries that have participated in previous IMOs, as well as their own neighbours who may wish to compete for the first time. Once the teams and adults arrive at the IMO, the host country meets all expenses for accommodation, meals and entertainment. In addition, it is not always easy to find sufficient accommodation for the number now taking part.

The long term planning which is now required of the host country, together with the need to ensure that an IMO is held each year, led to the formation of the IMO Site Committee. This committee has the task of ensuring that an IMO takes place each year, advising potential host countries of some of the matters that they must consider. At present we expect the IMO to be held in the following countries in the years stated.

Australia (1988), West Germany (1989), China (1990), Sweden (1991), East Germany (1992).

John Hersee
(Secretary, IMOSC)

Dr. Edwin Maxwell

and

Dr. Tamás Varga

The deaths have recently occurred of Dr. Edwin Maxwell, aged 80, and Dr. Tamás Varga, at the age of 67.

Dr. Maxwell was a member of the ICMI Executive Committee from 1954 to 1958 and Secretary of ICMI from 1971-74.

Dr. Varga, although never a member of the ICMI Executive Committee, was, like Dr. Maxwell, well known to, and greatly respected by, the international mathematics education community. Both gave much to mathematics teaching in their own countries and elsewhere, both were delightful personalities, and both will be remembered by many with great affection.

A.G. Howson

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