ICMI

Bulletin

of the
International Commission
on
Mathematical Instruction

No. 36

June 1994

The International Commission on Mathematical Instruction

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Legend: IMU stands for *The International Mathematical Union*; ICSU stands for *The International Council of Scientific Unions*; CTS stands for *The Committee on the Teaching of Science* (of ICSU).

Brief Report on

ICMI activities in 1993

1. Organisation

In 1993 a number of new member states were admitted to IMU and consequently to ICMI. These are *Croatia, Georgia,* and *Slovenia.* The place of the former Soviet Union has been granted to *Russia.* As to former Czechoslovakia, both the *Czech Republic* and the *Slovak Republic* have been proposed as new members of IMU from 1 January 1994.

In 1993 ICMI informed the National Committees of Mathematics and the Adhering Organizations of member states about the IMU General Assembly Resolution 5 (Kobe, 1990). According to this resolution member states are asked to review their national representation on ICMI under the perspective that normally National Representatives should not be asked to serve for more than two consecutive four-year terms. As a result, many Adhering Organizations have decided to appoint new National Representatives. This will be reflected in the list to be published in the June 1994 issue of the ICMI Bulletin.

The Executive Committee of ICMI met in Höör, Sweden, on the 9th and 10th of October 1993.

The International Council of Scientific Unions, ICSU, has decided not to operate with a Committee on the Teaching of Science, CTS, in the future. As one of the ex officio members of the Executive Committee of ICMI is IMU's representative on ICSU/CTS this will affect the organisational structure of ICMI. It is, however, not yet clear what exactly the effect will be.

ICMI continues to have three affiliated study groups, *HPM* (The International Study Group for the Relations Between the History and Pedagogy of Mathematics), *IOWME* (The International Organization of Women and Mathematics Education), and *PME* (The International Group for the Psychology of Learning Mathematics). On application by *WFNMC* (The World Federation of National Mathematical Competitions) the EC has decided to accept the affiliation of this association as a study group. The affiliation will date from 1 April 1994.

2. ICMEs

The planning of *ICME-8,* to be held in Sevilla (Spain) in July 1996, is progressing well. The International Programme Committee - chaired by Professor Claudi Alsina, Barcelona (Spain) - has produced preliminary drafts of the congress programme.

The EC has not yet received any formal bids to host *ICME-9* in the year 2000. At least one country is known to be preparing a bid to be submitted during 1994.

3. ICME Studies

The mounting and conducting of so-called ICMI studies on crucial themes and issues in mathematics education was intensified in 1993. The study conference on *Gender and Mathematics Education* was held in Höör, Sweden, 7-12 October 1993, with 75 participants from 23 different countries. The conference - which was organised by an International Programme Committee, chaired by Professor Gila Hanna, OISE, University of Toronto, Canada - was based on a Discussion Document published officially in *L'Enseignement mathématique* **38**, fasc. 1-2, janvier-juin 1992, pp 189-98, as well as in the ICMI Bulletin, No. 32, June 1992. The first outcome of the conference will be a proceedings volume of about 400 pages. The ultimate outcome will be a study published in the ICMI Study Series. Both publications will be edited by Gila Hanna.

The next study in the series will be *What is Research in Mathematics Education and What Are Its Results?*. The International Programme Committee is chaired jointly by Professors Jeremy Kilpatrick and Anna Sierpinska. A Discussion Document was published in *L'Enseignement mathématique* **39**, fasc. 1-2, janvier-juin 1993, pp 179-86 and in the ICMI Bulletin, No. 33, December 1992. The study conference will be held near Washington DC (USA) in May 1994. It is ICMI's intention to present the main outcomes of this study at the ICMI lectures in the International Congress of Mathematicians, Zürich, August 1994.

The first steps towards mounting a study on *Perspectives on the teaching of geometry for the 21st century* were taken in 1993. The appointment of the International Programme Committee was begun in 1993. It will be chaired by Professor Vinicio Villani, Pisa (Italy). The study conference will be held in Catania, Sicily (Italy) in 1995.

4. Regional Conferences

Financial support was given by ICMI to SEACME 6 (Sixth South East Asian Conference on Mathematical Education) which was held in Surabaya (Indonesia), 7-11 June 1993. The number of participants were almost 450 from 18 different countries, mostly in South East Asia.

The Executive Committee further decided to sponsor - and to financially support - a regional conference to be held in Shanghai (China), 16-20 August 1994. The theme of the conference will be Teacher Preparation in Mathematics. The Executive Committee has further agreed to sponsor a conference on regional collaboration to be held in Australia, 1995.

5. New initiatives

In connection with ICME-7 in Québec (Canada), August 1992, ICMI decided - on the suggestion of its President, Miguel de Guzmán - to mount a Solidarity Programme to help developing mathematics education in countries where there is a need for it.

As a first step in mounting this programme, a *Solidaity Fund* based on private

contributions by individuals, associations etc. was established. The Fund is to be activated to support concrete initiatives and activities that may foster solidarity in mathematics education between well-defined quarters in developed and less developed countries. For the time being the Fund will be in charge of a committee chaired by Professor Jean-Pierre Kahane, Past-President of ICMI, and with administrative assistance from the ICMI Secretariat. By the end of 1993 the Solidarity Fund contained a total of almost US$ 21.000.

In 1993 the first project under the auspices of the Solidarity Programme was carried out. With a generous financial support (US$ 1.500) of the Federación Española de Sociedades de Profesores de Matemáticas, Professors Miguel de Guzmán and Mariano Martínez were given the opportunity to give courses in two weeks in Managua (Nicaragua) in January-February 1993 (cf. ICMI Bulletin, No. 34, 1993).

In agreement with the organisers of the ICM-94, the International Congress of Mathematicians, to be held in Zürich (Switzerland), August 1994, the EC is planning for five ICMI lectures to be delivered at the congress.

6. ICMI Bulletins

In 1993 ICMI Bulletins No. 34 (June) and 35 (December) were published under the editorship of the Secretary of ICMI.

Mogens Niss, Secretary

ICMI Accounts 1993

1 January - 31 December

Swiss Francs Account:

Income:	
balance 1992	59.491,46
IMU (Schedule A: Administration)	10.000,00
IMU (Schedule B: Scientific Activities)	18.000,00
interest	1.950,34
total	89.441,80
Expenditure:	
transfer charges (IMU)	11,96
balance 1993	**89.429,84**
total	89.441,80

Danish Kroner Account:

Income:	
ICMI balance[1] 1992	4.168,52
Solidarity Fund balance [1] 1992	*916,16*
transfer from US Dollars account	6.578,00
total	11.662,68
Expenditure:	
EC meeting in Höör (Sweden), President's and Secretary's preceding work meeting in Copenhagen	8.301,66
ICMI study on gender, in Höör (Sweden)[2]	1.732,40
typing Bulletin Nos. 34 & 35	1.800,00
credit card charge	150,00
Solidarity Fund balance 1993	*916,16*
ICMI balance 1993	**-1.237,54**
total	11.662,68

Sterling Account:

Income:	
balance 1992	23.913,48
CUP royalties for studies	142,65
interest	815,88
total	24.872,01
Expenditure:	
International Mathematican Olympiads SC grant	300,00
transfer charges	4,29
balance 1993	**24.567,72**
total	24.872,01

US$ Account:

Income:	
ICMI balance[1] 1992	9.316,75
Solidarity Fund balance[1] 1992	*20.300,00*
UNESCO grant for ICME-7, last instalment[3]	800,00
interest	129,87
private contributions[4] to ICMI's **Solidarity Fund**	*529,58*
total	31.076,20
Expenditure:	
EC member's participation in ICME-7 (late payment)	1.823,39
EC meeting in Höör (Sweden), October 1993[2]	433,00
transfer to Danish Kroner Account	1.000,00
transfer charges	4,57
Solidarity Fund balance 1993	*20.829,58*
ICMI balance 1993	**6.985,66**
total	31.076,21

Notes:

1. As a consequence of the ICMI General Assembly and Executive Committee meetings held in Québec, August 1992, it was decided to establish an ICMI Solidarity Fund based on private contributions from individuals, organisations etc. The **Solidarity Fund** was mounted to assist mathematics education and mathematics educators in less affluent countries. Its money can only be spent (by a committee chaired by Professor Jean-Pierre Kahane) to serve such purposes and is therefore **not** part of ICMI's

general resources. However, the appearance of the Solidarity Fund on the ICMI accounts for 1993 is due to a wish to keep ICMI's number of different bank accounts low. For 1993 the accounts exhibit the ICMI balances and the Solidarity Fund balances separately.

2. In 1993 the preparation and holding of the ICMI study conference on *Gender and Mathematics Education* took place in Höör, Sweden. Only some of the costs were paid in 1993. An additional amount of about US$ 2.000 is due in 1994. An EC meeting was held in connection with the study conference.

3. In 1992 UNESCO contributed a grant of US$ 3.000 to support the participation in ICME-7 of delegates from developing countries. In accordance with UNESCO practice the grant was paid in two parts. The first part (US$ 2.200) was included in the accounts for 1992. The second part (US$ 800) was paid in 1993.

4. Of this amount, US$ 500 was granted by the Federacíon Española de Sociedades de Profesores de Matemáticas, Spain. In fact, this Federación gave a larger contribution to the Solidarity Programme as it spent further US$ 1.500 to directly support the work done in Nicaragua by Professors Martínez and de Guzmán within the framework of the Solidarity Programme, on which a report was published in Bulleting No. 34, June 1993.

5. In addition to the amounts displayed directly in the accounts, considerable extra sums should appear but do not and cannot. In 1993 Roskilde University (the Secretary's affiliation) contributed a substantial support of ICMI's work (e.g. telephone and fax, e-mail facilities, all the printing and distribution costs of the Bulletin, secretarial help of various sorts). It is estimated that the total contribution of Roskilde University is equivalent to about US$ 5.000. The ICMI Executive Committee expresses its gratitude for this generous support.

The Executive Committee's thanks also go to the institutions of its other members. These institutions, too, have given invisible support of ICMI's work in a variety of ways. For instance, in many cases these institutions have paid travel and other expenses related to participation in EC meetings and soforth.

6. In 1994, the preparation and holding of an ICMI study conference (on *What is Research in Mathematics Education, and What are Its Results?*), and the preparation of a new one (on *New Perspectives on the Teaching of Geometry for the 21st Century*) will imply considerable costs.

Mogens Niss
7 March 1994

ICMI studies

In the series of ICMI studies three are under way in different stages.

In Höör (Sweden), 75 participants from 23 different countries participated in the study conference on **Gender and Mathematics Education** (7-12 October 1993). The proceedings of this meeting are in a final stage of editing. At the same time preparations are being made for the publication of a very important outcome of an ICMI study: a volume in the ICMI Study Series. Both the proceedings and the study volume are being edited by Professor Gila Hanna, OISE, University of Toronto, Canada, who was also the chair of the International Programme Committee. The Local Organiser of the study conference was Dr. Barbro Grevholm, the College of Teacher Education, University of Lund, Sweden.

At the University of Maryland, College Park, near Washington DC, USA, 81 participants from 24 different countries took part in the study conference on **What is Research in Mathematics Education, and What Are Its Results?** (8-11 May 1994). The International Programme Committee was chaired jointly be Professors Jeremy Kilpatrick and Anna Sierpinska who will also edit the resulting ICMI study volume. The Local Organiser was Professor James T. Fey, University of Maryland, College Park, ML, USA.

The next study in the series will be dealing with **Perspectives on the Teaching of Geometry for the 21st Century**. This study is in an initial stage of preparation. Thus a Discussion Document will be ready in June-July 1994. It will be published in numerous hjournals, newsletters and magazines, including this Bulletin (in No. 37, December 1994) and in ICMI's official organ *L'Enseignement mathématique*. Readers will be invited to react to the Discussion Document by writing to the Chair of the International Programme Committee.

The study conference will be held at the University of Catania, Sicily, Italy, in September 1995. The International Programme Committee which began its work early in 1994 consists of

Professor *Vinicio Villani* (*Chair*),
Dipartimento di Matematica, Università di Pisa,
Via Buonarroti 2, I-56127 Pisa, ITALY
Tel: +39 50 599536, Fax: +39 50 599 524, e-mail: <villani@dm.unipi.it>

Professor *Carmelo Mammana* (*Chair of the Local Organising Committee*)
Dipartimento di Matematica, Università di Catania,
Città Universitaria, Viale A. Doria 6, I-95125 Catania, ITALY
Tel: +39 95 330633, Fax: +95 330094, e-mail <mammana@dipmat.unic.it>

Members are:

Régine Douady, Université de Paris VII, Paris, FRANCE

Vagn Lundsgaard Hansen, The Technical University of Denmark, Lyngby, DENMARK

Rina Hershkowitz, The Weizmann Institute of Science, Rehovot, ISRAEL

Joseph Malkevitch, York College, City University of New York, N.Y., USA

Iman Osta, The American University of Beirut, Beirut, LEBANON.

Mogens Niss, the Secretary of ICMI, Roskilde University, Roskilde, DENMARK is a member Ex Officio.

For further information of ICMI's study on the teaching of geometry, please contact Vinicio Villani on the address mentioned above.

Mogens Niss

New Study Group Affiliated to ICMI: WFNMC

After having considered the application submitted by *WFNMC*, The World Federation of National Mathematical Competitions, the Executive Committee has decided to grant WFNMC the status of a Study Group Affiliated to ICMI as from the 1st of April 1994. Looking forward to fruitful future cooperation between WFNMC and ICMI the EC wants to warmly welcome WFNMC to the ICMI network. The WFNMC is presided by

Professor *Peter O'Halloran*, President of the WFNMC,
Australian International Centre for Mathematics Enrichment
University of Canberra P.O. Box 1
Belconnen, ACT 2616
AUSTRALIA

Mogens Niss

News From the French Sub-Commission of ICMI

In November 1993 the French Sub-Commission of ICMI held a meeting which gathered representatives of several organisations and institutions involved in mathematics education:

- the IREMs (Institutes for Research on Mathematics Education)
- the APMEP (the French Mathematics Teachers' Association)
- the CNFM (the French National Committee of Mathematicians)
- the SMF (the French Mathematical Society)
- the Inspection Générale (the higher level inspectors in secondary education)

The Sub-Commission will probably be open to representatives of other associations as well.

It was time to elect a new team of officers. André Deledicq is the new President of the Sub-Commission for the next four year period.

The meeting was devoted to the preparation of ICME-8 and to the World Mathematical Year 2000. It was decided to focus the effort on

- drawing the attention of university mathematicians to initiatives and actions related to mathematics education;

- circulating information concerning ICMI studies and ICME-8 within the community of teachers and researchers in mathematics and mathematics education;

- giving access to fundamental French texts of the past on mathematics and mathematics education by reprinting these texts.

The French Sub-Commission is open to any suggestion, comment or proposal made by ICMI or its national Sub-Commissions.

The officers are:

President and National Representative: *André Deledicq*, SCFCIEM, 50 rue des Ecoles, F-75005 Paris,

Vice President: *Colette Laborde*, DidaTech, Labo LSD2, Université de Grenoble 1, IMAG, BP 53, F-38041 Grenoble Cédex 9,

Treasurer: *Pierre Ettinger*, IREM, Université de Toulouse,

Members: *Jean-Pierre Kahane, Noëlle Vigier, Paul Attali*

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A New National Sub-Commission: ICMI-Denmark

In the course of 1993 the Adhering Organization of the IMU in Denmark (Det Kgl. Danske Videnskabernes Selskab) and the National Committee for Mathematics endorsed the creation of a Danish National Sub-Commission of ICMI, abbreviated ICMI-Denmark. Elections to the Danish Sub-Commission were conducted in 1993 and the Sub-Commission thus appointed took office as of the 1st of January 1994.

The purpose of ICMI-Denmark is

- serve as a link between ICMI and mathematics education and mathematics educators in Denmark;

- to work for the exchange of information and views concerning mathematics education at all levels in the country;

- to disseminate within Denmark information about international trends in mathematics education and to inform the international mathematics education community about mathematics education in Denmark;

- to stimulate research on and development of Danish mathematics education at all levels.

The Sub-Commission is composed as follows:

- the mathematics inspectors appointed by the Ministry of Education to supervise mathematics education in the different sections of primary and secondary education in Denmark;

- representatives of the Danish Mathematical Society;

- representatives of the National Committee for Mathematics, two of which are to represent applicational aspects of mathematics;

- representatives of the Forum for the Didactics of Mathematics;

- representatives of the (p.t. four) Mathematics Teachers' Associations in Denmark.

The Sub-Commission elects an Executive Committee consisting of five members representing the main segments of the Sub-Commission. In its first meeting, held in February 1994, the following Executive Committee was appointed:

Chair: *Hans Jørgen Beck*, The Association Mathematics Educators in Colleges of Teacher Education

National Representative: *Martin P. Bendsøe*, The National Committee for Mathematics,

Members: *Leif Andersen*, The Association of Mathematics Teachers (upper secondary level), *Ole Haahr*, The Ministry of Education (primary and lower secondary level), *Vagn Lundsgaard Hansen*, The Danish Mathematical Association.

ICMI-Denmark may be contacted through its chair:

Seminarielektor Hans Jørgen Beck,
Paludan Müllersvej 5, 1
1815 Frederiksberg C,
DENMARK

Mogens Niss

A Zero-Based Mathematics Curriculum

Anthony Ralston

There has been considerable ferment about mathematics education over the past decade. Moreover, there is more activity in mathematics education research today than at any time in history. That all this ferment and research has thus far seemingly had relatively little impact on what happens in classrooms around the world can be ascribed to many factors, not least that inevitably in education there is considerable lag before there can be widespread implementation of research results or the ideas in reports such as the NCTM Standards no matter how impressive the results or how trenchant the ideas.

Another reason for the frustratingly slow pace of change in mathematics education or, for that matter, in any area of education is that realistic proponents of change must always seek an evolutionary approach because in a system with as much inertia as any educational system, revolution is just not on. It follows from this that proposed reforms in mathematics education emphasize what seems to be (politically) possible rather than being goal-oriented in the sense of proposing where you would like to end up. The result inevitably is incremental change which focuses on the possible rather than on what might be more generally desirable.

The purpose of this paper is to suggest the value of an exercise in mathematics curriculum design which is not constrained by the shackles of reality and which, therefore, can be goal-oriented. The outcome of this purely intellectual exercise would be a curriculum that you would like to be able to implement and some suggestions of how to get from where we are to where we would like to be.

The idea of a zero-based curriculum arises from the notion of zero-based budgeting which is probably familiar to my readers. In zero-based budgeting all items in a budget must be justified *ab initio* and not because there was a similar item in last year's budget. The initial result of such budgeting may be politically or otherwise impossible but it provides, at least, a blueprint for the budget you would like to have. So it is similarly with a zero-based curriculum.

Suppose then that in 1994 mathematics education did not exist and you wanted to invent it. The result would be a zero-based mathematics curriculum, that is a curriculum unconstrained by any past or present practice. What value might the development of such a curriculum have? A priori this question cannot be answered definitively. But here are some possible answers. If the resulting curriculum were perchance close (by some metric) to current practice, then the exercise might provide support for changes currently being proposed. On the other hand, if the results bore little resemblance to current practice in some or many of its aspects, it might provide intellectual justification for making changes more rapidly than they are now occurring and, as well, it might suggest further study and research on how to get from here to there.

With this article I hope to start a discussion in ICMI about a zero-based mathematics curriculum. Depending on how that discussion proceeds, it might be appropriate next to convene a conference to discuss the issues raised here or to have a session at ICME-8 devoted to this topic - or both.

In what follows I'll discuss the notion of a zero-based curriculum with respect to the matters that need to be considered for the primary school curriculum and the secondary school curriculum. I should note that here and later I am using "curriculum" generally in the sense of "subject matter". However, in the final section I consider related issues such as pedagogy and testing which some would include under the curriculum rubric.

Primary school mathematics

Since the definition of "primary school" varies from country to country, let me note first that this section focuses on kindergarten and the next six years. Here is a selection of questions which might be asked about the curriculum during these years from a zero-based perspective:

1. What should the role of arithmetic be in these years? Recent years have seen a lot of research about the use of calculators in primary school and whether or how much this should affect how much paper-and-pencil arithmetic is taught. Although most mathematics education researchers agree that past dominance of paper-and-pencil arithmetic in primary school mathematics is no longer appropriate, there is much less agreement over how much pencil-and-paper arithmetic should still be taught and in what year calculators should be introduced. And many observers have noted that, whatever the intended curriculum, the implemented curriculum in most places in almost all countries still contains a lot of pencil-and-paper arithmetic. One reason for this is that researchers have not yet shown to the satisfaction of many that principles of arithmetic can be learned without using pencil-and-paper arithmetic or if calculators are introduced immediately in kindergarten. A zero-based approach would use the existing research base as well as experience with current and past curriculum approaches to adjudge just how arithmetic should be taught in primary school and what approach should be used.

2. A related question is: What should the role of mental arithmetic be in primary school? And related to this question: How important is it to develop estimation ability in a calculator-ubiquitous world? In particular, it is important to decide how much facility with mental arithmetic we should try to develop in primary school. The appropriate role of pencil-and-paper arithmetic in a zero-based curriculum may depend upon whether there are calculations which are not reasonably done either mentally or with a calculator.

3. Although the structure and content of a zero-based curriculum should not be prejudged, it is surely not radical to suggest that arithmetic is likely to play

a much more reduced role than it has played historically in such a curriculum. In any case, arithmetic will surely not be the only component of the zero-based primary school mathematics curriculum. So we must ask: What other mathematics should be included in the primary curriculum? There are certainly a number(!) of candidates including, but not limited to, geometry, probability and data analysis. A project to develop a zero-based curriculum will have to consider carefully what non-arithmetic topics should be integrated with other topics and arithmetic.

4. The role of technology in the form of calculators is explicit or implicit in the foregoing. But how about the role of other technology - specifically computers? Should primary school children use languages like Logo in their mathematics classes? If so, when? What other software is appropriate for use in primary school mathematics? What does the rapid blurring of the boundary between calculators and computers imply about mathematics education? Since the rapidly growing importance of calculators and computers is one of the major motivations for the zero-based approach to curriculum, it would be folly not to consider how this technology should affect mathematics education not just today but for the foreseeable future. Many aspects of the usefulness of various kinds of software packages in mathematics education should be addressed.

Secondary school mathematics

Here our focus in on the seventh through twelfth or thirteenth years of school. A zero-based approach to secondary school mathematics is more difficult than for primary school mathematics simply because the secondary school mathematics depends upon what is done in primary school. Still, it is pretty clear about some of the questions which must be asked.

1. What should the subject matter of secondary school mathematics be? The problem here is that so many new subjects have been proposed in recent years as alternatives to or additions to the staples of algebra, geometry, trigonometry and calculus in the thirteenth year. What should the role of data analysis, probability and statistics be? Does discrete mathematics deserve place in the same year as calculus or perhaps in the previous year as a partner with "pre-calculus"? Is there a danger of introducing too many different subjects in secondary school with the possible result of doing justice to none?

2. Integration: In most countries, but not all, the traditional secondary school subjects are now taught in an integrated fashion. But how about the newer subject matter? Can and should it be integrated with algebra, geometry and trigonometry? Trying to answer this question will force a focus on the purpose of each topic in the secondary school curriculum which is, of course, at the crux of the zero-based approach. Answers will also be required to the questions of which traditional topics are still essential for secondary school students of mathematics and which are expendable.

3. Technology: The role of calculators and computers and their impact on curriculum will be at least as profound at the secondary level, perhaps more so, than at the primary level. The rapid increase in availability of both calculators and computers with symbolic and graphical capability forces a consideration of not just how to use this technology but also what topics in the curriculum it may render obsolete. For example, will the use of symbolic mathematical systems (i.e. so-called computer algebra systems) decrease the need for students to become good pencil-and-paper symbol manipulators? What is the relation of this question to that of how much pencil-and-paper arithmetic should be taught in primary school. And then there is the question of economics: How soon can graphing and symbolic calculators be made available to all students? And how soon can computers with symbolic mathematical system software be installed in all or almost all secondary schools? Of course, answers to these questions will vary enormously from country to country. (Which makes this a good place to note that a zero-based curriculum must not be monolithic; to be useful it would need to take into account economic, cultural and other differences among countries.)

Other issues

1. Pedagogy: Although the zero-based approach focuses on curriculum, clearly the issues of how the curriculum is to be taught and how teachers are to be educated to teach it cannot be ignored. Focusing on curriculum is not intended to suggest that curriculum is more important than pedagogy or teacher education. Rather it expresses a belief that it makes sense to design a curriculum before considering pedagogy and teacher education. And it also expresses a belief that curriculum change can be an engine to drive change in mathematics education generally. Pedagogical questions which should be considered include: What is the role of technology in the classroom and out of the classroom? Should the availability of technology affect how classrooms are organized and what the role of the teacher should be in the mathematics classroom? Should subject matter, even traditional subject matter, be approached differently through, for example, an algorithmic approach when it is available? (A zero-based approach needs to recognize that not just computers but also computer science (i.e. informatics) are requiring a reconsideration of the mathematics curriculum.)

2. Teachereducation: If a zero-based curriculum is very different from current practice, then teacher education would probably need to be changed considerably if teachers were to be able to teach a zero-based curriculum. So if a zero-based curriculum is a goal for curriculum change, there would need to be a similar goal - and means to reach it - for the education of mathematics teachers. Since there is reason to believe that much of current teacher education does not prepare teachers adequately to teach the current curriculum, it might prove even more daunting to design an educational program for teachers of a zero-based mathematics curriculum than to design the zero-based curriculum itself.

3. Testing: Or, if you will, assessment. All mathematics educators seem to agree that testing should not be allowed to drive the curriculum. Nevertheless, testing does drive the curriculum in many countries. Therefore, the designers of a zero-based curriculum would have to consider what kinds of testing would be appropriate - at all levels - for such a curriculum. What kinds of questions would be appropriate? How would the widespread use of technology in the classroom affect what kinds of tests could reasonably be given? How could the technology itself be used in testing to present problems and, perhaps, to assess the answers to them? These are just some of the questions which a zero-based study would need to address about testing.

4. Research: What should be the impact of research in mathematics education on a zero-based curriculum? On the one hand, there is research which supports significant changes in mathematics education. On the other hand, the nature of such research is that little (none?) of it is definitive in the sense of unequivocally supporting this change or that. A zero-based approach to the mathematics curriculum needs, therefore, to look to the corpus of mathematics education research for support of proposed changes but cannot expect to find "proof" of the efficacy of proposed changes.

From here to there

Finally, a zero-based curriculum project, if it, indeed, results in a significantly different curriculum than is offered today in most schools in all countries, must grapple with the question of how we might get from where we are to where the zero-based curriculum suggests is the desirable place to be. This is not just a question about teachers and teacher education and textbooks and other materials. It is also a political, social and economic question. Without these latter aspects, no matter how trenchant the reasoning supporting change in the curriculum, the eventual impact of a zero-based curriculum study would probably be modest. But with proper attention to these issues, it could be profound.

My conclusion is that a zero-based curriculum project has the potential to make a major impact on mathematics education. ICMI is just the organization within which to begin discussion of such a project. I hope my colleagues who read this will react to it to me and to ICMI.

(I'd like to thank Leone Burton for some very helpful comments on an early draft of this article.)

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Adults Learning Math
- a new field of research

Helga Jungwirth, Jürgen Maaß, Wolfgang Schlöglmann

Whenever you ask adults what they remember from school and especially from their mathematical education they will answer: "I liked math very much!", "The best hours in my life were math lessons!", "All I learned in math I am now using in my everyday life!", "I understand the technological structure of our society very well because I understood mathematics in school!", "I have no problems with computers because I learned logical thinking in the mathematics lessons!", "Now I'm visiting a further education course and I have problems with all subjects except math!"

Oh, you heard or expected other answers? Why? Did you read a research report on the results of teaching mathematics in school? There are only a few such reports. They tell us that many people after school forget nearly all they have known about mathematics. In industrialized countries some 10% (or more) are math illiterates. Our own research and analysis of math knowledge tests show for example the following results (percentages of right solutions):

- Calculating with integers lower than one hundred: addition (88%), subtraction (86%), multiplication (76%), division (90%), combined calculations with a negative number as result (35%)
- Calculating with simple decimal numbers: subtraction (83%), multiplication (60%), division (47%)
- Calculating with simple fractions: addition and subtraction (57%), multiplication (56%), division (39%).

The test was similar to school tests [1].

A second important aspect is the image of mathematics. Only very few people enjoyed their math lessons at school. Many people remember that they did not understand mathematics and that they were stressed by teachers and tests. They think that mathematics is not useful for them and has nothing to do with real life. This way of thinking is dangerous to mathematics teaching.

These two points and our experiences with different types of math courses for adults motivated us to undertake various research projects in this area. We investigated mathematical knowledge and belief systems about mathematics, evaluated math answers, analyzed curricula and organizational structures. We used tests, questionnaires, made interviews and had informal discussions with learners, teachers and organizers of courses. With respect to the beliefs about mathematics [2] we found that many adult learners consider mathematics as a toolbox they can use to solve job- or everyday-life problems. Simultaneously they agree that mathematics is a big theory with exact definitions and proofs, but only some of them characterize mathematics as a game with numbers, formulae and special rules for manipulation. More than 75%

believe that working with mathematics fosters logical thinking.

Why do more and more adults want to learn mathematics?
The most important motive for adult learners to start taking a course involving math is their job: they need better qualifications to remain employed or to improve their chances of obtaining a higher income. In order to get a new and better job some people need a formal graduation (for example a "technical master" ("*Meister*") degree). But there is another strong motive as well, beside the job-related ones. Participants of math courses are eager to learn, to generally improve their knowledge and abilities.

These personal motivations match structural tendencies of our technological society. All the new technologies are based on mathematics. All computers, any hard- and software, are products of mathematical technology [3]. More and more parts of our society are structured mathematically. In this situation further education in mathematics is not "only" useful for individuals and their employment, but also forms an important basis for a better orientation in and understanding of the technological world and its rules.

Cooperation
Mathematics education for adults is a new field of research within the didactics of mathematics. We have a lot of questions and only partial results. Therefore we are interested in cooperation: Have you worked in this field? Do you know anything about adults' learning of math? If you would like to exchange questions and answers with us, please contact us.

Literature

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In Memoriam - Nicolas Herscovics (1935-1994)

Jacques C. Bergeron

On January 3, 1994, PME lost one of its founding members, Professor Nicolas Herscovics. Nicolas was a faculty member of the Department of Mathematics and Statistics at Concordia University in Montreal, Canada. When he attended his first ICME meeting in Karlsruhe, Germany, in 1976, he deplored the fact that researchers interested in the teaching and learning of mathematics, and who had so much to discuss, were able to gather only once every four years. Therefore, he asked the participants who were interested in forming a subgroup of ICME, one that would meet every year in order to promote research in this domain, to endorse his proposal. The signatures he gathered, such as those of Freudenthal, Fischbein, Karplus, Bauersfeld, and Skemp, were sufficiently numerous and illustrious to lead to the immediate creation of IGPME (International Group for the Psychology of Mathematics Education) - the former name of PME.

Thereafter, Nicolas attended almost all of PME's annual meetings where he accomplished much underground work in order to convince colleagues of the necessity of not staying in isolation - one way being to recruit people in their country or even organize a PME meeting. He was also instrumental in founding PME-NA - the North-American Chapter of PME. With Carolyn Kieran and myself, he co-organized two meetings in Montreal: PME-NA V in 1983 and PME-XI in 1987.

His career as a researcher was relatively short, only 15 years - the last two at a reduced pace because of his illness. In spite of such a short period, he nevertheless published over seventy papers (most of them paired with an oral communication), directed many masters degree students, co-directed three doctoral students with me, and co-directed (with me) a research group which was funded by Quebec's Ministry of Education during the last 13 of these 15 years. Concurrently, he almost always had a full teaching load in mathematics and mathematics education!

For twelve years we worked on the problem of describing the understanding of early arithmetic concepts by five-to-nine year olds. We proposed a descriptive model of understanding which was constantly improved in the light of experimental evidence. With minor adaptions it was possible to apply it to more advanced concepts. Nicolas was also interested in the learning and teaching of algebra which he investigated with other colleagues. His last interest centered on pre-algebra which he researched with Liora Linchevski from Israel, and which until very recently, he was discussing with Gerald Goldin.

A brief glance at his life path reveals why he was a latecomer to research. His parents, who were Jewish-Rumanian, migrated to Belgium. During World War II they were arrested and deported to German labor camps, while Nicolas and his twin sister, aged five, were kept by a Catholic couple and also by a nun. In his own words, he was one of the rare Jews who served mass. His mother did not survive the labor camps.

After the war, his father returned to Belgium where he married a widow with five sons and returned to his former trade, tailoring. Nicolas, now aged ten, had to quit school and work in his father's store and learn the trade. When he was sixteen, the entire family moved to Montreal where he worked in the clothing industry and then in the plumbing industry, all the while attending evening school. After graduating from University with a first degree in Physics and a second in Mathematics, he left the business world to become a University Professor - at a substantial cut in salary!

When he was asked to take charge of the In-service program for Secondary level mathematics teachers, he felt the need to acquire some knowledge of Pedagogy and Psychology. So he registrered as a Ph.D. student at the University of Montreal, from which he graduated in 1979 at the age of 44. I had the pleasure of being not so much his thesis "director" as his "accompanist". Far from ending with his graduation, own collaboration lasted until 1991 when he learned that he had cancer.

A dozen years of almost daily work with him entitle me to attest to his keen intelligence, creativity, organizing ability and inexhaustible energy. He was very demanding of both his students and his collaborators, but it was never more than he required of himself. When debating ideas he could be harsh and without much concern for his opponents' feelings, an attitude that sometimes brought him fierce opposition. Nevertheless, after any such episodes, he always ended up being very positive and most generous with his time and with his ideas. Finally, he was also extremely honest with regard to giving credit for any ideas he used - even when these ideas originated with his students.

In conclusion, I think that the world of mathematics didactics has lost a star, a star that alas crossed our sky for only a short instant. He often told me how much he would have liked to accomplish if only he had another ten or fifthteen years left. I can only wish that other researchers or students (it cannot be I since I am retiring in a few months) feel the need and the taste to keep on exploring the new avenues that he traced.

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Contributions to the ICMI Solidarity Fund

One of the first components of the ICMI *Solidarity Programme* (decided by the ICMI Executive Committee at ICME-8, August 1992, on the proposal of the President of ICMI) to be established after its inception was the ICMI *Solidarity Fund*. The Solidarity Fund consists of contributions given by individuals, associations or organisations to support specific activities organised to serve the development of mathematics education in countries where international support is meaningful and needed.

The Steering Committee of the Solidarity Fund is very pleased to inform the readers of this Bulletin that a number of individuals and organisations have chosen to contribute to the Solidarity Fund. As to organisations, the *Federación Española de Sociedades de Profesores de Matemáticas* in Spain has contributed US$ 2.000 and the *Nederlandse Vereniging van Wiskunde Leraren*, the Netherlands, has contributed DFL 1.000. Finally, the *organisers of ICME-7* (Québec, August 1992) have transferred the final positive balance of ICME-7, amounting to US$ 16.000, to the Solidarity Fund. The Steering Committee and the Executive Committee of ICMI wish to express their deep gratitude and appreciation of the contributions of these bodies and of the individuals whose names in respect of anonymity will not be mentioned here.

Mogens Niss

ICME-9, 2000, Call for Bids

It is well known that The Eight International Congress on Mathematical Education, ICME-8, is going to be held in Sevilla, Spain, in July 1996. The site of the subsequent congress in the series, ICME-9, has not yet been decided. As the new Executive Committee (EC) of ICMI (which will to be appointed at the General Assembly of the IMU to be held in conjunction with the International Congress of Mathematicians, Zürich (Switzerland) this coming August) is likely to attempt to seek the matter settled in the course of 1995, countries which are interested in hosting the congress are kindly invited to submit bids to the ICMI EC in a not too distant future.

In addition to containing information about the proposed conference site and its facilities, bids should also seek to show the academic, logistic, financial, infra-structural and technological capabilities of the prospective organising bodies. In considering the bids, the EC will give particular emphasis to documented commitment to involvement and support from a wide national and regional spectrum of associations of mathematics educators, mathematicians, mathematics teachers, and soforth, as well as from national and local authorities and agencies.

Bids should be sent to the Secretary of ICMI, Professor Mogens Niss, at the ICMI Secretariat (address on the back of the cover of this Bulletin).

FUTURE CONFERENCES

II CIBEM, July 1994

The Second Iberoamerican Congress on Mathematics Education, II CIBEM, will take place in Santa Catarina, Blumenau, Brazil, 18-22 July 1994. The meeting is being organised by Universidade Regional de Blumenau, and Sociedade Brasileira de Educação Matematica. The International Programme Committee for the congress is presided by Ubiratan D'Ambrosio. For additional information, please contact

Maria Salett Biembengut or José Valdir Floriani,
Fundação Universidade Regional de Blumenau,
Rua Antonio de Veiga, 140
Caixa Postal 1507,
CEP 89012900, Blumenau SC
BRAZIL
Tel: +55 473 23 0422
Fax: +55 473 22818

2nd WFNMC International Congress, July 1994

The Second World Federation of National Mathematical Competitions Congress will be held in Sofia, Bulgaria, 23-28 July 1994. Deadline for abstracts (to be sent to the conference secretary) was 18 May 1994. Further information may be obtained from the conference secretary

Borislav Lazarov,
Union of Bulgarian Mathematicians,
G. Bonchev str. bl. 8
113 Sofia,
BULGARIA

PME18, July-August 1994

The Eighteenth Annual Conference of the International Group for the Psychology of Mathematics Education, PME18, will be held at the College of Science of the University of Lisbon, Portugal, 29 July - 3 August 1994. Plenary addresses will be given by Niels Jahnke, Carolyn Kieran, John Mason, and João Pedro Ponte.

The conference language will be English. Proposals for contributions will be considered only if submitted by people who have sent a pre-registration form (and a

proposal for a contribution) to the conference secretary by 15 January 1994.

The conference secretary is

João Filipe Matos, PME18
Departamento de Educação Faculdade Ciências
Campo Grande - C1 - Piso 2
1700 Lisbon
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Telephone: +351 1-7573141 ex. 2029
Fax: +351 1-7573624
e-mail: <efjm@scosysv.fc.ul.pt>

ICM 94: The International Congress of Mathematicians, August 1994

The next International Congress of Mathematician will be held 3-11 August, 1994, in Zürich, Switzerland, under the auspices of the International Mathematical Union. The lectures will be held at the Kongresshaus of the city of Zürich and in the lecture theatres at the Federal Institute of Technology (ETH-Zürich) and at the University of Zürich.

The Swiss Mathematical Society has entrusted a committee with the organisation of the congress. The President of this committee is Henri Carnal, the Secretary is Christian Blatter. The administration of the participants (hotels, reservations etc.) has been delegated to a professional congress organiser.

For further information please write to

ICM 94
International Congress of Mathematicians
ETH Zentrum
CH-8092 Zürich
SWITZERLAND

ICMI-China Regional Conference on Mathematics Education, August 1994.

A regional conference on mathematics education will be held in Shanghai, 16-20 August 1994. The theme of conference is *Teacher Preparation in Mathematics*. For details see ICMI Bulletin 34, page 21.

For further information about the conference please contact

Professor Zhang Dian-zhou or Professor Zhang Zhen-ya,
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East China Normal University,
Shanghai 200062
The People's Republic of CHINA
Tel: +86 21 257 1095
Fax: +86 21 257 8367

7th International Symposium on World Trends in Science and Technology Education, August 1994

This symposium will be held 24-31 August 1994, at Veldhoven (Koningshof), The Netherlands, under the auspices of the International Organization for Science and Technology Education (IOSTE). The theme of the symposium is *Science and Technology Education in a Demanding Society*. For details see ICMI Bulletin 34, page 22.

For further information please contact

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Tel: +31 53 840 840 or +31 53 840 631
Fax: +31 53 307 692
e-mail: vantrommel@utwente.nl (bitnet)

NORMA 1994, September

A Nordic Conference on Teaching Mathematics will be held in Lahti, Finland, 2-6 September 1994. The theme of the conference - which is being organised by the University of Helsinki and the Lahti Research and Training Centre - is "Theory into Practice". The Programme Committee is chaired by Erkki Pehkonen, University of Helsinki. The registration fee is FIM 1000 (approx. US$ 165). Deadline for outlines of proposed contributions was 15 November 1993.

For further information, please contact

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Fax: +358-0-1918073

or

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Tel: +358-18-892265
Fax: +358-18-892219
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Teaching Mathematics for Industry, September 1994

With the sponsorship of the Czech Technical University in Prague and the SEFI Mathematics Working Group a satellite conference to the IGIP-SEFI Symposium on Engineering Education (1994) will be held, 18-20 September 1994 ,at the Czech Technical University.

For further information, please contact

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Fax: +46 31 161973

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Fax: +42 2 3119238
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7. Carinthian Symposium for Mathematics Education: On Trends and Perspectives, September 1994

This conference will be held at the University of Klagenfurt, Austria, 26-30 September

1994. The Department of Mathematics at the University of Klagenfurt was founded 20 years ago. So, we invite empirical and theoretical contributions which show the development during the last two decades of mathematics education and research and open perspectives for the future. In so doing, investigations and deliberations should be centrered on the human being - whether as a pupil, a student, a teacher or a user of mathematics.

For further information please write to

Didaktik Symposium,
Institut für Mathematik,
Universitätsstrasse 65-67
A-9020 Klagenfurt
AUSTIA
Tel: +43 463 2700-411 or 429
Fax: +43 463 2700-427

Regional Collaboration in Mathematics Education: An ICMI Regional Conference, April 1995

This conference, to be held at Monash University, Melbourne, Australia, 19-23 April, 1995, will bring together people from three rather different communities: mathematics and mathematics education, governmental and non governmental organisations, and the computing and telecommunications industry. It will also experiment with the use of telecommunications in linking several off-shore conference sites with the main site at Monash.

The main aim of the conference is to address the issues, problems and mechanisms concerning regional collaboration. The academic content of the conference will be organised around three broad themes: Mathematics and the environment, Teachers and the system, Learners and society, and papers are invited which address these themes in the context of regional development.

Keynote speakers and presenters include: Benvenido Nebres (Phillipines), Cheryl Praeger (Australia), Ken Clements (Australia), Jeremy Kilpatrick (USA), Christine Keitel (Germany), Colette Laborde (France).

The conference is chaired by Professor Alan J. Bishop, Faculty of Education, Monash University. Further information can be obtained from the

Conference Secretariat,
144 Jolimont Road, East Melbourne, 3002
AUSTRALIA,
Tel: +61 3 654 7533
Fax: +61 3 654 8540.

PDME III, July 1995

PDME III, Political Dimensions of Mathematics Education Conference, will take place in Bergen, Norway, 24–29 July 1995. The official languages of the conference will be English and Spanish. For information on PDME see the article by Stieg Mellin-Olsen, ICMI Bulletin No. 34, page 16–17.

For further information, please contact

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The ICMI Bulletin on E-Mail

Several people around the world have been asking if not this Bulletin could be made available on e-mail. As from this issue, the Bulletin is now stored as an ASCII file in the editor's (i.e. the ICMI Secretary's) electronic post system. If you want to receive a copy of this issue as an ASCII text through e-mail, please contact Mogens Niss at <mn@mmf.ruc.dk>

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