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1. Elections at the IMU General Assembly, 1974

The General Assembly of the International Mathematical Union was held in August 1974 at Harrison Hot Springs; near Vancouver, Canada. At the General Assembly, elections to ICMI took place as follows.

Professor S. Iyanaga of Japan, at present Vice President of ICMI, was elected to be President of ICMI for the period 1975-78. Professor Iyanaga has appointed Professor Y. Kawada of Japan as Secretary of ICMI for the same period. He has also appointed Professor B. Christiansen of Denmark and Professor H. G. Steiner of the Federal Republic of Germany as Vice Presidents.

Members-at-large of ICMI were elected as follows: Begle (USA), Bhatnagar (India), Castelnuovo (Italy), Christiansen (Denmark), Iyanaga (Japan), Kudryatsev (UUSR), Lelong (France), Neumann (Australia), Smàdani (Poland) and Suranyi (Hungary). Members ex officio are the retiring President of ICMI, the Secretary of IMU and the representative of IMU on the ICSU Committee on Science Education. There is no change in the remaining members - that is, the national representatives - except that Professor Iyanaga has been replaced by Professor Kawada as national representative of Japan.

2. Report by the President (Sir James Lighthill)

It is a pleasure to report in this Bulletin on four very successful ICMI symposia held in the second half of 1974 (see section 3 for the details). I myself can confirm from personal knowledge the satisfactorily high quality of two of these, having been in the chair at the Vancouver Symposium 'Evaluation of Modern Mathematics Curricula' and having given one of the introductory papers at the Nairobi Symposium 'Interaction between Linguistics and Mathematical Education'. My successor as President of ICMI, Professor Iyanaga, attended not only the Vancouver Symposium but also the Bielefeld Symposium 'Teaching of Geometry' on which he has commented extremely favourably to me, and he of course played a most important role in the Tokyo Symposium 'Curriculum and Teacher Training for Mathematical Education'.

Experience with the Nairobi and Tokyo Symposia has confirmed the value of ICMI's new policy of holding major Regional Conferences - in each case jointly with other organisations. The Nairobi Regional Symposium for Africa, and the Tokyo Regional Conference for East Asia and Australasia, were able to bring to each of the regions concerned the advantages of a major pooling of ideas and experience from many different countries faced with certain regional or otherwise common problems in mathematical education.

In the light of these experiences I am delighted to be able to confirm now the project (mentioned in earlier Bulletins) of a Regional Conference for South Asia to be held in India in December, 1975; once more, jointly between ICMI and other bodies. Details are given in section 4; here I would like to record my special thanks to the International Mathematical Union for making a special grant to ICMI to facilitate its sponsorship of this important meeting concerned with problems of integrated mathematics curriculum development in developing countries.

The ICMI Executive Committee, meeting in Vancouver on 21 August 1974, unanimously resolved to adopt the arrangements described in section 5, for affiliation of IACME (Inter-American Committee on Mathematical Education) to ICMI. The general ICMI policy of holding Regional Conferences will be implemented in Southern and Central America entirely through the medium of this relationship with IACME. The ICMI Executive Committee has already acted on item (iii) in the Memorandum of Affiliation by making to IACME a proposal for a Symposium on teacher training with special reference to problems of teacher training in developing countries of Latin America.

The Executive Committee has sought also to continue the policy of active ICMI concern with problems of primary education in mathematics. Accordingly, it strongly supported the proposal of the Polish National Sub-commission for an ICMI symposium to be held in Warsaw from 25th to 28th August 1975 on a particularly interesting question: that of the elementary teaching of combinatorics, probability and statistics in primary schools. Details are given in section 4.

The Executive Committee is also anxious to plan international discussion meetings to be held jointly between those concerned with education in mathematics and those concerned with education in the many sciences which make use of mathematics. Possibilities along these general lines are to be explored through discussion with the ICSU Committee on the Teaching of Science.

In the meantime, active planning of the 3rd International Congress of Mathematical Education, to be held in Karlsruhe from 16th to 21st August 1976, is well under way. This is expected to be a meeting on a very large scale, with a membership of at least 2000, at which every kind of question concerned with mathematical education will be discussed. In particular, all the matters which have been the topics of ICMI Symposia since the 1972 Congress will be reconsidered in depth at the 1976 Congress in the light of the reports of those Symposia.

This is the fourth and the last of the ICMI Bulletins to be issued by Dr. Maxwell and myself since the decision to produce a series of ICMI Bulletins was taken at the Exeter Congress in September, 1972. We hope that the series has been found useful. Future Bulletins will be issued from Tokyo by the new President and Secretary of ICMI, Professors Iyanaga and Kawada, who are planning to increase the circulation to around 500 copies. They have asked me to mention that any National Sub-commission wishing to propose any item for inclusion in the ICMI Bulletin should send such a proposal to

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Hongo, Bunkyo-ku
Tokyo, Japan

It is with great confidence that I wish ICMI every success during the years to come under Professor Iyanaga's able presidency.

James Lighthill

3. Reports on Recent Symposia

ICMI Symposium at Vancouver (Canada) 22-24 August 1974

Theme: Evaluation of Modern Mathematics Curricula

The symposium was devoted primarily to a discussion of the methods available for evaluation of new curricula, although some tentative results of the application of some of these methods of evaluation were also noted. The first two days were devoted to presentations on the theme from eleven countries: Canada (the host country), USA, Brazil, India, Japan, USSR, Poland, Hungary, Germany, Denmark and UK. The last day was concerned with discussion and summarisation.

In Canada, education is the responsibility of each separate province. Ontario adopted modern mathematics curricula around 1964 and abolished external examinations in 1967. With 80% of children staying in school to age 18 and having a free choice of courses (on a course credit system) a natural evaluation method is based on observing the proportions opting for mathematics courses; these indicate that the subject is more than holding its own. In another province (Saskatchewan), coming much later to modern mathematics, evaluation through questionnaires to teachers had been tried but the response rate was much too low. British Columbia used an evaluation based on the Stanford arithmetic reasoning and computation test, with indications that a forwardness of over a year relative to the average US student had been lost during the six years after modern mathematics curricula had been introduced. Quebec, after using much material of French origin, reported somewhat similar results.

Several US evaluation studies on a large scale were briefly described. A widespread belief that acquisition both of cognitive skills and of attitudes in mathematics depends on the individual teacher much more than on any other variable was supported by massive statistics, which showed also that this variable 'teacher quality' is not well correlated with any objective data about the teacher's training or knowledge! The importance of textbooks is supported by a very close observed relationship of what is acquired to 'what is in the textbooks' rather than to any other material that may have been presented. No significant support for special aids (film, TV, maths laboratories, team teaching) had emerged from the evaluations. Modern mathematics with emphasis on discovery methods appeared to have made young people in the USA better able to think and less able to compute.

The idea of evaluation by 'determining which books sell' was suggested by Brazilian experience where sales of abstractly oriented material were stated to have plummeted two years ago in response to a general disillusionment with such material coupled with a growing belief that a developing country needs a particularly practical approach to mathematics teaching, integrated as far as possible with science teaching. The rapid introduction of profession-oriented secondary schools had been tending to accelerate this process.

India has for a long time been introducing in selected groups of schools curricula that are 'modern' both in method and content while at the same time emphasizing practical applications. Comparative studies demonstrate greater alertness and penetration in the pupils of these selected schools relative to the schools not selected for these changes, although admittedly several psychological (rather than curriculum) factors could contribute to such a difference.

Japan is another country where 80% of the age group now reaches 'senior high school' (immediate pre-university level). Under the wise influence of Professor Iyanaga and others a subtle middle course between 'traditional' and 'modern' curricula has been followed. This course has, however, been introduced simultaneously with the huge expansion of secondary education and the inevitable lowering of the standards that has gone with that, and evaluation of the effects of the two developments is proving exceedingly hard to disentangle.

The USSR is another country deeply concerned with evaluating its material from the point of view of practical skills as well as of theoretical understanding. A new commission under the chairmanship of Academician Kolmogorov has recently begun a major new evaluation exercise.

Polish experience has confirmed the view that significant changes in teaching methods can only be achieved along with changes in curriculum content. Opinion surveys of teachers and pupils show that it is such new classroom methods which are widely preferred and regarded as important. In Poland, also, evaluation of training for primary school teachers has shown the great superiority of methods which take the student through the subject matter along the same routes as the pupils will follow (preceding introduction of concepts and formalism by extensive concrete exercises, etc.) to break down the diffidence that may have been generated by inferior mathematics teaching in a student's own early years.

A modern system of primary teaching of mathematics was introduced a decade ago in a sample of Hungarian schools. Now the children in these schools are significantly better than others even when tested in traditional mathematics, or in reading and writing! It is again important to remember, however, the non-curriculum factors operating where selected schools and teachers are involved. Experience in the Federal Republic of Germany, in fact, showed improvements in attainments when a new mathematics curriculum was introduced in a selection of primary schools, followed much later by an observed loss in average attainment after the same curriculum had been introduced in all primary schools.

Germany is, of course, another country facing an enormous expansion of secondary education. Developments planned to deal with this include the concept of a Grundkurs (oriented more practically) for about 90% of the pupils and a Leistungkurs in greater depth (and oriented more theoretically) for about 10%.

Denmark in its approach to evaluation emphasizes 'affective' goals (attitudes etc.) and aims at a strong interaction between teacher and student which is relied upon as the prime method of student evaluation. The modern curricula introduced in 1964 were revised in detail in 1971 after a thorough evaluation leading

to a recognition of the need for a reduction in content to give more time for concept formation built up in depth from detailed work making use of the child's immediate experience and environment.

The UK contrasted four different approaches to evaluation, whether of whole projects or of texts and other materials. Emphasis was placed on the essential need for 'formative' evaluation: the experimental process of extended classroom trial of materials while they are being generated and finalised. By contrast, 'experimental' evaluation where certain schools are selected for use of new curricula and methods, and then compared with a 'control' group of other schools, was regarded with suspicion because of bias by the morale-boosting effect of being selected and trained to use new material. 'Summative' methods using masses of statistical data face two dangers: either the samples are not large enough to give statistical significance where so many variables are involved (including the 'teacher quality' variable which can so easily swamp the others) or the samples are so vast that it is impossible to maintain proper standards of accuracy and reliability in the collection of raw data. These dilemmas have led to greater emphasis on a 'clinical' or 'anthropological' approach to evaluation where classrooms are selected as randomly as possible and the investigator, behaving almost like an unnoticed 'fly on the wall', tries to observe in as much depth and detail as possible all aspects of the transfer of attitudes, knowledge and skills taking place and its dependence on the materials used.

Evidently, many obstacles to the objective evaluation of modern mathematics curricula still exist. The massive raising of the school leaving age all over the world is not the least of these. High-powered salesmanship by purveyors of materials is another! As to the results of the evaluations that have taken place, they can in most respects be regarded at present as inconclusive. Nevertheless, in the context of an international symposium it is of interest to note that almost complete unanimity was expressed on one subject: the general ineffectiveness of imported materials, except where they have been subjected to a lengthy and detailed process of modification and adaptation to the general environment of children in the country where they are to be used.

In the concluding discussion, methods of evaluation of students' attitudes, knowledge and skills were subjected to particularly detailed scrutiny because such evaluation often forms one necessary stepping-stone towards an objective evaluation of materials (that is, curriculum projects, classroom texts and educational aids). Among the most important goals of modern mathematics curricula are the improvement of student attitudes to the ideas of mathematics and to what the student can do with them. Evaluations had, indeed, suggested some very positive achievements in this sphere by modern mathematics curricula. These were not always maintained at age 14-15, however, where indeed a certain statistical deterioration in attitudes to school work was common to all subjects of study. Furthermore, attitudes regarding some particular goals of mathematical work, such as accuracy, had not necessarily been improved.

The right level of 'drill and practice' work, for acquisition of skills of mathematical manipulation in elementary algebra and arithmetic, was the subject of extended discussion. There was widespread agreement that excessive drill and practice in traditional mathematical teaching had had a

seriously adverse effect on attitudes to mathematics, as well as incurring the danger of teaching skill without any understanding. The pendulum might however have swung too far in the other direction in many modern mathematics curricula: understanding without any skill was an equally unbalanced goal. A partial retracing of steps towards some intermediate level of drill and practice would produce a better balance between attitudes and understanding on the one hand and knowledge and skills on the other.

The important interactions between mathematics teaching and science teaching were much stressed in this context. Science teaching was held to be greatly facilitated by a reasonable level of manipulative skill in elementary algebra as well as arithmetic. Future developments of 'hand calculators' may offer partial substitutes for students' detailed arithmetic skills but not for their skills in algebraic manipulation.

Lastly, strong emphasis was placed on teacher training as an essential pre-requisite for effective mathematical education, particularly where new methods and curricula are introduced; these, indeed, render in-service training just as important as pre-service training. Without it there is a grave danger that new material is simply taught by old methods, although the new methods are widely regarded as more important than the new material. Again, loss of effectiveness in a proportion of teachers who feel insecure or 'threatened' by the introduction of new methods or curricula can be minimised by proper training measures. The aim was summed up by one speaker as the training of teachers skilled equally in facilitating the acquisition of a satisfactory general level of mathematical attainments (affective and cognitive) by a majority of pupils, and in helping a modest proportion of pupils to reach high levels of attainment.

Extensive additional work on methods of evaluation of modern mathematics curricula and on the analysis of their results is evidently needed. It is hoped, in particular, that important further steps in this direction may be taken at the 3rd International Congress of Mathematical Education in 1976.

The Nairobi Symposium on "Interactions between Linguistics and Mathematical Education", 1-11 September 1974

The ICMI Bulletin no. 3 gave a rather extensive description of the planning of this Symposium, which was originally envisaged by ICMI at the Exeter Congress and which was subsequently prepared and convened under the joint sponsorship of UNESCO, CECO and ICMI.

The Symposium brought together 28 specialists, each serving in his personal capacity. Out of this group, 15 specialists were nationals of nine African countries - Ghana, Kenya, Lesotho, Liberia, Nigeria, Swaziland, Tanzania, Uganda and Zambia. All participants were specialists in at least one of the two fields, mathematics education and linguistics, and in several cases participants also had special knowledge in science education.

The work of the Symposium took place in plenary sessions and working groups during nine working days. In the first plenary session, following the inauguration, presentations covering the background and the objectives were given by Professor Sir James Lighthill and Professor Bent Christiansen. The three main objectives were (cf. ICMI Bulletin no. 3):

- (1) To contribute to the systematization within the field of these difficulties in mathematical education which pertain to linguistics, and further to analyze these difficulties and their mutual relationships;
- (2) To identify problems calling for further studies and research, and to indicate how and by whom such activities might be put in bond;
- (3) To identify pedagogical approaches that may help the learner of mathematics to overcome those of his difficulties which relate to linguistic aspects and to indicate how such approaches might be put into practice.

It was agreed that participants should be divided into two working groups. Each group would consider the total input into the Symposium (the invited papers and presentations, the papers presented by participants during the Symposium, the outcomes of the plenary discussions and the programmes presented during visits to educational institutions in Nairobi). However one group would concentrate its considerations on the objectives (1) and (2), while the other would concentrate on (3) and (2). Each group would develop, for presentation at the closing sessions, a group report identifying the findings of the group and its suggestions and recommendations. This plan was carried out in a remarkably successful cooperation between the specialists from each of the two fields, linguistics and mathematical education, and the results will be found in very substantial chapters of the final report.

In the plenary sessions of the earlier working days background papers, provided for the participants in advance of the Symposium, were presented. The titles will indicate the scope of the discussions: "The development of the discipline of linguistics" (Professor Peter Strevens); "Mathematical education in the context of the Symposium" (Bryan J. Wilson of the British Council and Bent Christiansen of UNESCO); "Linguistic problems encountered by contemporary curriculum development projects in mathematics" (Robert K. Morris); "Tanzania's experience in and efforts to resolve the problem of teaching mathematics through a foreign language" (Dr. G. Mmari, Tanzania); "Language and mathematical concepts and practice in an African society" (Professor C. O. Taiwo, Nigeria); "The medium of instruction in primary schools in Zambia" (S. Chimuka and R. Zulu, Zambia); "Aspects of sociolinguistic research" (Professor Michael A. K. Halliday); "Aspects of psycholinguistics in the context of the Symposium" (Ruth Clark); "Mathematics, language and effective teaching - pedagogical implications" (Dr. John Gay). Each speaker aimed in his brief presentation at highlighting such aspects of his paper which he found most relevant on the background of the preceding work of the Symposium. Discussions in plenum and/or in working groups followed each presentation. Towards the end of the Symposium a number of brief reformulations were written by authors of the invited papers. These reformulations will be included in the report of the Symposium.

In concluding plenary sessions reports from the two working groups were presented for discussion, and agreement on the form and content of the report was reached. In the last plenary session the final draft report was presented and accepted. The responsibility for the editing of the very extensive document was conferred upon an editorial committee. The report is

expected early in 1975. It describes the origin, purpose and scope of the symposium, and outlines its progress identifying the background of the presentations and the discussions. The report finally outlines the findings of the Symposium, and gives a summary of its many recommendations which are concerned both with future studies and research and with more immediate pedagogical implications.

Bent Christiansen

Report on the ICMI-IDM Symposium on the Teaching of Geometry,
Bielefeld, 16-20 September 1974

ICMI and the Institute for Didactics of Mathematics of the University of Bielefeld, FRG jointly organized a conference on the teaching of geometry which was held at the Center for Interdisciplinary Research of Bielefeld University. The prior information about this conference had been channeled through ICMI Bulletin no. 3 and through various national and international journals.

This conference was attended by 110 mathematicians and mathematics educators from 13 different countries (Czechoslovakia, Belgium, FRG, France, GB, Ireland, Japan, Luxembourg, The Netherlands, Poland, Sweden, Uruguay, USA). The programme contained the following lectures.

H. J. Vollrath, Würzburg: The place of Geometry in the Teaching of Mathematics. An Analysis of Recent Developments.

W. Servais, Morlanwelz: A Comprehensive and Modern Teaching of Geometry.

R. Stowasser, Bielefeld: Problemorientierte Zugänge zur Geometrie.

G. Pichert, Giessen: Die Bedeutung der Darstellenden Geometrie für die Mathematikausbildung.

H. Freudenthal, Utrecht: Geometrie in der Grundschule.

A. Bishop, Cambridge: Visual Mathematics.

S. Iyanaga, Tokyo: A Combined Geometry - Algebra Curriculum for Japanese Secondary Schools.

G. Ewaldy, Bochum: Anschauung und Axiomatik, dargestellt an einer Begründung der absoluten Geometrie.

T. Fletcher, Darlington: Geometrical Insight and Solution of Problems.

G. Glaeser, Strasbourg: Inzidenzgeometrie im Dienste einer progressiven und polykonkreten Pädagogik.

Related to each lecture were discussions in working groups and a plenary discussion. Some of the basic matters of concern in the discussions were the following: What is geometry and how should it be approached and organized in the teaching of mathematics at the various levels? What role should problem solving, local ordering and axiomatics play in this organization? What background should a teacher have in order to be well prepared for geometry teaching? Can one identify a minimum of knowledge and insight concerning geometry a student should have when leaving secondary school?

Congress languages were English and German. There were simultaneous translations between the two languages during the lectures.

A special welcome was addressed to participants by Professor Kunle, Karlsruhe, who is the president of the FRG.

The conference proceedings are being edited by and will be available from the Institute for the Didactics of Mathematics, University of Bielefeld, D4801 Jöllenbeck, Heidsiekerheide 94, West Germany.

H. G. Steiner

ICME-JSME Regional Conference in Tokyo (Japan) 5-9 November 1974

Theme: Curriculum and Teacher Training for Mathematical Education

The Organising Committee under the Chairmanship of Professor Z. Kobayashi arranged a programme as follows:

Lectures at Plenary Sessions

Professor M. H. Stone: "Teaching of Mathematics, Some Questions, Some Answers".

Dr A. G. Howson: "Some Experience of Curriculum Development in England".

Academician S. L. Sobolev: "The Experience of Siberian Mathematical Olympiads 1962-73".

Professor B. H. Neumann: "Teaching Teachers of Teachers".

Professor A. Lichnerowicz: "But et difficultés de l'expérience française de renouvellement de l'enseignement mathématique".

Mr J. Vanniasingham: "Modern Mathematics Program and Inservice Training".

Professor H. G. Steiner: "Modern elementary algebra as a significant component in a contemporary secondary school mathematics curriculum".

Professor Y. Akizuki: "How to educate the spirit of mathematics".

Working Groups for Papers and Discussions

A: Mathematics in Primary School

B: Mathematics in Secondary School

C: Preparing Teachers of Mathematics in Training Institutions

D: Inservice Training

E: Educational Technology in Mathematical Education

Visits to Institutions

Elementary School of Keio Gijuku

Taito Lower Secondary School

Toho Girls' Senior High School

Tokyo Gakugei University

Metropolitan Institute for Educational Research

Professors Iyanaga (Japan) and Neumann (Australia) acted as co-chairmen of the Regional Conference. They and Professor Kobayashi all gave initial and concluding addresses. An additional initial address was given by Professor Hiratsuka and an additional concluding address by Professor Steiner. The participants, including 120 from Japan and 25 from other countries, found the schedule hard but stimulating in a most enjoyable way and the general impression was of a successful and valuable Conference.

S. Iyanaga

4. Plans for Future Symposia

ICMI Symposium at Warsaw (Poland) 25-28 August 1975

Theme: Combinatorics and Probability in Primary Schools

The Symposium is sponsored jointly by ICMI and by the Polish Ministry of Education. The subject matter includes combinatoric aspects of the teaching of various topics including sets, arithmetic, geometry and an introduction to statistics. Further information may be obtained from Professor Z. Semadeni, Institute of Mathematics, Polish Academy of Sciences, ul. Sniadeckich 8, 00-950 Warszawa, Poland.

2nd World Conference on Computer Education

This Conference, organised by IFIP (International Federation of Information Processing) with the co-sponsorship of ICMI, is being held at Marseille, France from 1 to 5 September, 1975. The Chairman of the Programme Committee is Dr J. Hebenstreit, École Supérieure d'Électricité, 10 Avenue Pierre-Larousse, 92-Malakoff, Paris.

Regional Conference to be held in India during one week in December 1975

Theme: Integrated Mathematics Curriculum Development for Developing Countries

The Conference is being sponsored by ICMI jointly with the Indian National Science Academy, University Grants Committee and National Council for Educational Research and Technology. Participation is being invited from all the developing countries of South Asia.

The objectives of the Conference are to collect information about the state of mathematical education in various countries of the region, and about their needs and goals and their efforts in the field of curriculum development; and to examine the possibility of formulating an integrated curriculum in mathematics at secondary and undergraduate levels which is relevant for the attainment of the goals of those countries.

Further information may be obtained from the Executive Secretary, Indian National Science Academy, Bahadur Shah Zafar Marg, New Delhi-1, India.

3rd International Congress on Mathematical Education to be held at Karlsruhe (Federal Republic of Germany) 16-21 August 1976

The planning of this third major Congress under the auspices of ICMI continues most actively. Information may be obtained (as it becomes available) from Professor H. Kunle, Mathematisches Institut II, 75 Karlsruhe, Kaiserstrasse 12, Federal Republic of Germany.

5. MEMORANDUM ON AFFILIATION OF IACME TO ICMI

The International Commission on Mathematical Instruction (ICMI) is enjoined by its Terms of Reference, section (f) to

'take the initiative in inaugurating appropriate programmes designed to further the sound development of mathematical education at all levels, and to secure public appreciation of its importance. In the pursuit of this objective, the Commission shall co-operate, to the extent it considers desirable, with effective regional groups which may be formed spontaneously, within, or outside, its own structure.'

The Executive Committee of ICMI regards the Inter-American Committee on Mathematical Education (IACME) as an effective regional group in this sense, and in agreement with IACME has now set up a formal machinery of co-operation between ICMI and IACME, along the following lines:

- (i) IACME, as the regional body devoted to bringing about within the Americas improved international liaison on matters concerned with mathematical education, is to be described as affiliated to ICMI, the globally international body devoted to bringing about worldwide international liaison on these matters;
- (ii) ICMI and IACME will continuously exchange information regarding all their proposed activities;
- (iii) ICMI will advise IACME regarding activities that would coordinate well with other activities of concern to ICMI;
- (iv) ICMI will propose names of possible participants in IACME Conferences and other meetings;
- (v) ICMI will give international publicity to IACME's programme of activities;
- (vi) IACME will make suggestions to ICMI regarding subjects and participants for ICMI meetings and will assist in making ICMI's plans and programmes known within the Americas;
- (vii) at the same time, the affiliation of IACME to ICMI implies no payments of money by either party to the other.