# ICMI

## Bulletin

## of the International Commission on Mathematical Instruction

## No. 15

## January 1984

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

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The International Commission on Mathematical Instruction

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# COMMISSION INTERNATIONALE DE L'ENSEIGNEMENT MATHÉMATIQUE (INTERNATIONAL COMMISSION ON MATHEMATICAL INSTRUCTION)

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# ICME 5

## Adelaide, Australia 24-30 August 1984

We begin by reminding readers that the second and final announcement concerning the Fifth International Congress on Mathematical Education has now been published. Copies may be obtained from

ICME 5
GPO Box 1729
Adelaide 5001
South Australia
Australia

A reduced registration fee of $(Aust)140 will apply to all those registering and paying on or before 29 February 1984. The regular registration fee will be $175 and for those paying on or after 1 July 1984 the fee will rise to 195 Australian dollars.

Information regarding the organisers of the theme and action groups was given in Bulletin 13 and the names of the plenary speakers in Bulletin 14. (This information along with much else can be found in the Second announcement.)

The following information supplements that provided in the earlier Bulletins.

Organisers have now been appointed for eight topic areas, and two study groups have accepted responsibility for organising a series of presentations for their areas of interest.

1. Evaluation, Examination and Assessment.

   Professor Kenneth J. Travers,
   University of Illinois.

2. Theory of Mathematics Education.

   Professor Dr. Hans-Georg Steiner,
   Universität Bielefeld.

3. Research and Teaching.

   Professor Bent Christiansen,
   Royal Danish School of Educational Studies.

4. Language and Mathematics.

   Dr. Ed. Jacobsen,
   UNESCO.

5. Women and Mathematics.

Professor Joanne Rossi Becker,
Virginia Polytechnic Institute and State University.

6. Competitions.

Mr. Peter J. O'Halloran,
Canberra College of Advanced Education.

7. Teaching of Geometry.

Professor Izzie Weinzweig,
University of Illinois, Chicago.

8. Teaching of Probability and Statistics.

Professor Lennart Råde,
Chalmers University of Technology and University of Göteborg.

In addition to poster sessions, project displays and commercial exhibitions, there will be two ongoing workshops throughout the Congress - one at primary level and the other at junior secondary level.

As well as the Congress itself, several specialist groups will be holding conferences in Australia in the weeks and days around the Congress. The International Study Group for the Psychology of Mathematics Education will hold its Eighth Annual Conference at the University of Sydney from 16-19 August. There will be a one-day conference for those interested in the theory of mathematics education in Adelaide on Friday, August 31.

Two other groups will hold adjunct conferences. The International Study Group for the History and Pedagogy of Mathematics will convene in Adelaide on August 23 and 24, and the Research Council for Diagnostic and Prescriptive Mathematics is meeting in Melbourne on August 21 and 22. The latter group will meet at Monash University which will also host a conference for administrators of the mathematics curriculum (18-23 August).

Other conferences of interest to ICME5 participants are

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| August 13-17 | University of Western Australia, Perth, Western Australia.<br>Twelfth Australasian Conference on Combinatorial Mathematics and Computing. |
| August 30-September 2 | University of Queensland, Brisbane, Queensland.<br>Conference on Computer Assisted Learning in the Tertiary Environment (CALITE). |
| September 2-5 | Macquarie University, Sydney, New South Wales.<br>Second Australian Computers in Education Conference. |

# ICMI SYMPOSIUM IN WARSAW

An ICMI Symposium on the theme "What Should be the Goals and the Content of General Mathematical Education" was held in Warsaw from 17 August to 22 August, 1983, during the International Congress of Mathematicians.

The chairpersons were: A.Z. Krygowska, Cracow and H.G. Steiner, Bielefeld. The Symposium was opened by the President of ICMI, Jean-Pierre Kahane, and by H.G. Steiner.

The speakers and their themes were:

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|---|---|
| P. Damerow (West Berlin) | Mathematics for all: ideas, problems, implications. |
| A.Z. Krygowska (Cracow) | Components of mathematical activities which should play a significant role in mathematical education for all. |
| D. Wheeler (Montreal) | Mathematization as a basic orientation for the teaching of mathematics for all. |
| J. de Lange (Utrecht) | The place of geometry in the teaching of mathematics for all. |
| W. Walsch (Halle) | Mathematics for all. The role of proof. |
| A. Ralston (Buffalo, NY) | Implications of a new university mathematics curriculum on school mathematics. |
| B. Cornu (Grenoble) | The role of calculators in mathematics for all. |
| H.-G. Steiner (Bielefeld) | The process of mathematization and the social dimension of mathematics. Epistemological and didactical considerations. |
| E. Jacobsen (Unesco, Paris) | The society's demand on mathematics teaching. |
| A.G. Howson (Southampton) | Motivation and attainment. |
| Sekou Traore (Brazzaville) | The situation of mathematics in Africa. |
| E. Lluis (Mexico) | Fixing goals of mathematical instruction. |
| A.I. Weinzweig (Chicago) | The work of the Second International Mathematics Study. |
| G. Brousseau (Bordeaux) | Some effects which caused the failure of the new math reform. |
| S. Turnau (Cracow) | Why mathematics courses do not teach mathematics. |

A concluding panel discussion was chaired by B. Christiansen (Copenhagen).

# MATHEMATICS FOR ALL

## IMPRESSIONS FROM THE ICMI SYMPOSIUM AT WARSAW *)

During the 1950s and 1960s, a development took place in most countries towards a school structure which could be suitable for mathematics teaching of all pupils from the first year of school. Correspondingly, official decisions and external frameworks were established during the following decade; but a difficult problem area concerning the rationale behind mathematics for all, its content in a broader sense, and the working methods of teachers and learners remains.

One of several reasons for this is that the accumulated professional experience concerning mathematics teaching have their roots in the earlier school structure, where mathematics were taught to a selected group at intermediate and later levels. In the first wave of the Modern Math Reform these new difficulties were not realized. But in the seventies the question about the "identity" of mathematics for all became a problem area of international scope, and it was increasingly realized that to identify a mathematics teaching which may be "appropriate" for everyone in sufficiently many respects would be a very difficult process, which would call also for investigations and decisions about role and placement of the calculator and the computer.

The world-wide concern with this whole problem field was illustrated clearly by the Symposium which was convened by ICMI this summer during the International Congress of Mathematicians at Warsaw. It brought together up to 200 congress participants in the course of its four 4-hours sessions, at which fifteen invited speakers contributed to an analysis of the theme: What should be the goals and content of general mathematics education?

The names of the speakers and the titles of their presentations are shown elsewhere in this issue of the Bulletin. The list of themes displays the complex problem field for consideration, and these presentations, all given by colleagues internationally recognized for their knowledge and experience concerning mathematics edu-

*) This is not a report of the Warsaw Symposium, but rather some personal observations and some related opinions expressed by the author, Professor Christiansen, who participated in the Symposium and chaired the concluding panel discussion. The views expressed are those of the author, and not necessarily those of the ICMI Executive Committee.

cation, confirmed clearly that no general answers, no common strategy, and certainly no easy patent solution is emerging from the international debate of "general mathematics" in these years.

However, I do not regard this as an indication of lack of power or valuable resources within the discipline of mathematics eduaction. Rather, the meeting showed me that this discipline is coming into maturity. Thus:

- the debate of the difficulties (identifying aspects and possibilities);
- the estimates of present states and of ongoing developments;
- the reports about ways in which future steps are envisaged;

are to be conceived of as tools for use in the individual national context. It is in that context "next steps" are to be planned and then performed in the reality of school. Not as final steps, but as actions which will lead to reactions and thus provide background for further attempts to shape and guide the educational process in better accordance with the given societal hopes and intentions.

* * *

The special constraints and demands on <u>mathematics education for all</u> in the developing countries were brought to attention by two of the speakers.

Thus, Sekou Traore (Brazzaville) argued for the necessity of a mathematics education for all geared to the needs of society, and to the needs of the individual in his further development, whether this takes place in the educational system or during his later functions in society. Accordingly, mathematics for all must be identified in its close relationship to mathematics teaching within the given educational system, and this must in a sense be the case regardless of the present state of that system.

Similarly, E. Lluis (Mexico) pointed to specific general perspectives characteristic for developing countries. First, he made the important observation that knowledge of goals for mathematics education, as these were seen in statements about trends in highly developed societies, could lead to inappropriate planning in developing countries attempting to follow the "fashion" inherent in such statements. Second, he pointed to the fact that in most developing countries only a very small percentage of the children receive more than a few years schooling.

* * *

It was my task to chair a concluding debate in a panel consisting of most of the speakers. Four problem areas had in my opinion played an important role in the previous presentations, and I illustrated these areas by displaying the following lists of key questions:

I Structure of school

Basic common course? Number of years?
Branching (number of branches, levels)?
Earlier levels' relationship to next level?
Examinations?

II Process/product

Process/activity/situations/project work?
Organizing principles?
Support/guidance of teachers?
Evaluation, control?
Knowledge acquired in terms of mathematics content?

III Role and place of reasoning and proof

Local organization?
Systematization of a domain?
Deductive sequences?
Mathematization as modelling of situations?
Role of textbooks?

IV Importance of a common national/international core

Common use of language, terminology, symbols?
Basic content? Structure?
Definitions, systematic development?

When presenting these themes and addressing selected questions to specified panel members, I stressed that we were not at this symposium attempting to reach any synthesis or to formulate common answers. The ensuing debate served accordingly mostly to clarify personal positions now seen - and often modified - in the perspectives of views and proposals presented by other speakers.

I shall allow myself to offer here - as an illustration - some of my personal comments to the above themes. These statements are slightly enlarged versions of my own contributions to the panel debate and they include some references to views expressed by the speakers at the Symposium.

Mathematics for all should not be "a minimal course", as Steiner expressed it. Rather, it should be called "mathematics for everyone", as suggested by Wheeler, and later interpreted by me in the panel debate as mathematics for each individual.

There must be a basic common course, and it should cover a substantial number of years. In my opinion 7-8 years, but others (like Madame Krygowska) would say 8-9, because this common course would fulfil important social functions. It should provide background for learning mathematics, it should lead to conceptions of mathematics, of knowing, and of learning, which are different from person to person, but which are also shared to some large extent. It should provide background for co-operation and communication within and about mathematics. It should provide respect for other persons in such co-operation and communication.

Intentions and hopes such as these were behind the growth of the comprehensive school in Europe through the sixties and seventies, and they remain - even under the pressure of the recession - as strong socio-political factors.

But clearly, there is a limit to the number of years in which we should let the common course proceed. Hence, branching (and in this connection teaching of different types of mathematical content under different goals and intentions) must follow after the basic common course. The earlier level should - in my opinion - in some broader sense provide background for the next level of school. However, there is a danger that reference to usefulness at later stages becomes a substitute for motivation related to the actual stage of learning. And similarly, I look with grave concern at the trend (now supported by the recession) to use tests and examinations as means to decide the individual's route through school mathematics.

The problem area III is also of central importance in the identification of mathematics for all. Thus, it is of increasing concern, if we have lost important mathematical values in Europe in our change from the earlier élitarian system to the comprehensive school?

There are reasons to accept that learning was predominantly instrumental for the large majority of the selected group, which was taught mathematics at intermediate level in the previous system. But it is beyond dispute that an important transfer of norms and values took place for a small group of the students through their work with central areas of the classical curriculum such as these:

(i) The agreement on the use of symbols and terminology more of less strictly linked to formal definitions of concepts (and to learning of these by heart).

(ii) The repeated dealing with reasoning linked to explicit fromulation: (1) of the premisses; (2) of the result to be obtained; and (3) of the arguments leading from the premisses to the conclusion.

(iii) The systematic development of the subject matter areas, in which aspects of the deductive methods were clearly interwoven.

Granted, we "know" today that concepts are not acquired through definitions; that learning to prove need not be furthered by reproduction of proofs established by others; and that the deductive building of subject matter may represent only a so-called didactical inversion, which so often have been described as a fatal mistake by Freudenthal. But could we not - in the light of what we know today about the construction and development of human knowledge, and about relationships between personal and shared knowledge - motivate the students for reflective work of systematic and deductive character? And could we not make the "classical values" of mathematics accessible to students by use of new types of mathematical activity? In the panel debate, this question was answered in the affirmative e.g. by Madame Krygowska, Steiner, and Brousseau.

Throughout the Warsaw Symposium a basic interest was demonstrated in the mathematical working process (in addition to its products), an interest in mathematical activity, in the use of situations, in mathematizing conceived in different ways. In fact, most speakers took occasion to stress the importance of these process aspects for mathematics teaching and learning.

However, an increased emphasis on the learner's activity, e.g. of an exploratory and problem solving nature, was strongly advocated by didacticians in the seventies; but it was already then (as expressed in chapters I-III in "New Trends in Mathematics Teaching", Volume IV) recognized that activity in itself does not automatically result in mathematical learning and that learning "as intended" through activity calls for new competences and functions on the part of the teacher.

Accordingly, the question was raised at the Symposium about the ways in which activity and process may become valuable tools for the "general" teacher; tools which may support learning as intended of both process and product aspects of mathematics. This problem leads to very basic questions concerning organizing principles for mathematics teaching and, more generally, concerning the education of mathematics teachers. The new ICMI studies will hopefully provide an improved background for the investigation of these specific questions and of the general theme of the symposium.

Bent Christiansen

# ICMI-JSME REGIONAL CONFERENCE IN MATHEMATICS EDUCATION

This regional conference took place in Tokyo, October 10-14 1983, under the joint sponsorship of ICMI and the Japan Society of Mathematical Education (JSME). Other collaborating bodies were the Japanese National Commission for UNESCO, the National Institute for Educational Research, the Mathematical Society of Japan, the Ministry of Education of Japan, the Tokyo Metropolitan Board of Education, the National Federation of Educational Research Organisations, and the Commemorative Association for the Japan World Exposition.

The Conference Chairman was Professor S. Iyanaga, a former President of ICMI. The organising committee was under the chairmanship of Professor T. Kawaguchi of Tokyo University, the Honorary President of JSME.

The Conference was the main regional activity of ICMI between ICME4 (1980) and ICME5 (1984), and catered primarily for the countries of east Asia. However there was wider international participation: countries represented including Australia, Bangladesh, Brazil, China, Denmark, Federal Republic of Germany, France, Hong Kong, India, Indonesia, Israel, Korea, Malaysia, Nepal, New Zealand, Pakistan, Philippines, Poland, Singapore, South Africa, Soviet Union, Sri Lanka, Sudan, Thailand, United Kingdom, USA and Vietnam. In all, 73 out of the 380 participants were from outside Japan.

The organisation of the Conference, which took place at the Komaba Eminence, Tokyo, was the best of any international meeting that I have attended. Excellent,even fierce, time-keeping by chairmen ensured that later speakers in each session had adequate time, while still ensuring opportunities for questions and a limited amount of discussion. The official conference languages were Japanese and English, with a very high standard of translation available in both directions. The general theme was that of school mathematics in and for changing societies. Various aspects of this theme which featured strongly in the talks and discussions included consideration of the widespread belief that rapid scientific and technological development required greater mathematical competency in future citizens. This belief did not go unchallenged, however, various participants arguing that in many industries technology was being used to replace the need for some of the mathematical skills previously sought in employees. Examples given ranged from the use of automatic measuring devices to obviate the need for the use of traditional methods of measurement, to the introduction of automatic change-giving machines in supermarkets. What is needed in schools is the development of a broad mathematical understanding in all students, such as a 'feel' for numbers and for shape, and the ability to estimate sensible answers to problems, rather than the mastery of a large number of specific techniques, since the latter may still not include those necessary in any particular job even at a relatively low level of employment.

The expansion of mathematical applications, often in unexpected fields, provided another challenge to the school curriculum. The emphasis placed on applied mathematics in schools varied widely among the countries represented. The general view was that much greater effort should be made to demonstrate the usefulness of much of the mathematics taught in schools, not only because of the subject's importance in all fields of science and technology but also because of the motivating effect on students of seeing how the mathematics they are studying is used in practice.

Many of the conference papers discussed the impact on school mathematics of calculators and computers. This proved to be another field in which experience varied widely between countries. In many there is considerable reluctance on the part of teachers to allow their students to use calculators, even at secondary level, while in others they are so commonplace that they are no longer a matter for comment. Similarly, the spread of school computing facilities has been slow in many of the countries represented, even among those such as the host country where finance is not the major constraint. At the other end of the spectrum, every secondary and nearly every primary school in the UK now has at least one microcomputer, and the implications of this for both subject matter and classroom methodology is a major area of current research.

All questions of school curricula, however, are overshadowed in many of the developing countries present by the explosive increase in student population. This brings in its wake not only the questions of finding enough qualified teachers, but also the pressing need to diversify the mathematics curriculum, particularly at secondary level, to cater for the widening range of achievement among students now in the schools.

Altogether this was a very worthwhile conference, excellently organised, and participants left eagerly looking forward to ICME5, at which many of these key issues will be explored at an even wider international level.

Bryan Wilson

The plenary speakers at the Tokyo Conference were

Professor T. Kawaguchi, "Fundamental Philosophy on Curriculum Making of Mathematical Education".

Professor B.F. Nebres (but presented by a colleague in Professor Nebres' absence), "Problems of Mathematics Education in and for Changing Societies - Problems in South East Asian Countries".

Professor B. Christiansen, "New Trends in Mathematics Education from a World-Wide Viewpoint".

Dr. E. Jacobsen, "UNESCO'S Activities in the Field of Mathematics Education and a Critical Estimation on the Results of the Tokyo Conference".

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# PROPOSALS CONCERNING THE PLANNING OF FUTURE ICME PROGRAMMES

A marked feature of the four ICMEs which have been held to date, and that planned for Adelaide this coming August, is their great diversity of aim and organisation. This can be ascribed to a number of factors, for example, the national characteristics of the host countries. Whilst some degree of diversity in the planning of ICMEs is clearly desirable, it has become increasingly apparent that if the administrative load on host countries is to be decreased (thus permitting a greater number of countries to act as host), and if international involvement in the planning of the Congresses is to be effectively developed, then new planning procedures will have to be adopted. (We note that programme planning for the Adelaide Congress was officially delegated by the ICMI Executive Committee to an International Program Committee of 34 members, of which 10 members appointed by the Executive Committee (4 from Australia) formed a Core Committee. This planning included the appointment of organisers (two or three) for each of the sections.)

The proposals below were made following the meeting of the Executive Committee held at Warsaw in August, 1983 (see Bulletin 14). National Representatives, and any other interested readers of the Bulletin, are requested to send any comments, criticisms and suggestions which they might wish to make on these proposals to the Secretary by 15 June, 1984 at the very latest. Revised proposals will then be produced by the Executive Committee and will be presented to the Assembly of National Representatives to be held at Adelaide for ratification.

## The Proposals

The proposals are based on the assumption that an ICME must serve four major purposes: it must act as

(i) a means whereby educators from different nations can explain and show what is happening in mathematics education in their own countries, can learn what is happening in other lands, and can share experiences for their mutual benefit;

(ii) a forum for the exchange of information on what are currently identified as the most significant problems of mathematics education in various countries of the world;

(iii) a means whereby mathematics educators can learn of, and benefit from, recent advances in mathematics, other relevant disciplines, and technology;

(iv) a show-case for work of a recognised professional standard and, as such, a means whereby workers within the discipline/study of mathematics education can set and raise standards.

For administrative purposes it would seem advantageous to separate Congress activities into two distinct classes (whilst realising that aims (i) to (iv) can be sought within each). We refer to these below as

A-type activities:

plenary sessions;

sub-plenary sessions arranged within sections;

working groups;

and

B-type activitites:

national contributions;

project and group presentations;

poster sessions:

## Administration

### 1. The IPC

It is proposed that the ICMI EC should appoint an International Programme Committee consisting of 10 people, of which two to four would come from the host country. The ICMI EC would also appoint one of the 10 as Chairperson of the IPC - not necessarily a member from the host country. These appointments would be made at the EC meeting held at the preceding ICME or failing that within three months of that meeting.

The IPC would have the duty of approving the academic programme of the ICME.

It would, in particular, have the responsibility for:

(a) determining the number of plenary sessions to be held and for inviting the requisite number of speakers. (It is accepted that one plenary lecture will be given by the President of ICMI on a topic of his/her choice. There will also be opening and closing sessions. During the latter a report on ICMI's activities will be presented. There is a need for the IPC to identify plenary speakers and to issue invitations at least two years prior to the ICME.)

(b) determining the sections into which congress activities will be divided. Once these sections have been decided the IPC will appoint for each section a panel chairperson and four further panel members. The IPC will also determine how many sub-plenary sessions and working groups will be allotted to each section.

(c) appointing a committee (Committee B) of seven members (including the chairperson and at least one IPC member) to be responsible for organising the B-type activities and for ensuring that suitable provision is made for accommodation, technical back-up, etc.

When appointing section panels the IPC should seek to ensure as wide an international representation as possible and to secure an appropriate balance between members from developed and developing countries. However, the professional competence and knowledge of panel members must always be the over-riding consideration. National Representatives would be invited (via the Bulletin, ICMI General Assembly, etc.) to submit suitable names (together with a brief description of the person's background and contribution to mathematics education). Appointment of section panels should be completed three years prior to the ICME.

Committee B will comprise mainly of members from the host country. However, the IPC will nominate at least one member from a non-host country and, in addition, a member involved in the organisation of B-type activities at the preceding ICME. Committee B shall be appointed at least 30 months prior to the ICME.

2. Section panels

Each section panel will be responsible for:

(a) submitting the appropriate number of names of sub-plenary speakers and titles to the IPC for its approval (to be done at least 15 months prior to the ICME);

(b) submitting the appropriate number of topics to be studied in working groups to the IPC for its approval, and also nominating leaders for these groups (to be done at least 12 months prior to the ICME).

It is expected that section panels will select sub-plenary speakers who have distinguished themselves through their research and/or developmental work, critical analyses, etc. within the preceding four years. The need to keep an international balance whilst maintaining professional standards is again stressed.

It is expected that the working groups will frequently be led by panel members.

In all cases the Chairperson of the section-panel shall have the deciding vote in decisions taken by that panel.

3. Committee B

This committee will prepare a programme for B-type activities for approval by the IPC at least 18 months prior to the ICME. (Here 'programme' indicates a structure and not a detailed account - clearly the names of countries and individuals wishing to contribute to sessions may not be known until later.)

4. Publications

The publishing policy is ultimately to be decided by the National Organising Committee (which will be legally responsible for the financial aspects of the Congress). However, it should be determined after consultation with the IPC and the ICMI EC.

5. Affiliated study groups of ICMI

These would have no official standing so far as A-type activities are concerned. However, it is hoped that those closely connected with these groups would be represented on the Congress committees and appropriate section panels. The statutory duty of each study group to report on its work during an open session during each ICME would remain.

6. Publication of committee members' names

The names of those serving on the IPC and the section panels will be published in the ICMI Bulletin.

Appendix

It has been suggested that a valuable new kind of B-type activity would be a series of talks (four, say) devoted to mathematics education in selected countries. The countries would be chosen to provide a geographical, social and economic balance and would vary from ICME to ICME. The object would be to present a survey of major developments in each country: of problems identified, and of work initiated and completed.

Invitations to participate in the series would be issued by the ICMI EC and the meetings would be chaired by the President of ICMI or his/her alternate. These talks would be in addition to the more general national contributions.

Comments and opinions on this suggestion are also sought.

A.G.H.

# SEVENTY FIVE YEARS OF ICMI*

(continued)

It was not until 1952 that the Commission resumed its activities. Now, however, it became attached to the newly created International Mathematical Union (IMU) as a sub-commission of this latter body. It was at the first general assembly of the IMU in Rome, 1952 that the decision was taken to reconstitute ICMI and a special committee of five (including Henri Fehr), was appointed to draw up a plan of work in preparation for the ICM to be held in Amsterdam in 1954. Additional members were then co-opted to form an ICMI Executive Committee under the Presidency of Albert Châtelet. Twenty-seven countries established National Committees for Mathematics communicating with IMU and each of these committees had a national sub-commission which was assigned the task of collaborating with ICMI.

The new Executive Committee met for the first time in January 1954 when it was agreed that reports would be made at the Amsterdam ICM on two issues:

(1) The part of mathematics and the mathematician in contemporary life;

(2) Mathematical instruction for students between the ages of 16 and 21.

The choice of the first theme was in marked contrast to much that had gone before: attention was now directed not so much at current practice, but at the changing social and scientific contexts within which mathematics curricula had to be designed. The war had, for good or ill, disclosed what Behnke described as 'new possibilities, new opportunities for applying mathematics'. Biometry, econometry and cybernetics were new areas which offered 'the possibilities or work and activities for the mathematician'. The ICMI inquiry, it was urged, should 'not neglect any aspects of the problems being either of intellectual, scientific, social kind or of the nature of practical application'.

At the 1954 ICM the General Assembly of IMU agreed terms of reference for ICMI including procedures for the election of its officers: at that time the IMU assembly elected the President and ten 'free' members of the Commission, whereas the two Vice-Presidents and the Secretary, who, with the President, formed the ICMI 'Bureau', and three further executive committee members were elected by the 'free' members and the national representatives. A meeting to elect officers and to determine a plan of work for the next three years was held at Geneva in July, 1955.

It was proposed that the Commission should study three themes

(i) a continuation of that prepared for Amsterdam on the contemporary role of mathematics and mathematicians;

(ii) Mathematical teaching up to the age of fifteen years (thus complementing the second Amsterdam theme);

(iii) the scientific basis of mathematics in secondary school teaching and the scientific training of secondary school mathematics teachers;

and report on these at the 1958 Edinburgh ICM.

Behnke, who spoke to the second proposal stressed the need carefully to listen to psychologists and didacticians when discussing mathematics teaching up to the age of fifteen. Whilst his views received support, it was urged that the mathematician's voice should also be heard equally on this issue. The debate was more significant in retrospect than it might have appeared at the time, for very soon a whole wave of curriculum reform was to break - what has now become known as the 'new math'. The collaboration between mathematicians and psychologists which the 1955 meeting thought essential did not take place in the majority of countries. Expectations and hopes went unfulfilled; the mathematicians blamed the educationists and the educationists blamed the mathematicians.

The third theme was thought ill-balanced and it was agreed to drop the reference to teacher training.

At this point in the debate there was a new contributor; one who was to play an increasingly important role in ICMI affairs in the following two decades and who without doubt was to have the greatest influence on ICMI's development - Hans Freudenthal.

Freudenthal was worried by the very general nature of the themes suggested: there was the risk that national sub-commissions would respond to them with descriptions of organisation and administration, rather than with accounts of a scientific nature. It was the duty of ICMI to promote research and study of this latter scientific kind and one way in which the danger of which he warned might be averted was to suggest limited and well-defined subjects for inquiry, for example,

the need for a preliminary, intuitive approach in the teaching of geometry;

the help which psychology could bring to the early stages of mathematics teaching and learning;

the importance of teaching of geometry;

logic and mathematics teaching.

It was essential that the themes chosen should encourage work in depth and should encourage schoolteachers to call upon their experiences.

Freudenthal's arguments were well received, but at that time led only to the substitution of the proposed theme (i) by:

> a comparative study of the methods used in introducing geometry.

The Geneva meeting, then, although having little immediate impact upon the way in which ICMI proceeded, was of great importance in sowing the seeds of future changes. The traditional 'survey' came under attack for not promoting that work in depth - research and study - which ICMI, it was argued, should foster. (It is surprising how infrequently the word 'research' occurred in ICMI writings before that date.) That didacticians and psychologists might have valuable contributions to make to mathematics education was also argued more strongly than hitherto.

Another significant event at the meeting was the election of the Indian, Ram Behari, to the executive committee, the first member to come from outside Western Europe and North America. Akizuki, from Japan, narrowly failed to be elected on that occasion, but he was to join the committee four years later together with A.D. Alexandrov (the first member from the USSR). ICMI was now becoming more truly international and this fact was emphasised when it was officially represented by Marshall Stone at a meeting held in Bombay in 1956 - probably the first major international conference on the teaching of mathematics and science to be held in Asia.

Now, however, significant changes and innovations began to take place in mathematics education in several countries. The nations of Europe were beginning to enjoy economic prosperity and educational systems were expanding quickly. Many colonies of France and the United Kingdom were becoming (or had, like India, become) independent. With independence came the desire to 'catch up quickly' with their past rulers, and education was seen as a vital factor in national development. Within mathematics education enormous changes were taking place. The effect of Bourbaki on university curricula was enormous, Birkhoff and Maclane's A Survey of Modern Algebra (1941) which the American Mathematical Monthly had declined to review when it was first published, on the grounds that it was 'advanced' work, now became a much-used introductory undergraduate text. Calls were made for a radical revision of school mathematics courses and, in the USA, a timely aid to fund-raising was provided in 1957 by the first flight of the Soviet Sputnik. This resulted in the launching of the nationally-financed School Mathematics Study Group, an off-shoot of two conferences of mathematicians drawn from the major US universities. Elsewhere, particularly in Belgium, radical changes

in school mathematics were being proposed. In 1959 the first of the Arlon seminars took place, on the subject of topology in schools; later seminars were to consider such topics as analysis and vector spaces. In November of that same year came the most influential of all the seminars, that held at Royaumont under the aegis of the Organisation for European Economic Cooperation. The Royaumont seminar, then, concerned only a minority of those countries which belonged to ICMI. Nevertheless, it was chaired by the then ICMI President, Stone, and its two Vice-Presidents, Behnke and Kurepa, and the three Western European members of its relevant Executive Committees - Frostman, Maxwell and Piene were present at the meeting. Nowadays, Royaumont is usually remembered for Dieudonné's polemical talk and there is no doubt that this was to have an enormous effect on the reforms and experiments which were to follow. Yet those who have not taken the Royaumont report down from their bookshelves for some years might be surprised by the relatively mild (and perceptive) tone of many of the contributions and by the useful survey of contemporary practice in participating countries which it provides.

Royaumont was followed in 1960 by an OEEC seminar in Yugoslavia at which Stone, Kurepa, Artin, and Choquet amongst others (including teacher trainers and schoolteachers) helped prepare guidelines on how new material might be introduced to the grammar school (lycée, gymnasium) curriculum.

Not surprisingly, therefore, 'modern mathematics' occupied a prominent part in the discussions held at the 1962 ICMI in Stockholm. There the three topics chosen for discussion were:

1. Which subjects in modern mathematics and which applications of modern mathematics can find a place in programmes of secondary school instruction?
2. Connections between arithmetic and algebra in the mathematical instruction of children up to the age of 15.
3. Education of the teachers for the various levels of mathematical instruction.

(To be concluded)

* The first part of this brief history of ICMI was published in Bulletin 14. A fuller account, complete with bibliographical references, can be found in Educational Studies in Mathematics, vol 15, No.1, 1984.

# JOURNALS ON MATHEMATICS EDUCATION

## 3. ZDM

### Zentralblatt für Didaktik der Mathematik/International Reviews of Mathematical Education

There has been a rapid growth of publications on research in mathematical education, experimental reforms in various countries, new pedagogical concepts and insights, new ideas, and new teaching concepts.

The problem of keeping up with developments within this complex, of furthering the scientific treatment of individual problems without unnecessary duplication, and of co-ordinating the work of various groups and institutions on a national and international scale has, in the last few years, been clearly recognized and discussed, e.g. at the recent International Congresses on Mathematical Education.

The central periodical for mathematics teaching Zentralblatt für Didaktik der Mathematik (ZDM) helps to solve this problem and will enable interested persons to find material in the flood of published documents. ZDM's aim is to provide teachers, researchers, students, librarians with easy access to information on literature from all fields of mathematical education and related areas.

The periodical was founded on the combined initiative of the Mathematics Teaching Centre, founded in Karlsruhe in 1968, and the Ernst Klett Publishing House, Stuttgart. The fact that the International Commission on Mathematical Instruction (ICMI) was prepared to take some responsibility for the contents of the periodical ensured international collaboration. An editorial committee has been set up; in addition, well-known mathematicians and experts in mathematics teaching in Germany and abroad are members of an advisory board which contributes to the planning of the periodical.

The journal appears every two months, each issue containing an articles section and a documentation section.

The articles section consists of the columns "analyses", "book reviews" and "information", in which central problems of mathematical education are discussed and information between mathematical educators is exchanged. This section includes also detailed reviews of selected publications, reports on projects and conferences and details of important forthcoming events (congresses, conferences, seminars) dealing with mathematics teaching. The further development of this section depends on the readiness of the mathematical educators to cooperate as authors and suppliers of information. Please send proposals for contributions to the editorial office of ZDM. Synoptical articles which might reflect future trends and summarize views of central problems of mathematical didactics are especially appreciated.

The main part of Zentralblatt für Didaktik der Mathematik is dedicated to documentation. It is an abstracting service and reference tool in the field of mathematical education providing ready access to current publications on topics such as mathematics instruction, basic pedagogical and psychological problems, elementary mathematics and its applications as well as computer science education. There is also information on such fields as recreational mathematics, games or home computers.

The information presented is extracted from all relevant documents published mainly in German-, English- and French-speaking countries. (The coverage of East European literature will be started now.) This includes journal articles (from more than 250 journals), textbooks, schoolbooks, audiovisual media, teaching aids, reports, dissertations, conference papers and syllabuses. The publications are announced in the documentation section by bibliographic data and one abstract each in German and English.

The bibliographic part is followed by an index section, facilitating pinpointed retrieval of documents according to different criteria: author, subject, corporate source/affiliation, journal title.

Since 1978 the German "Fachinformationszentrum Energie, Physik, Mathematik" is a coeditor of ZDM.

In the Fachinformationszentrum, ZDM citations have been stored on EDP carriers since 1978, and a machine-readable database in mathematical education has been set up. This bibliographic database can be searched by computer and is available for literature retrieval according to your particular requirements.

ZDM appears bimonthly. One volume consists of six issues with approx. 160 pages per issue. About 500 publications will have been selected for announcement in the documentation section of every issue.

Subscription rate: DM 175, - per year (volume) plus postage and handling; price per issue DM 35,-.

Sample issues are available. Please send your order or request to your bookseller or directly to

Ernst Klett Verlag, Postfach 809, D- 7000 Stuttgart 1. F.D.R.

Material for publication, general editorial correspondence and books for review should be addressed to ZDM. For more information about our literature information and the databases available, please ask for our detailed brochure on information services. All communications to be addressed to:

Zentralblatt für Didaktik der Mathematik, Fachinformationszentrum Energie,Physik,Mathematik,GmbH, D-7514 Eggenstein-Leopoldshafen 2, F.D.R.

Gerhard König, Editor.

# MATHEMATICS AND LANGUAGE (II)

## Latin America

Although somewhat homogeneous in respect to official languages, Latin America offers a strong linguistic diversity. Besides large linguistic groups, mainly in the Andean countries and Central America, there are many minority groups. In Brazil alone, about 200 different languages are known. With the commitment to universal elementary education endorsed by the Ministries of Education of all the countries of the region, a serious problem is posed, particularly for Science and Mathematics Education.

Several projects of Mathematics Education in indigenous languages are under way. But, except for research conducted within these projects and for research under way by linguists and anthropologists, no major comprehensive effort has been taken to understand the deep interrelation between cognitive processes and language in the special case of Latin American native languages. Also, ethnomathematics, which is much related to pre-school numeracy, has only recently been brought to academic attention and become the subject of research.

In order to assess the situation with respect to curriculum development in Science and Mathematics in Latin America and to find out the state of research on the interrelationship of language and cognition with emphasis on Math and Science, a Symposium will be held in Leticia, Colombia, at the end of March 1984, sponsored by this Committee and the Interdisciplinary Center for the Improvement of Science Education (CIMEC), with financial support from the Organization of American States and other international agencies.

Among the projects which will present their current efforts we mention the Puno project in Perú [1] , the research in the aymara logico-linguistic structure [2], the education project of the Schuar Federation [3] and the several projects of the Summer Institute of Linguistics in the Amazon Region. Other projects, identified in the context of Education for culturally differentiated groups, will also be represented [4].

[1] Proyecto Experimental de Educación Bilingue-Puno, INIDE, Ministerio de Educación, Lima, Perú.

[2] Ivan Guzman de Rojas; Problematica Logico-Linguistica de la Comunicación Social con el pueblo Aymara, IDRC - MR 66s.

[3] Maurizio Gnerre: Dita, Parole e Numeri: Note sulla crescita della serie di numerali in Schuar, La Ricerca Folklorica, nº 4, 1980, p. 43-39.

[4] Inés Chamorro et al, eds.: Alternativas de Educación para grupos culturalmente diferenciados, OAS, Washington (in press).

We would appreciate being contacted by researchers doing work in closely related areas.

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# I S G H P M

International Study Group on the Relations Between the History and Pedagogy of Mathematics.

The aims of this group, which was affiliated to ICMI in 1976, are described quite succinctly in its title. Interests of members span all levels of education, and cover all levels of pedagogical and historical training. ISGHPM is jointly chaired by Bruce Meserve of the University of Vermont and Roland Stowasser of the Technische Universität Berlin. Meetings of the group often take place at annual meetings of the NCTM in the U.S.A. The group mounted special sessions at the International Congress of Mathematicians in Warsaw in August 1983, and is planning to arrange suitable activities at ICME5 in Adelaide in August 1984.

A particularly important part of the group's activities is the preparation of materials suitable for classroom use. Thus, for example, at its meeting in April, 1983 at the University of Michigan, the use of source material from the rare books collection was discussed, and material distributed. It is hoped that classroom kits will be prepared containing background source material, bibliographical information, sample lessons and instructions, problem sets and suggestions for further reading, designed to be of use to teachers without historical training.

The group's activities are publicised in its Newsletter (North American Edition) edited by Charles H. Jones, IHPST, Victoria College, University of Toronto, Toronto, Canada M5S 1K7. Requests for copies should be addressed to the appropriate member detailed below.

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# EDUCATING AMERICANS FOR THE 21ST CENTURY

A plan of action for improving mathematics, science and technology education for all American elementary and secondary students so that their achievement is the best in the world by 1995. A report to the American people and the National Science Board, National Science Foundation, Washington, DC 20550, 1983, vols, pp 124,251.

These two important volumes form the final report of the Commission established to review precollege education in mathematics, science and technology in the USA (see Bulletin 13, p28).

The major recommendations for Federal action are:

1. The President should immediately appoint a National Education Council made up of representatives from a cross-section of national interests. This Council should provide leadership in developing, coordinating and implementing plans to improve and maintain the quality of the Nation's elementary and secondary education in mathematics, science and techology.

2. The Federal government should finance and maintain a national mechanism to measure student achievement and participation in a manner that allows national, state and local evaluation and comparison of educational progress.

3. The unique national role of the Federal government in ensuring access in its broadest sense to educational opportunity must continue.

4. The Federal government should encourage and finance, in part, the establishment of exemplary schools or programs in mathematics, science and technology in each community throughout the Nation to serve as examples and catalysts for upgrading all schools.

5. The Department of Education and the National Science Foundation should support and facilitate the dissemination of information to help build this national network of exemplary programs.

6. The Federal government has a responsibility to ensure that such (teacher) training is available and should provide funding for in-state teacher training programs in mathematics, science and technology.

7. The National Science Foundation should provide seed money to develop and establish state-wide or regional on-site teacher training programs using the new information technologies.

8. The National Science Foundation, which has recognized expertise in leading curriculum development, should again take the leadership role in curriculum evaluation and development for mathematics, science and technology. The National Science Foundation should set up a process to evaluate existing curricula, identify good curricula, disseminate information, act as a clearing house and promote the development of guidelines for new curricula as necessary.

9. Research into the processes of teaching and learning should be supported with Federal funds at both the basic level and the level of classroom application.

10. The National Science Foundation....should again take the leadership role in evaluating the status of developments in educational applications of new technologies. This should include such actions as determining needed initiatives, supporting prototype demonstrations, disseminating information on model materials and practices, and supporting research on integration of educational technologies with the curriculum.

11. Science broadcasts are an important and cost-effective vehicle of informal learning, which warrant continued and substantial Federal investment and support.

12. Federal regulation of commercial (broadcasting) stations should include a required period of educational programming for children.

13. The Federal government should provide supplementary support for museum education activities in mathematics, science and technology at a level that will encourage a rich spectrum of activities and options.

14. Private industry and government agencies should create programs and opportunities which let children see science and technology in actual operation in their plants and installations.

The cost of the scheme for the first year it is in effect is budgeted at $1.51 billion.

The two volumes consist respectively of the Commission's recommendations and source material emanating from a number of special meetings. Thus the second volume contains, for example, reports on 'The Mathematical Science Curriculum K-12: What is still fundamental and what is not', 'The uses of Educational Technology' and 'Research on cognition and behavior'.

A further US report of less specific interest to mathematics educators, but which serves very well to illustrate the context and atmosphere in which the NSB's Commission met and reported was also published in 1983. It was A Nation at Risk: The Imperative for Educational Reform, the report of the National Commission on Excellence in Education. The main body of that report is reprinted in Notices of the American Mathematical Society, Vol. 30, No.6, October, 1983, pp580-590.

EUROPEAN SEMINAR ON MATHEMATICS IN ENGINEERING EDUCATION

A seminar on the above topic will be held under the auspices of the European Society for Engineering Education at the University of Kassel, FRG, from 8-10 March, 1984.

Plenary sessions will be held on topics such as 'Developments in Teaching Methods', 'The Impact of Computers on the Curriculum'. There will also be time allocated for discussion and for poster sessions.

Further details can be obtained from N. C. Steele, Department of Mathematics, Coventry Polytechnic, Priory St., Coventry CV1 5FB (Tel. (0) 203-24166 ext. 568), or from K. Spies, University of Kassel, Fachbereich Mathematik, Wilh. Allee 71, 35 Kassel, West Germany.

## ICMI BANK ACCOUNTS

Please note the change in the account number for the ICMI dollar account. All the accounts are held at t he Southampton University Branch of Barclays Bank (20-79-32). The account numbers are:

| | | |
|---|---|---|
| Sterling | current : | 90514500 |
| | deposit : | 71270478 |
| | | |
| Dollar | deposit | 38567217 |

# LATE NEWS

The planning committee for the ICMI study on the effect of the computer and informatics on mathematics and its teaching at the university and pre-university level met in Paris on 7 and 8 January, 1984. Preliminary plans were prepared for the international symposium which is to be held (most probably in or near Strasbourg, France) from 30 March to 4 April 1985. Clearly the subject of the study is of considerable worldwide interest and it will be impossible to accommodate all those who would wish to attend the 1985 symposium. The planning committee hopes, however, that this constraint will not prevent many national commissions and individuals from contributing to the study. The committee intends to produce a short discussion paper in connection with the study and this will be sent to National Representatives and others who receive this Bulletin in March, 1984. We hope that this document will be widely circulated and will stimulate the preparation of reports and papers which can be considered at the symposium and possibly included in its Proceedings. It is intended to reserve some places at the symposium for those who indicate by their reaction to this discussion paper that they have a valuable contribution to make to the work of the study.

The editors of the Bulletin are pleased to have recently received contributions to the Mathematics and Language series from the National Representatives of Nigeria and the USA. These will appear in Bulletin 16 which it is intended to publish in June 1984. We hope that other readers will also send us articles on this or any other topic which they believe will have international appeal.

NOTE: This Bulletin is prepared with the help of a generous grant from UNESCO. 