BULLETIN

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Mathematical Instruction

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Bulletin of the International Commission on Mathematical Instruction

No. 58 June 2006

Editor:
Bernard R. Hodgson
Département de mathématiques et de statistique
Université Laval
Québec G1K 7P4 CANADA

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About ICMI

Background The *International Commission on Mathematical Instruction*, ICMI, is a commission of the *International Mathematical Union* (IMU), an international nongovernmental and nonprofitmaking scientific organisation with the purpose of promoting international cooperation in mathematics. Among international organisations devoted to mathematics education, ICMI is distinctive because of its close ties to both the mathematics and the mathematics education professional communities, as well as for its breadth — thematic, cultural, and regional.

Established at the Fourth International Congress of Mathematicians held in Rome in 1908 with the initial mandate of analysing the similarities and differences in the secondary school teaching of mathematics among various countries, ICMI has expanded its objectives and activities considerably over the years. The Commission aims to offer educational researchers, curriculum designers, educational policy makers, teachers of mathematics, mathematicians, mathematics educators and others interested in mathematical education, a forum to promote reflection, collaboration, exchange and dissemination of ideas and information on all aspects of the theory and practice of contemporary mathematical education from an international perspective. ICMI thus takes initiatives in inaugurating appropriate programmes designed to further the sound development of mathematical education at all levels, and to secure public appreciation of its importance. The Commission is also charged with the conduct of the activities of IMU bearing on mathematical or scientific education. In the pursuit of its objectives, the Commission cooperates with various groups, regional or thematic, which may be formed within or outside its own structure.

As a scientific union, IMU is a member organisation of the *International Council for Science* (ICSU). This implies that ICMI, through IMU, is to abide to the ICSU statutes, one of which establishes the principle of non-discrimination. This principle affirms the right and freedom of scientists to associate in international scientific activities regardless of citizenship, religion, political stance, ethnic origin, sex, and suchlike. Apart from observing general IMU and ICSU rules and principles, ICMI works with a large degree of autonomy.

Structure Members of ICMI are not individuals but countries, namely those countries that are members of IMU and other countries specifically coopted to the Commission. Each member of ICMI appoints a Representative and may create a Sub-Commission for ICMI to maintain liaison with the Commission in all matters pertinent to its affairs. ICMI currently has 81 members.

The Commission is administered by the *Executive Committee (EC) of ICMI*, elected by the General Assembly of IMU and responsible for conducting the business of the Commission in accordance with its Terms of Reference and subject to the direction and review of the members. The *General Assembly of ICMI*, consisting of the members of the ICMI EC and the Representatives to ICMI, convenes every four years in conjunction with the International Congress on Mathematical Education.

ICMI Activities A major event in the life of the international mathematics education community, the quadrennial *International Congress on Mathematical Education*, ICME, is held under the auspices of ICMI and typically gathers more than three thousand participants from all over the world. The

ICMI Executive Committee is responsible for the selection of a site for an ICME as well as for the appointment of an International Programme Committee, in charge of the scientific content of the congress. The practical and financial organisation of an ICME is the independent responsibility of a Local (or National) Organising Committee, under the observation of general ICMI principles.

Apart from the ICME congresses, the Commission organises or supports various activities, such as the *ICMI Study Programme*, in which each Study, built around an international study conference, addresses an issue or topic of particular significance in contemporary mathematics education and is directed towards the preparation of a volume, published in the New ICMI Study Series (NISS), which aims to offer a coherent, state-of-the art representation of the domain of the Study; the *ICMI Regional Conferences*, supported by ICMI morally and sometimes financially in order to facilitate the organisation of regional meetings on mathematics education, especially in less affluent parts of the world; or the *ICMI Solidarity Project*, aiming at increasing the commitment and involvement of mathematics educators around the world in order to help the furtherance of mathematics education in those parts of the world where there is a need for it that justifies international assistance and where the economic and socio-political contexts do not permit adequate and autonomous development.

The above-mentioned activities are of a more or less regular nature. In addition to those, ICMI involves itself in other activities on an *ad hoc* basis. For instance, ICMI has recently reinitiated contacts with UNESCO. Also ICMI is involved in the planning of the education components on the programme of the International Congresses of Mathematicians, the ICMs.

ICMI Affiliated Study Groups The Commission may approve the affiliation to ICMI of Study Groups, focussing on a specific field of interest and study in mathematics education consistent with its aims. The current Study Groups affiliated to ICMI are the *International Study Group on the Relations between the History and Pedagogy of Mathematics* (HPM), the *International Study Group for Mathematical Modelling and Applications* (ICTMA), the *International Organization of Women and Mathematics Education* (IOWME), the *International Group for the Psychology of Mathematics Education* (PME) and the *World Federation of National Mathematics Competitions* (WFNMC).

Information and Communication The official organ of ICMI since its inception is the international journal *L'Enseignement Mathématique*, founded in 1899. The homepage of the journal can be found at the address http://www.unige.ch/math/EnsMath/. Under the editorship of the Secretary-General, ICMI publishes the *ICMI Bulletin*, appearing twice a year. The Bulletin is accessible on the ICMI website http://www.mathunion.org/ICMI/, where more information about ICMI can also be found.

Support to ICMI The principal source of ICMI's finances is the support it receives from its mother organisation, the International Mathematical Union. Every year ICMI thus has to file a financial report for the endorsement of IMU, as well as a scientific report on its activities. Quadrennial reports are presented to the General Assemblies of both IMU and ICMI.

But one of the greatest strengths of ICMI is the time contributed freely by the hundreds of mathematicians and mathematics educators committed to the objectives of the Commission.

The Members of ICMI

All countries members of the International Mathematical Union, the mother organisation of ICMI, are *de facto* members of ICMI. But it is also possible for a country not a member of IMU to become a member of ICMI. (Information on this matter can be obtained from the Secretary-General of ICMI.)

There are currently 81 member countries of ICMI, 67 of which are also members of IMU. In the following list, (*) indicates a member of ICMI that is not a member of IMU.

A Argentina
Armenia
Australia
Austria
B Bangladesh (*)
Belgium
Bosnia and Herzegovina
Botswana (*)
Brazil
Brunei Darussalam (*)
Bulgaria
C Cameroon
Canada
Chile
China
Costa Rica (*)
Croatia
Cuba
Czech Republic
D Denmark
E Egypt
Estonia
F Finland
France
G Georgia
Germany
Ghana (*)
Greece
H Hong Kong
Hungary
I Iceland
India
Indonesia
Iran
Ireland
Israel
Italy
Ivory Coast
J Japan
K Kazakhstan
Republic of Korea
Kuwait (*)
L Latvia
Lithuania
Luxembourg (*)
M Malawi (*)
Malaysia (*)
Mexico
Mozambique (*)
N Netherlands
New Zealand
Nigeria
Norway
P Pakistan
Peru
Philippines
Poland
Portugal
R Romania
Russia
S Saudi Arabia
Senegal (*)
Serbia and Montenegro
Singapore
Slovakia
Slovenia
South Africa
Spain
Swaziland (*)
Sweden
Switzerland
T Thailand (*)
Tunisia
Turkey
U Ukraine
United Kingdom
United States of America
Uruguay
V Venezuela
Vietnam
Z Zambia (*)

The International Commission on Mathematical Instruction

ICMI Executive Committee 2003 – 2006

Nikolai DOLBILIN
Steklov Mathematical Institute
Gubkin str. 8, GSP-1
Moscow 117966, RUSSIA
dolbilin@mi.ras.ru

Peter L. GALBRAITH
School of Education
The University of Queensland
St Lucia, QLD 4072 AUSTRALIA
p.galbraith@mailbox.uq.edu.au

Petar S. KENDEROV
Institute of Mathematics and Informatics
Bulgarian Academy of Sciences
Acad. G. Bonchev Street, Block 8,
1113 Sofia, BULGARIA
kenderovp@cc.bas.bg

Frederick Koon-Shing LEUNG
Faculty of Education
The University of Hong Kong
Pokfulam Road, HONG KONG SAR
hraslks@hku.hk

***Ex officio* members:** **John M. BALL** (President of IMU)
Mathematical Institute
University of Oxford
24-29 St Giles'
Oxford, OX1 3LB, UK
ball@maths.ox.ac.uk

Phillip GRIFFITHS (Secretary of IMU)
Institute for Advanced Study
Olden Lane
Princeton, NJ 08540-0631 USA
pg@ias.edu

Legend: IMU stands for the *International Mathematical Union*. ICMI is a commission of IMU.

The ICMI Awards for 2005

The Felix Klein and Hans Freudenthal Medals are the two awards created by the International Commission on Mathematical Instruction (ICMI) for recognising *outstanding achievement in mathematics education research*. The Felix Klein Medal, named for the first president of ICMI (1908-1920), honours a lifetime achievement. The Hans Freudenthal Medal, named for the eight president of ICMI (1967-1970), recognises a major cumulative program of research.

The ICMI Awards represent the judgement of an (anonymous) jury of distinguished scholars of international stature. The jury for the 2005 Awards was chaired by Professor Michèle Artigue, of the Université de Paris 7.

ICMI is proud to announce the second awardees of the Klein and Freudenthal Medals.

> The Felix Klein Medal for 2005 is awarded to **Ubiratan D'Ambrosio**, Emeritus Professor at UNICAMP, in Brasil. This distinction acknowledges the role Ubiratan D'Ambrosio has played in the development of mathematics education as a field of research and development throughout the world, above all in Latin America. It also recognises Ubiratan D'Ambrosio's pioneering role in the development of research perspectives which are sensitive to the characteristics of social, cultural, and historical contexts in which the teaching and learning of mathematics take place, as well as his insistence on providing quality mathematics education to all, not just to a privileged segment of society.
>
> The Hans Freudenthal Medal for 2005 is awarded to **Paul Cobb**, Professor at Vanderbilt University, in the US. This distinction acknowledges his outstanding contribution to mathematics education: a rare combination of theoretical developments, empirical research and practical applications, which has had a major influence on the mathematics education community and beyond.

Citations of the work of these medallists can be found below. Presentation of the medals, and invited addresses of the medallists, will occur at ICME-11 in Monterrey, México, July 2008.

<u>Recipients of previous ICMI Awards:</u>

2003 Felix Klein Medal	Professor Guy Brousseau
2003 Hans Freudenthal Medal	Professor Celia Hoyles

(Document for a press release issued on April 3, 2006)

Citation for the 2005 ICMI Felix Klein Medal to Professor Ubiratan D'Ambrosio

The second Felix Klein Medal of the International Commission on Mathematical Instruction (ICMI) is awarded to Professor Ubiratan D'Ambrosio, Brasil. This distinction acknowledges the role Ubiratan D'Ambrosio has played in the development of mathematics education as a field of research and development throughout the world, above all in Latin America. It also recognises Ubiratan D'Ambrosio's pioneering role in the development of research perspectives which are sensitive to the characteristics of social, cultural, and historical contexts in which the teaching and learning of mathematics take place, as well as his insistence on providing quality mathematics education to all, not just to a privileged segment of society. His role in promoting mathematics education research and development in Latin America, both as regards priorities and content and as regards institutional and organisational frameworks, can hardly be over-estimated. His focus on providing graduate and postgraduate programmes for young researchers exemplifies his contribution.

Ubiratan D'Ambrosio was born in 1932 in São Paulo, Brazil. He was trained as a mathematician in Brazil and Italy and obtained his doctorate in science at the University of São Paulo in 1963. Until 1972 he spent most of his time in the USA (Brown University, SUNY/Buffalo) where he worked on Calculus of Variations and Measure Theory, while at the same time developing an increasing interest in interdisciplinary work and postgraduate programmes. Upon his return to Brazil in 1972, when he took up the post of director of the Institute of Mathematics, Statistics and Computer Sciences at the State University of Campinas (UNICAMP), Ubiratan D'Ambrosio's endeavour was to include new topics such as mathematical logic, mathematical modelling, bio-mathematics, computational linguistics and artificial intelligence as part of the Institute's research profile along with more classical areas. Later, he broadened his contribution to include mathematics education. In 1975 he was involved in creating a Masters programme in the teaching of sciences and mathematics at the UNICAMP.

During the 1970's, Ubiratan D'Ambrosio gradually moved into the field of mathematics education, partly as a result of his involvement in the activities of the Inter-American Committee on Mathematics

Education (IACME/CIAEM), of which he was later to become Vice-President and President. This gave rise to a variety of contacts with international protagonists in mathematics education such as Luiz Santaló, Hans Freudenthal, and Ed Begle, contacts which were greatly extended and amplified by his attendance at the International Congresses on Mathematical Education (ICMEs), in particular ICME-3, held in Karlsruhe, Germany in 1976. For that Congress he was in charge of a panel working on the theme "Why teach mathematics?", the report of which ("Overall goals and objectives for mathematical education") was published — with D'Ambrosio as the author — in Unesco's *New trends in mathematics teaching*, Vol. IV (Paris, 1979). At ICME-3 he raised, as one of the very first mathematics educators to do so, socio-cultural questions related to research in mathematics education while pointing to the links between these questions and the history of mathematics and the other sciences in different contexts.

Ubiratan D'Ambrosio was elected Vice-President of ICMI for the term 1979-1983, in which capacity he helped found the African Mathematical Union and the African Society for the Advancement of Science. When his term was over he took up office as the chair of the International Study Group of the Relations between History and Pedagogy of Mathematics.

As a result of his interest in the social and cultural conditions for mathematics education, in particular as regards the nature of mathematical knowledge in different cultures at different times, Ubiratan D'Ambrosio began to develop what is internationally his best-known contribution to the field of mathematics education, the idea of *ethnomathematics*. In 1978 he wrote a paper on the mathematical knowledge and practices of native American cultures, took part in a Unesco conference in Khartoum, Sudan, on developing mathematics in third world countries, and participated in a conference "Mathematics and the Real World" at Roskilde University, Denmark. Probably the first international presentation of his ideas concerning ethnomathematics, including a sketch of its development into a programme of research and activity, was Ubiratan D'Ambrosio's plenary lecture "Socio-Cultural Bases for Mathematical Education" at ICME-5 in Adelaide in 1984. Soon after came a series of publications that developed the initial ideas in greater detail, and in 1985 he co-founded the International Study Group on Ethnomathematics. He was the Vice-President of the study group 1988-1996. Since its inception, ethnomathematics has continued to grow as a field of research and development and has exerted considerable influence on mathematics education in several continents, above all in Latin America and Africa.

Today, Ubiratan D'Ambrosio is a very active Emeritus Professor at UNICAMP while also teaching at several other universities in São Paulo in postgraduate programmes of mathematics education and the history of science. He also continues to do research in ethnomathematics and related areas.

Ubiratan D'Ambrosio belongs to a generation that helped to found the field of mathematics education. His contribution to research is essentially as a philosopher — in the classical broad sense of that word — of mathematics education reflecting on its role in a complex world characterised by unrest and by an uneven distribution of goods and privileges across regions, countries, and societies. By focusing his attention on developing cultures, Ubiratan D'Ambrosio broadened our conception of mathematics education. More than that, he has helped to open the eyes of the mathematics education community to an understanding of how mathematical ideas are generated and how they evolved through the history

of mankind. This work made a significant contribution to our appreciation of the field of scientific invention and its relation to ad hoc practices that occur in different cultures and subcultures. His contribution has played a key role in legitimating alternative forms of mathematical activity and in elaborating the now-familiar idea that the quasi-mathematical knowledge of the learner can be built upon rather than rejected.

(Document for a press release issued on April 3, 2006)

Citation for the 2005 ICMI Hans Freudenthal Medal to Professor Paul Cobb

The second Hans Freudenthal Medal of the International Commission on Mathematical Instruction (ICMI) is awarded to Professor Paul Cobb, whose work is a rare combination of theoretical developments, empirical research and practical applications. His work has had a major influence on the mathematics education community and beyond.

Born in a small town in southern England, Paul Cobb did not expect to develop an academic career. After earning a BSc with honours in mathematics from the University of Bristol, he spent a few years working as a secondary school mathematics teacher. In 1978 he enrolled into a one-year Masters programme in mathematics education at the University of Georgia in Athens. Little did he know at that time where this seemingly insignificant step would take him. A few years later he was already one of the rising stars of research in mathematics education. It did not take him much longer to gain an international recognition and become a central figure as well as a major influence in the field of mathematics education. He is now Professor at Vanderbilt University, in the US.

Paul Cobb's professional activity spans two decades and more than one research paradigm. Once a close collaborator of Ernst von Glasersfeld and of Leslie P. Steffe, he began his career as a developer, and subsequently a critic, of the theoretical perspective known as *radical constructivism*. Cobb's research and development projects, first in the field of elementary school mathematics and later of middle school statistics, are exemplary in many respects. They are a product of a comprehensive, well-designed, consistent, and constantly updated research programme. Its main strength is its sensitivity, both to the lessons learned from earlier implementations and to the evolving practical needs of the field of education.

The dynamic character of Paul Cobb's theoretical perspective is a natural outcome of his thoughtful studies. His work shows an acute awareness of the insufficiency of any over-delineated approach, and he has gradually moved the focus of his work from individual learners to teams, to classrooms, and to district-wide infrastructure. Across these settings, he has been systematically examining the consequences of the assumption that human learning is inherently social. In this respect, his work with Erna Yackel on sociomathematical norms paved important new ground. Thanks to this systematic foundational contribution, Paul Cobb is today regarded as one of the leading sociocultural theorists in the field of mathematics education and beyond, and his work is currently yielding new insights on issues such as equity and students' identities.

Paul Cobb is a prolific writer, widely read within the broad education community. His research spans more than a hundred journal articles and book chapters, as well as several books authored or edited with others. Prestigious journals, such as *Educational Researcher*, *Cognition & Instruction*, *Journal of the Learning Sciences*, *Mind*, *Culture*, and *Activity* have consistently published his work. Many of his publications have multiple authors, as do his numerous empirical studies. Paul Cobb's life project can thus be seen as a truly collective endeavour, implemented according to the same principles as those that he promotes in his educational writings.

Paul Cobb's work has had a tangible impact on the mathematics education vocabulary. It is through this work that such widely-used notions as *taken-as-shared meaning* or *sociomathematical norms* entered the professional discourse. The fact that his contribution is recognized and valued within the mathematics education community and beyond finds further confirmation in his numerous grants, distinctions and awards, and in particular, his recent election to the National Academy of Education of the US.

(Document for a press release issued on April 3, 2006)

ICME-9 Proceedings: The Revised Version of the CD Issued

Due to a defect in the content of the CD accompanying the book of Proceedings of ICME-9, it was announced in the *ICMI Bulletin* 55 (December 2004), p. 6, that the Japanese colleagues in charge of the congress had decided to issue a revised and expanded version of the CD, to be sent to all ICME-9 participants. The appearance of the revised version of the CD ("r-CD") has met with some delay with respect to the original plans, and this has been a matter of deep regret and serious concern to our Japanese friends. But I am pleased, on behalf of the organisers of ICME-9, to inform the ICMI community that the process of preparation of the r-CD is now completed and that the shipping of the new CD is planned to take place by the end of June 2006.

The list of the regular lectures presented at ICME-9 and included in the revised CD is given in the *ICMI Bulletin* 57 (December 2005).

The following text is the preface appearing on the r-CD.

Bernard R. Hodgson
Secretary-General of ICMI

Preface
(taken from the r-CD)

The book of Proceedings of ICME-9,

> *Proceedings of the Ninth International Congress on Mathematical Education*, Hiroshi Fujita, Yoshihiko Hashimoto, Bernard R. Hodgson, Peng Yee Lee, Stephen Lerman and Toshio Sawada, eds., Kluwer Academic Publishers, 2004,

was published accompanied by a CD. Regrettably, that CD suffered from some serious omissions, corrected in the present revised edition.

The two main additions to this *Digital Edition (Revised 2005)* of the *Proceedings of the Ninth International Congress on Mathematical Education* are: (i) thirty-three of the papers presented as regular lectures at ICME-9 (for a total of 488 pages), (ii) the entire book of Proceedings, reproduced here with kind permission of the copyright owner, Springer Science + Business Media.

This "revised CD" (r-CD) is divided in three parts. The first part presents various materials newly compiled for this expanded digital edition. Besides buttons allowing navigation throughout the r-CD, this part provides the welcome greetings of the Chair of the International Programme Committee presented at the opening ceremony of ICME-9, as well as the list of the members of the ICMI

Executive Committee and of the ICME-9 International Programme Committee and National Organizing Committee. But more importantly one finds there the texts from thirty-three of the regular lecturers, and also a set of photographs from the congress, many of which were taken during the opening ceremony.

The second part of this r-CD repeats the contents of the original CD, and the third part is a file corresponding to the entire book version of the ICME-9 Proceedings, not previously available electronically.

It is hoped that the *Proceedings of the Ninth International Congress on Mathematical Education — Digital Edition (Revised 2005)* will be a useful tool for researchers as well as for all those interested in mathematics education, while providing a more complete and vivid record of the congress itself.

To understand what this r-CD has accomplished, we briefly recount the story of the original. While it is stated in the Preface of the printed Proceedings (p. xii) that "the CD part of these Proceedings contains, in addition to files for the whole content of the book part, vivid scenes of the ceremonies and the IRT, full texts of regular lectures if available, and some scientific animation etc.", it turned out that neither the "whole content of the book part" nor the "full texts of the regular lectures if available" appear on the accompanying original CD.

The editors of the Proceedings, the Japanese organizers of the ICME-9 congress and the Executive Committee of ICMI deeply deplore this regrettable situation, which obviously was a source of frustration to many participants and especially to the regular lecturers, whose papers thus remained inaccessible to the community. However the organizers of the congress announced, shortly after the proceedings volume came out, their decision to publish a revised and expanded version of the CD to be sent anew to all ICME-9 participants.

On behalf of my colleagues of the Executive Committee of ICMI, I wish to express our gratitude to all the Japanese colleagues who, a number of years after the conclusion of the congress, have worked together in identifying and implementing a sound solution to the problem caused by the defect in the original ICME-9 CD. We are in particular grateful to Katsuhiko Shimizu, who brought an essential contribution in the preparation and production of the expanded CD. But above all we wish to repeat here our highest esteem and appreciation to the Chair of the International Programme Committee and President of the National Organizing Committee, Hiroshi Fujita San. During the closing ceremony of ICME-9, the President of ICMI and myself already had the opportunity to tangibly express to our colleague our gratitude for the exceptional leadership role he had played in the organisation of ICME-9. The resolution of the flaw in the first version of the CD owes much to his professionalism and sensibility.

Bernard R. Hodgson
Secretary-General of ICMI
bhodgson@mat.ulaval.ca

December 2005

Election of the 2007-2009 Executive Committee of ICMI — The Slate of Candidates

The Executive Committee of the International Mathematical Union has announced in April 2006 the composition of the slate of candidates for the election of the next ICMI Executive Committee:

President:	Michèle Artigue	(France)
Secretary-General:	Bernard R. Hodgson	(Canada)
Vice Presidents:	Jill Adler	(South Africa)
	William (Bill) Barton	(New Zealand)
Members-at-Large (*7 candidates for 5 posts*):		
	Maria G. (Mariolina) Bartolini Bussi	(Italy)
	Jaime Carvalho e Silva	(Portugal)
	Olimpia Figueras	(Mexico)
	Celia Hoyles	(UK)
	S. Kumaresan	(India)
	Frederick K.S. Leung	(Hong Kong)
	Alexei Semenov	(Russia)

The election of the 2007-2009 ICMI EC will take place during the General Assembly of IMU, to be held in August 2006 in Santiago de Compostela, Spain, on the occasion of ICM-2006 (Madrid).

As announced earlier (see *ICMI Bulletin* 55, December 2004, pp. 18-22), this IMU GA will also be presented with amendments to the procedure for the election of the ICMI EC. One consequence, should these amendments be adopted, is that the following election of the ICMI EC would happen during the ***General Assembly of ICMI*** that will take place in 2008 on the occasion of ICME-11. Thus, as a transition measure, the next ICMI EC would serve for a three-year term (2007-2009), instead of the usual four-year.

Considering the procedure for election currently in force, the above slate is being formally submitted by the IMU Executive Committee to the IMU GA. Still the proposed new model for the preparation of the ICMI EC slate, including the formation and action of an *ICMI Nominating Committee* with mandate to prepare this slate, has been implemented for the 2006 election. The slate submitted by the 2006 ICMI Nominating Committee had the status of advice to the IMU EC.

The reader is reminded that 2006 ICMI Nominating Committee is composed as follows: Mogens Niss (*Chair*, Denmark), John Ball (*IMU President*, UK), Hyman Bass (*ICMI President*, USA), Victor Vassiliev (Russia), Tomas Recio (Spain), Günter Törner (Germany) and Lim-Teo Suat Khoh (Singapore).

Bernard R. Hodgson, Secretary-General of ICMI
bhodgson@mat.ulaval.ca

A Call for Bids for ICME-12 (2012) — A Reminder

A call for bids to host the Twelfth International Congress on Mathematical Education (ICME-12), to take place in 2012, was issued in the December 2004 *ICMI Bulletin* (No. 55, pp. 11-12). ICMI member countries were then invited to indicate, by November 1, 2005, their intention to submit a bid for ICME-12. Three countries have responded to this call, namely (in alphabetical order) China, Korea and South Africa. While this preliminary declaration does not imply that these three countries should feel "obliged" to eventually present a firm bid, I also with to stress that at this stage it is possible for other countries to submit a bid, even if no preliminary declaration has been made.

I wish to remind that the final deadline for submitting a bid is **November 1, 2006**. Documents should be presented in twelve copies. Decisions about the site of ICME-12 will be made by the 2007-2009 Executive Committee of ICMI, to take charge as of January 1, 2007.

I shall be happy to reply to any query about preparing an invitation to host ICME-12 (or a later ICME...).

Bernard R. Hodgson, Secretary-General of ICMI
bhodgson@mat.ulaval.ca

IMU President Receives a Knighthood

IMU President John Ball, Sedleian Professor of Natural Philosophy and Fellow of Queen's College, University of Oxford, has received a knighthood in the New Year (2006) Honours list.

A world-renowned mathematician, John Ball is particularly active, through his IMU presidency, in supporting the advancement of mathematics in developing countries. His main research areas lie in elasticity theory, the calculus of variations, and infinite-dimensional dynamical systems. He is especially interested in the mathematics of microstructure arising from phase transformations in solids, where the problem of predicting microstructure morphology is related to deep unsolved questions of the multi-dimensional calculus of variations such as understanding quasiconvexity.

(Based on a *BBC News* communiqué, December 31, 2005)

Celebrating the ICMI Centennial

ICMI will be celebrating in 2008 its 100th anniversary. The International Programme Committee appointed to plan the symposium organised on this occasion, whose composition was announced in the June 2005 issue of the *ICMI Bulletin* (No. 56), had its first meeting in February 2006 under the chairmanship of Ferdinando Arzarello (ferdinando.arzarello@unito.it). Details on the programme of the symposium will be announced in a near future. But it is already known that the symposium will take place in Rome — the birthplace of ICMI — on March 5-8, 2008, at the Accademia dei Lincei for the first days, and on the final day at Liceo Virgilio, an ancient school very near to Lincei. The Local Organising Committee is chaired by Marta Menghini (Marta.Menghini@uniroma1.it).

A Change in the Web Address of ICME-10

Note of the Editor: The following message was sent by e-mail on May 31, 2006, to all the participants at ICME-10.

Since the early years of the planning of the ICME-10, our website (www.icme-10.dk) has generously been hosted by the Southern University of Denmark. However, due to some structural changes at the university, our domain was left unprotected for a short period of time. It was a surprise and a shock to realize that the domain "www.ICME-10.dk" had in the meantime been bought by an unidentified person or organisation. We have therefore been forced to change our domain to:

www.icme10.dk

(We have simply lost our hyphen!)

We will of course make an effort to recover our old domain and establish a link, so that both addresses will hopefully be active in the future. Meanwhile, please use our new address.

Fortunately all the web-pages of the sub-groups are fully updated and the procedure for uploading documents to these pages is unchanged. So the functioning of the website is the same.

We apologise for any inconvenience this change of domain may cause. As promised at ICME-10 the website will remain active until at least a year after ICME-11 — hopefully without further changes in the domain.

Morten Blomhøj, Chair of Local Organising Committee for ICME-10
IMFUFA, Roskilde University, DENMARK
morten@mmf.ruc.dk

Purchasing the NISS Volumes:
A New Procedure for the ICMI Discount

The volumes resulting from the ICMI Studies appear in the New ICMI Study Series (NISS), published by Springer under the general editorship of the President and Secretary-General of ICMI.

According to the contract negotiated in 1999 between ICMI and Springer (then Kluwer), any individual interested in the activities of ICMI and purchasing these books for personal use is entitled to the ***ICMI Society Discount***, namely a **60% discount** on all NISS series hardbound volumes and a **25% discount** on all softbound volumes within the series.

Springer has recently announced a *new procedure* for obtaining the ICMI society discount. Orders must be placed personally through the NISS homepage

http://www.springeronline.com/series/6351

on the Springer website. In order to obtain the society discount granted to ICMI, individuals should enter the respective tokens when asked to during the ordering process, *on the bottom of the payment screen.*

The following **ICMI Token Numbers** have been issued by Springer:

Token for Hardbound: YSwE925dq6SEdhk
Token for Softbound: C6zHr25NZDdFAay

This discount is not available to institutions or when ordering the NISS volumes through a bookstore.

(**Note:** Springer uses the expression "ICMI members" when speaking of their potential customers in this specific context, which neglects the fact that ICMI members are countries, not individuals.)

Address of the NISS homepage

http://www.springeronline.com/series/6351

A New ICMI Study Volume Available — NISS 9

The Study volume resulting from the thirteenth ICMI Study has recently appeared as volume 9 of the New ICMI Study Series (NISS):

> Frederick K.S. Leung, Klaus-D. Graf and Francis J. Lopez-Real, eds., *Mathematics Education in Different Cultural Traditions — A Comparative Study of East-Asia and the West: The 13th ICMI Study*. Springer, 2006. 597 p. (NISS 9) ISBN: 0-387-29722-7

Individuals purchasing the book for personal use are entitled to the usual "ICMI discount" of 60% on the hardbound price.

More information about the book can be found on the NISS homepage, inside Springer website:
http://www.springeronline.com/series/6351

From the back cover

In recent years there has been an upsurge of interest concerning international comparisons of mathematics education, stimulated in part by large-scale studies such as TIMSS and PISA. However, many educators have felt that the analysis of such comparisons requires a deep understanding of the underlying cultural and social factors involved, and this perspective led to the 13th ICMI Study Conference being convened to consider the issues. Because of the impossible complexity of trying to cover all different cultural traditions worldwide it was decided to focus on two significant traditions, broadly speaking East Asia and the West. This important volume is the outcome of the ICMI Study.

The volume covers a very wide field including the contexts of mathematics education, the curriculum, teaching and learning, and teachers' values and beliefs. Within these broad parameters some of the particular cross-cultural issues that are discussed include intuition and logical reasoning, influences of Confucianism and Ancient Greek traditions, basic skills and process abilities, learners' perspectives, assessment practices, textbooks and ICT multimedia.

Throughout the book emphasis is placed on uncovering and understanding differences and similarities, not just between these two major traditions but within the cultures themselves. Simplistic analyses or solutions are avoided and the authors demonstrate a cultural sensitivity that results in a collaborative, rather than competitive, spirit evident in the comparisons that are made. Much of the focus is on learning together, as much from our failures as our successes. The contributing authors are highly experienced and eminent members of the mathematics education community and together they have provided us with a book that is an invaluable source of information, discussion, reflection and insight. ***Mathematics Education in Different Cultural Traditions*** will be of special interest to mathematics teachers, teacher educators, researchers, education administrators, curriculum developers, and student teachers.

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Report on

ICMI activities in 2005

1. Organisation

The 2003-2006 **Executive Committee (EC) of ICMI** had its fourth and fifth meetings in 2005. The EC met on June 19-22, 2005, at the University of the Witwatersrand in Johannesburg, South Africa, just prior to the First Africa Regional Congress of ICMI. It also met on December 15-18, 2005, at the Indira Gandhi National Open University in New Delhi, India. A National Conference on Mathematics Education was held at the National Council of Educational Research and Training (NCERT), in New Delhi, in conjunction with the ICMI EC visit.

The President and Secretary-General of ICMI were invited for part of the meeting of the **Executive Committee of IMU** held in Rio de Janeiro on April 22, 2005. In addition to allowing the IMU EC members to receive a report on ICMI and its activities, this meeting was the occasion of discussing specific issues such as the difficult financial situation of ICMI and the possible collaboration of ICMI to IMU initiative towards developing countries. It also allowed to examine concerns expressed by the IMU EC about the situation of students of mathematics at the university level and to identify a joint action of IMU and ICMI on this matter (see item 6 below).

Following a postal ballot held in August 2004, two countries that were already **members of ICMI**, *Indonesia* and *Pakistan*, have been admitted to IMU as of January 1, 2005. Consequently at the end of 2005, ICMI had 81 member countries, 67 of which are also members of IMU. Of the 81 member countries of ICMI, 16 had in 2005 no appointed Representative to ICMI: *Armenia*, *Bosnia and Herzegovina*, *Brunei Darussalam*, *Estonia*, *Greece*, *Kazakhstan*, *Kuwait*, *Pakistan*, *Peru*, *Saudi Arabia*, *Senegal*, *Slovenia*, *Tunisia*, *Turkey*, *Ukraine*, *Uruguay*. (One country, the *Democratic People's Republic of Korea*, has since 2003 an observer status to the IMU.) Among the remaining 65 member countries, 10 could still not be reached by e-mail. During 2005, a total of fifteen collective e-mail messages were sent by the Secretary-General to the ICMI Representatives, some of these providing information on ICMI and its activities, and others asking for input from the Representatives.

As indicated in the 2004 report, it was decided that the new election process on which the Executive Committees of IMU and ICMI agreed in 2004 would be used for the **2006 election**, but necessarily on an informal basis (pending approval of the new proposed procedures and structures at the 2006 IMU General Assembly). Consequently a *Nominating Committee of ICMI* was set up for the 2006 election, with a mandate to prepare the selection of the slate of candidates for the ICMI Executive Committee, but operating informally as an advisory body to the IMU Executive Committee. This Nominating Committee is composed of Mogens Niss (Chair), John Ball, Hyman Bass, Victor Vassiliev, Tomas Recio, Günter Törner and Lim-Teo Suat Khoh. A call for nomination of candidates to the 2007-2009 ICMI Executive Committee was made in August 2005 to the IMU Adhering Organisations and Committees for Mathematics as well as to the ICMI Representatives.

2. ICMEs

The composition of the **ICME-11** International Programme Committee was finalised early in 2005 and is announced in the June 2005, No. 56, issue of the *ICMI Bulletin*. The IPC is chaired by Marcela Santillán, Rectora at the Universidad Pedagógica Nacional, and had its first meeting in Mexico City on October 29 to November 1st, 2005. One member of the IPC was denied entrance to Mexico on that occasion, and the President of ICMI wrote to the Mexican Secretary of State to ensure that such a dismissal would not happen again in connection with ICME-11.

An official call for bids to host **ICME-12** in 2012 was made by the Secretary-General of ICMI during the closing session of ICME-10. This call also appears in the *ICMI Bulletin* (No. 55, December 2004, pp. 11-12). Three countries, namely (in alphabetical order) China, Korea and South Africa, have responded in 2005 to the invitation of informing the ICMI Executive Committee by a declaration of intent that they are considering preparing an official bid to host ICME-12, to be submitted by November 2006.

The preparation of the revised and expanded version of the CD accompanying the book of Proceedings of **ICME-9** has met with some delay, so that the diffusion of the new CD, first planned to take place in 2005, has been postponed to 2006. The revised CD will be sent to all ICME-9 participants.

3. ICMI Studies

Two new ICMI Studies were launched in 2005:

- **ICMI Study 18**: *Statistics Education in School Mathematics: Challenges for Teaching and Teacher Education*
  A new ICMI Study was launched in 2005 on the theme of statistics and is organised jointly with the International Association for Statistical Education (IASE). The International Programme Committee is chaired by Carmen Batanero and its composition is announced in the December 2005 issue of the *ICMI Bulletin*. The Study Conference is planned to take place in July 2008 in Monterrey, México, as a satellite conference to ICME-11.
- **ICMI Study 19**: *The role of mathematical reasoning and proving in mathematics education*
  The ICMI Executive Committee decided at its December 2005 meeting that the 19th ICMI Study will be devoted to the role of proofs and proving in mathematics education. The IPC, to be chaired by Gila Hanna and Michael de Villiers, is now under appointment.

As regards other on-going Studies, the situation at the end of 2005 was as follows.

- **ICMI Study 13**: *Mathematics Education in Different Cultural Traditions: A Comparative Study of East-Asia and the West*
  The NISS volume is currently in preparation under the editorship of Klaus-Dieter Graf, Frederick K.S. Leung and Francis Lopez-Real and is expected to appear early in 2006. (NISS 9)
- **ICMI Study 14**: *Applications and Modelling in Mathematics Education*
  The NISS volume is currently in preparation under the editorship of Werner Blum, Peter Galbraith, Hans-Wolfgang Hehn and Mogens Niss and is expected to appear by the end of 2006. (NISS 10)

- **ICMI Study 15**: *The Professional Education and Development of Teachers of Mathematics*
  The Discussion Document for this Study was published in various journals and newsletters, including the *ICMI Bulletin* No. 54, June 2004, pp. 12-23, in *L'Enseignement Mathématique* 50 (2004) pp. 191-200 and in *Educational Studies in Mathematics* 56 (2004) pp. 359-372. The Study Conference was held in Águas de Lindóia, São Paulo, Brazil, on May 15-21, 2005, and was attended by 157 participants (including 94 women) from 33 different countries. The NISS volume is currently in preparation under the editorship of the two co-chairs, Deborah Ball and Ruhama Even. (NISS 11)
- **ICMI Study 16**: *Challenging mathematics in and beyond the classroom*
  The two co-chairs of the International Programme Committee are Peter J. Taylor and Edward J. Barbeau. The Discussion Document for this Study appears in the *ICMI Bulletin* No. 55, December 2004, pp. 32-46, in *L'Enseignement Mathématique* 51 (2005) pp. 165-176 and in *Educational Studies in Mathematics* 60 (2005) pp. 125-139. The Study Conference will take place at the Norwegian University of Science and Technology, in Trondheim, Norway, on June 27 to July 3, 2006.
- **ICMI Study 17**: *Digital Technologies and Mathematics Teaching and Learning: Rethinking the Terrain*
  The two co-chairs of the International Programme Committee are Celia Hoyles and Jean-Baptiste Lagrange. The Discussion Document for this Study appears in the *ICMI Bulletin* No. 57, December 2005 and in *L'Enseignement Mathématique* 51 (2005) pp. 351-363. A short announcement was published in *Educational Studies in Mathematics* 60 (2005) pp. 267-268. The Study Conference will take place at Hanoi University of Technology, Viet Nam, on December 3-8, 2006.

At its June 2003 meeting, the ICMI EC launched a reflection on the ICMI Study programme and its accomplishments since its inception in the mid 1980s. The Studies being concretely reflected in the NISS Study volumes (appearing in the NISS series), the ICMI EC had invited Stephen Lerman (London South Bank University) to review and analyse the research papers published in the Study volumes. The report, received in 2005, suggests some slight modifications in the overall organisation of the Study programme on which the ICMI EC is reflecting.

4. ICMI Regional Conferences

Two ICMI Regional Conferences were held in 2005.

- The **First Africa Regional Congress of the International Commission on Mathematical Instruction** was held at the University of the Witwatersrand in Johannesburg, South Africa, on June 22-25, 2005. The conference was attended by some 180 participants from 23 countries, including in particular the following fourteen African countries: Botswana, Burkina-Faso, Kenya, Lesotho, Malawi, Mozambique, Namibia, Nigeria, South Africa, Swaziland, Tunisia, Uganda, Zambia and Zimbabwe. The conference was financially supported by ICMI (3 000 USD) and by IMU Commission on Development and Exchanges (CDE). The latter grant of 10 000 USD allowed to provide support for regional delegates as well as support for two participants from Francophone Africa (Tunisia) and India. A report on the conference appears in the *ICMI Bulletin* 57 (December 2005).

- **ICMI-EARCOME 3** (Third ICMI East Asia Regional Conference on Mathematics Education) was held in China from August 7 to 12, 2005. Three higher teacher education institutes were co-organizers: East China Normal University in Shanghai, Nanjing Normal University in Nanjing City, and Hangzhou Teachers college in Hangzhou City. The conference took place during the first four days on the campus of East China Normal University, in Shanghai. Participants then divided into two groups moving to Nanjing or Hangzhou respectively for the last two days' sessions. There were over 300 participants, with 152 coming from 15 foreign countries of East Asia and around the world. A report on the conference appears in the *ICMI Bulletin* 57 (December 2005).

Besides **EMF 2006**, to take place in May 2006 in Sherbrooke, Canada, two ICMI Regional Conferences are planned for 2007. In addition to **ICMI-EARCOME-4** in Penang, Malaysia, already announced, the ICMI EC has granted the status of an ICMI Regional Conference to another conference:

- **Second ICMI Africa Regional Congress**, to take place in Nairobi, Kenya, on May 23-27, 2007, on the theme *Embracing Innovative Responses to Challenges in Mathematics Instruction*.

The ICMI EC is represented on the International Programme Committees of these conferences respectively by Michèle Artigue and Bernard R. Hodgson (EMF 2006), Frederick Leung (ICMI-EARCOME 4) and Jill Adler (Second Africa Regional Congress).

5. Other activities

The celebration of the **centennial of ICMI**, in 2008, is now under preparation. As the Commission was established in Italy, during the 1908 Congress of Mathematicians held in Rome, the Executive Committee is grateful that the Italian mathematicians and mathematics educators communities have accepted the task of hosting the symposium to be organised on this occasion. The International Programme Committee in charge of this symposium is chaired by Ferdinando Arzarello and the composition of the IPC is announced in the June 2005, No. 56, issue of the *ICMI Bulletin*. The symposium will take place on March 5-8, 2008, at the Accademia dei Lincei in Rome. The Local Organising Committee is chaired by Marta Menghini.

ICMI has co-sponsored since 2001 international workshops organised in Utah, USA, in the context of the annual **Park City Mathematics Institute (PCMI)** hosted by the Institute for Advanced Study (Princeton, USA). In 2005 PCMI has supported the participation to the ICMI Study 15 conference on teacher education of two persons involved in the PCMI International Seminar (from Cameroon and Iran). As indicated in the 2004 report, ICMI was invited to join with the organisers of the PCMI International Seminar for a meeting with **World Bank** officials. In regards to possible actions, recent discussion with PCMI and the World Bank has centred on two projects of joint workshops for training mathematicians and mathematics teachers. One concerns Cambodia and neighbouring countries, in partnership with CIMPA (Centre International de Mathématiques Pures et Appliquées), and the other Africa, in partnership with AMMSI (African Mathematics Millennium Science Initiative). In each case, ICMI is involved in the mathematics teacher education component.

Over the last years, ICMI has been sponsoring, jointly with UNESCO and other bodies, the development of a mathematical exhibition entitled "**Experiencing mathematics**", whose aim is to improve the image of mathematics among the general public. Two sets of the exhibit are now

available and are being circulated internationally under UNESCO and ICMI auspices. The 2005 programme of travel included China (Beijing), Greece (Athens), Mozambique (Maputo) and South Africa (Johannesburg, Kimberley, Cape Town, Potchefstroom, Richards Bay). The African exhibition project was supported through a grant of 6 000 USD from IMU Developing Countries Strategy Group (DCSG) which covered the transportation to and from Africa. Additional funds needed to be raised for the circulation of the exhibit inside Africa. The exhibition is devised so to evolve according to the local needs/culture/expertise, for instance by organising a regional and coherent pedagogical design around the exhibition. The Africa exhibits thus incorporated ingredients of ethnomathematics. The current plans for 2006 includes Namibia (12 towns, including Windhoek), Thailand (Bangkok), France (Lyon) as well as Spain (Madrid), where it will be shown during and after the International Congress of Mathematicians in the Centro cultural Conde Duque.

ICMI has maintained in 2005 its collaboration to IMU **Developing Countries Strategy Group (DCSG)** which aims at increasing, guiding and coordinating IMU's activities in support of mathematics and mathematics education in the developing world. ICMI is represented in the DCSG by Vice-President Michèle Artigue. ICMI is collaborating to the project of a Clearinghouse for African Mathematics, to be housed at the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy. ICMI contributes to this project by collecting information about activities linked to mathematics education in Africa, in particular as regards existing associations, projects, master and doctorate programmes in education, and mathematics competitions. The DCSG also approved a grant to support the circulation in Africa of the international mathematics exhibition "Experiencing Mathematics".

6. IMU Concerns about Mathematics Students

Declining numbers of students are choosing to pursue mathematics study at the university level, and many of those who do, even with some initial enthusiasm for mathematics, are discouraged by their early university mathematics instruction and so turn away from it. The resulting decline in the numbers and quality of students pursuing university mathematics studies is a worldwide trend, now for more than a decade, and it threatens the vigour and growth of the mathematical sciences, on which contemporary societies and economies fundamentally depend. The professional mathematics community is not alone in being seriously concerned about this, and this has led the IMU EC to call for a gathering of data to document this trend internationally, and analyze its causes. The IMU has enlisted ICMI to partner in this undertaking, and take responsibility for its design.

This trend draws attention to another, distinct but importantly related, problem, which is the inadequate supply of mathematically qualified students choosing to become mathematics teachers in the schools. Thus, gathering data to understand these two parallel phenomena has become the agenda of a joint project of the IMU and ICMI, called the "**Pipeline Project**", which will lead to a report that should be of wide interest, in a number of countries, to mathematics departments, schools of education, government policy and funding agencies, and others. This project was initiated at the July 2004 ICMI EC to which IMU President John Ball participated. A task group, chaired by ICMI EC member Frederick Leung, has been appointed with the mandate to define a detailed work plan for the project and frame it as a proposal for funding to relevant funding agencies. Progress in that direction

has been made in 2005. The Pipeline Project will be organised in collaboration with some major professional organisations.

7. ICMI Affiliated Study Groups

ICMI continues to have five Affiliated Study Groups, namely (in the chronological order of their affiliation to ICMI) **HPM** (The International Study Group on the Relations Between the History and Pedagogy of Mathematics) and **PME** (The International Group for the Psychology of Mathematics Education) — 1976, **IOWME** (The International Organization of Women and Mathematics Education) — 1987, **WFNMC** (The World Federation of National Mathematics Competitions) — 1994 and **ICTMA** (The International Study Group for Mathematical Modelling and Applications) — 2003.

8. The ICMI Awards

ICMI Vice-President Michèle Artigue is currently chairing the **ICMI Award Committee**, responsible for selecting the recipients of the Awards. A call for suggestions for the 2005 ICMI Awards has been launched by the Award Committee and disseminated among the mathematics education community though various channels (ICMI Representatives, Affiliated Study Groups, national and international journals and associations). At the end of 2005, the ICMI Awards Committee was completing its review task so that the announcement of the Awards could be made early in 2006.

9. Information and Communication

Besides direct e-mail contact with the ICMI Representatives or other members of the international mathematics education community, the dissemination of information about the Commission and its activities is generally accessible through the ***ICMI Bulletin*** and the ICMI website, both under the editorship of the Secretary-General of ICMI. During the year 2005, the publication of the *Bulletin* has experienced delays, so that the two issues dated June 2005 (No. 56) and December 2005 (No. 57) were still outstanding at the time of this report.

The ICMI EC has started in 2003 a project of renewing its **website** (*www.mathunion.org/ICMI/*) and making a much greater use of it for contacts with the international mathematics education community. An agreement was made in 2005 with the Studio École of the School of visual arts of Université Laval for the design and implementation of a new website for ICMI.

Bernard R. Hodgson, Secretary-General
Université Laval, Québec, Canada
bhodgson@mat.ulaval.ca
12 May 2006

ICMI Accounts 2005

1 January – 31 December

BALANCE AS OF JANUARY 1:

ICMI	• **Canadian Dollars**	**52 210,42**
	• **US Dollars**	**48 510,90**
Solidarity Fund (US Dollars)		***36 827,13***

Canadian Dollars Account:

Income:	
balance 2004	52 210,42
IMU (Schedule A: Administration — 15 000,00 CHF) [1)]	14 173,93
IMU (Schedule B: Scientific Activities — 27 000,00 CHF) [1)]	25 513,07
donation to ICMI from the local organizers of Study 15 Conference[2)]	5 624,28
interest	948,58
total	98 470,28
Expenditure:	
ICMI Study 15: Study Conference (May 2005), Águas de Lindóia, travel of IPC[2)]	3 184,85
ICMI Study 17: IPC meeting, London (April 2004) [3)]	418,32
ICMI EC meeting, Copenhagen (July 2004)[4)]	2 879,87
ICMI EC meeting, Johannesburg (June 2005)	3 840,57
ICMI EC meeting, New Delhi (December 2005)	6 016,61
ICMI Centennial: preliminary meeting, travel and local expenses of Secretary-General[5)]	1 693,53
ICME-11: IPC meeting, México, October, expenses of Secretary-General	154,02
Klein and Freudenthal ICMI Awards: medals[6)]	773,04
translation of articles for the *ICMI Bulletin*	220,00
transfer to USD account (corresponding to 1 160,34 USD)	1 425,37
bank charges (checks and foreign transfers)	94,00
ICMI balance 2005	**77 770,10**
total	98 470,28

US Dollars Account:

Income:	
ICMI balance 2004	48 510,90
return payment of loan from ICME-10[7)]	7 500,00
donation to ICMI from ICME-10[8)]	2 339,66
transfer from CAD account (corresponding to 1 425,37 CAD)	1 160,34
ICMI interest	744,72
Solidarity Fund balance 2004[9)]	*36 827,13*
Solidarity Fund interest	497,30
total	97 580,05

Expenditure:	
ICMI Study 15: Study Conference (May 2005), Águas de Lindóia, travel of IPC[2)]	2 390,00
ICMI EC meeting, Johannesburg (June 2005)	2 996,00
ICMI EC meeting, New Delhi (December 2005)	3 970,00
ICMI balance 2005	**50 899,62**
Solidarity Fund balance 2005	***37 324,43***
total	97 580,05

Average exchange rate, 2005 1 USD = 1,21 CAD

Notes:

1. Considering the fact that the value of the US dollar has in recent years substantially diminished with respect to many currencies, the decision made in 2004 to have the annual grant of IMU given to ICMI in Canadian dollars was maintained in 2005, as this is the currency through which a majority of ICMI expenses are paid.

2. The Local Organising Committee of the conference of the fifteenth ICMI Study on *The Professional Education and Development of Teachers of Mathematics*, held in Águas de Lindóia, Brasil, generously supported the participation of the members of the International Programme Committee by covering the local costs of the IPC and also by making a donation of 5 624,28 CAD to ICMI, corresponding almost entirely the travel expenses of IPC members incumbent upon ICMI.

3. Costs, reimbursed only in 2005, for the participation of one member of the International Programme Committee of ICMI Study 17 to the IPC meeting held in London in April 2004.

4. Some of the local costs for the meeting of the Executive Committee of ICMI held in Copenhagen in July 2004 on the occasion of ICME-10 were reimbursed by ICMI in 2005 as part of the final accounting between ICMI and ICME-10.

5. The Secretary-General met in February 2005 with the chair of the International Programme Committee for the celebration of the centennial of ICMI, and other members of the IPC taking part in the Fourth Conference of the European Society for Research in Mathematics Education (CERME 4) in Sant Feliu de Guíxols, Spain.

6. In recognition of the work done for ICMI, a student from École Boulle (Paris), where the medals accompanying the ICMI Awards were designed, was invited to Copenhagen to present the medals to the ICME-10 participants. The local expenses, covered by ICMI, were reimbursed to ICME-10 in 2005 as part of the final accounting between ICMI and ICME-10.

7. Reimbursement in 2005 of an interest-free loan of 7 500 USD made in 2000 to ICME-10.

8. The Local Organising Committee of ICME-10 made in 2005 a generous donation of 2 339,66 USD to ICMI as part of the final accounting between ICMI and ICME-10.

9. The assets of the **ICMI Solidarity Fund**, established in 1992, are kept, on the ICMI accounts, separately from ICMI's general resources.

10. In addition to generous donations received in 2005 from the organisers of ICME-10 and of the Study Conference of ICMI Study 15, ICMI has been financially supported, directly and indirectly, by various bodies and institutions. In particular the Secretary-General's home institution, Université Laval, has contributed in 2005 a substantial support to ICMI's work of the order of 8 000 USD (e.g. through the printing and distribution costs of the ICMI Bulletin, plus a partially reduced teaching load). The same is true of other members of the Executive Committee as well as some of the individuals involved in the programme committee of ICMI activities, as their home institutions could partially cover their travel and other expenses related to their participation in meetings. The ICMI Executive Committee expresses its gratitude for this generous support.

However, as already mentioned in previous financial reports, this type of "invisible" support has become more and more problematic, due to the financial situation of several higher education institutions around the world, thus putting a severe constraint on ICMI finances.

Bernard R. Hodgson, Secretary-General
Université Laval, Québec, Canada
10 May 2006

A Report from HPM

Constantinos Tzanakis

In the last few months there were the following activities, related to the International Study Group on the Relations between the History and Pedagogy of Mathematics (HPM).

1. Mini-Workshop: ***Studying Original Sources in Mathematics Education***
Mathematisches Forsschunsinstitut Oberwolfach, Germany, May 1st-5th, 2006, organised by Fulvia Furinghetti, University of Genova, Italy, Hans Niels Jahnke, University of Essen, Germany and Jan van Maanen, University of Groningen, The Netherlands.
(This report is based on a more detailed report written by H.N. Jahnke and B. Smestad in the *HPM Newsletter*, no 62, July 2006.)

Among the various possible activities by which historical aspects might be integrated into the teaching of mathematics, the study of an original source is the most demanding and the most time consuming. It requires a detailed and deep understanding of the mathematics in question, of the time when it has been written and of the general context of ideas, and language becomes important in ways which are completely new compared with usual practices of mathematics teaching. Thus, reading a source is an especially ambitious enterprise, but rewarding and substantially deepening the mathematical understanding. In principle, the aims and effects, which might be pursued by way of a source, will not be different from those attained by other types of historical activities. However, there are some ideas, which are specifically supported by reading mathematical sources:

(1) to see mathematics as an intellectual activity;
(2) to place mathematics in the scientific, technological and philosophical context of a particular period in the history of ideas;
(3) to participate in an activity oriented more to processes of understanding, than to final results;
(4) to appreciate the role and importance of the different languages involved; those of the source, of modern mathematics and of everyday life;
(5) to see what is supposed to be "familiar", becoming "unfamiliar";

There have been 17 contributions from 16 contributors coming from 10 different countries, who gave detailed presentations on particular cases concerning the points mentioned above. These presentations were followed by lively discussions, in which participants were given the opportunity to elaborate on their ideas further. Each presentation and the follow-up discussion were based on material (original texts, students' worksheets, etc) distributed in advance, or on the spot.

2. Launching a new journal: ***International Journal for the History of Mathematics Education***
As mentioned in the previous report on the HPM Group activities (see *ICMI Bulletin* no 57, December 2005), the rousing success of the Topic Study Group 29, *The History of Learning and Teaching Mathematics*, at the International Congress on Mathematical Education (ICME-10) in Copenhagen in 2004, demonstrated the need for a permanent and stable international forum for scholarly research in

the history of mathematics teaching. Therefore, a new journal, provisionally titled *International Journal for the History of Mathematics Teaching*, has been established. More details can be found in the above-mentioned issue of the *ICMI Bulletin*. In the meantime, the title has been finalized to ***International Journal for the History of Mathematics Education***. It is published electronically by the Teachers College, Columbia University and in printed form by COMAP. The first issue is due for September 2006 and the second for March 2007. Its website (to be updated shortly) is http://www.tc.edu/centers/ijhmt/.

3. The "HPM Tongxun" and the Tongxun Group in Taiwan

(This section is based on a more detailed report written by W-S. Horng which will appear most likely in the *HPM Newsletter*, no 63, November 2006.)

This is a publication in the context of the HPM Group, edited by Wann-Sheng Horng, of the Department of Mathematics of the National Taiwan Normal University. It is published in Chinese since 1998 on a monthly basis. Actually, the February and March issues merge into one issue, and similarly for the July and August issues due to spring and summer vacations respectively. Therefore, the *Tongxun* has ten issues (both printed and electronic versions) each year and is circulated in printed form of 500 copies to local mathematics teachers and historians of mathematics of the international Chinese community. Several issues are devoted to special themes, like for instance, the special issues:

On the *Suan Shu Shu* (Han Bamboo Text on Calculation), November 2000;
On Arabic mathematics, no 11-12, Vol. 4, 2001;
On mathematical induction, no. 2/3, 4, Vol. 7, 2004 (guest editor: Tsang-Yi Lin);
On Heron's Formula, no. 4, Vol. 9, 2006 (guest editor: Jung-hong Su).

Contributors to this Newsletter are mathematics teachers, postgraduate students or researchers in this area. This collaboration encourages them to promote the HPM activities — some of them even become local leaders for both the HPM and Mathematics teaching. They become very enthusiastic about the HPM perspective, contributing to this Newsletter just to share their ideas and vision with their colleagues. Despite the fact that no formal organization, such as a society, is to be expected for "up-scaling" development, a total of about forty correspondents plus ten editorial members is a strong indication that an active local HPM group could emerge. For instance, some of the members of this group have joined W.S. Horng to write a book on Suan Shu Shu, which is expected to appear in July 2006.

For details see http://math.ntnu.edu.tw/~horng/.

4. Proceedings of the ICME-10 Topic Study Group 29: *The History of the Teaching and Learning of Mathematics*

(For more details on this TSG, see the *ICMI Bulletin* no 55, December 2004, pp. 49-50.)

At ICME-10, the first specialized Symposium on the history of mathematics education took place as TSG 29. The Organizing Team was H. Gispert (France), H-C. Hansen (Denmark), H. Khuzwayo (South Africa), G. Schubring (Germany, co-chair) and Y. Sekiguchi (Japan, co-chair), and the main goal of the Symposium was to create a net of international communication between researchers in this

field, and to establish a discussion between the various national histories and their approaches. Directly related to the activities in this TSG is item 2 above in this report.

The Proceedings of this TSG will appear as a double issue of *Historica Paedagogica*, nos 4-5 of vol. XLII (2006). A more detailed report will probably appear in the November issue of the *HPM Newsletter* (no 63).

5. 5th European Summer University on the History and Epistemology in Mathematics Education (ESU-5), 19-24 July 2007, Univerzita Karlova v Praze, Pedagogickα fakulta, Katedra matematiky a didaktiky matematiky (Charles University in Prague, Faculty of Education), Czech Republic (website: http://www.pedf.cuni.cz/kmdm/esu5)

This is one of the main activities of the HPM Group. A detailed account of its aim, focus, themes, activities, proceedings and history can be found in the *ICMI Bulletin* no 57, December 2005. In the mean time the deadline for the submission of proposals has expired (May 15, 2006) and the plenary sessions have been finalized.

Activities during the ESU
(a) There will be 6 **plenary lectures**, one for each main theme of the ESU-5:
Theme 1 *(History and Epistemology as tools for an interdisciplinary approach in the teaching and learning of Mathematics and the Sciences):*
Leo Corry, Tel-Aviv University, Israel: *Axiomatics between Hilbert and R.L. Moore: Two Views on Mathematical Research and their Consequences on Education*
Theme 2 *(Introducing a historical dimension in the teaching and learning of Mathematics):*
Luis Puig, University of Valencia, Spain: *Researching the history of algebraic ideas from an educational point of view*
Theme 3 *(History and Epistemology in Mathematics teachers' education):*
Fritz Schweiger, University of Saltzburg, Austria: *The implicit grammar of mathematical symbolism*
Theme 4 *(Cultures and Mathematics):*
Ulrich Rebstock, University of Freiburg, Germany: *Mathematics in the service of the Islamic community*
Theme 5 *(History of Mathematics Education in Europe):*
Hélène Gispert, Université Paris-Sud, France & Gert Schubring, Bielefeld University, Germany: *The History of Mathematics Education and its contexts in 20th century France and Germany*
Theme 6 *(Mathematics in Central Europe):*
Magdalena Hyksova, Czech Technical University in Prague, Czech Republic: *Contribution of Czech Mathematicians to Probability Theory*

(b) There will also be 2 **panel discussions**:
Panel 1: *Mathematics of yesterday and teaching of today*
Évelyne Barbin, Université de Nantes, France (coordinator); Abraham Arcavi, Weizmann Institute, Israel; Luis Radford, Laurentian University, Canada; Fritz Schweiger, University of Saltzburg, Austria

Panel 2: *The emergence of mathematics as a major teaching subject in secondary schools*
Gert Schubring (coordinator), Bielefeld University, Germany; Livia Giacardi, University of Turin, Italy; Hélène Gispert Université Paris-Sud, France; Nikos Kastanis, University of Thessaloniki, Greece.

(c) There will be parallel sessions of 29 **3-hour Workshops**, based mainly on historical and/or epistemological material, and another 20 **2-hour Workshops**, based mainly on didactical — pedagogical material. In workshops the participants read and work on the basis of material distributed by the organizer of the workshop (e.g. original texts, chosen and briefly presented by the organizer, or teaching material used or proposed by the organizer etc).

(d) There will be 48 30-minute **oral presentations**, running in parallel sessions, for participants who want to speak about their own experience, or research. This is an activity in the spirit of a conventional research conference.

Finally, it is expected that **poster sessions** and **exhibitions** of books and other didactical material will also be present in this ESU.

6. Meeting on *The promises and problems of a semiotic approach to mathematics, the history of mathematics and mathematics education*, July 13-15, 2006, Bielefeld, Germany, organised by Michael Otte, Gert Schubring and Falk Seeger.
(This report is an excerpt from a more detailed report written by the organizers and distributed to prospective participants.)

During the last two decades or so, the semiotic approach of C.S. Peirce has turned out to be a widely acclaimed framework inspiring the phrasing and the understanding of key problems in the epistemology and history of mathematics. Surprisingly enough, a wide reception of Peirce's ideas could also be found in mathematics education — possibly as a result of the demise of radical constructivism. It seems appropriate to ask now looking back at what has come out of the promises of the past and what might be lines and key problems of future development. A partial list of some of the salient issues to discuss is the following:

Nominalism and realism of the sign
Representation
Activity Theory, culture, and semiotics
Signs and texts in learning mathematics
Symbolization and the process of abstraction in the history of mathematics

More details on the outcome of this meeting will probably appear in the next issues of the *HPM Newsletter*.

7. A regional meeting related to the HPM Group: Special Meeting on *History and Mathematics Education*, 14-15 April 2006, University of Thessaloniki, Greece.
Motivated by the activities and results of the ICME-10 Topic Study Groups TSG 17 and TSG 29, Greek researchers interested in the HPM perspective organized a regional meeting at the University of Thessaloniki, Greece, aiming to present current international trends on important issues relevant to the

HPM perspective, with reference to all educational levels, and in this way to give an opportunity to the Greek educational community to be informed about those issues that are of great importance nowadays.
There were 15 presentations structured along the following three main themes:

- On the History of ancient Greek Mathematics (4 presentations)
- On the History of Mathematics Education (6 presentations)
- On the relations between History of Mathematics and Mathematics Education (5 presentations).

The Proceedings (in Greek) were published in advance by Ziti Publications, Thessaloniki, Greece and were distributed on the spot. A more detailed report will appear in the November issue (No 63) of the *HPM Newsletter*.

8. Announcement: The former chair of the HPM Group (1996-2000) and co-editor (with the late J.G. Fauvel) of the ICMI Study volume no 6 *History in Mathematics Education* (Kluwer 2000), Jan van Maanen, started in June 2006 as the Professor of Mathematics Education at the University of Utrecht. As such he will also be the Director of the Freudenthal Institute, a centre of expertise in Mathematics Education, which is part of the Faculty of Mathematics and Sciences of Utrecht University.

Constantinos Tzanakis, Chair of HPM
Department of Education, University of Crete,
74100 Rethymnon, Crete, GREECE
tzanakis@edc.uoc.gr

ICMI Affiliated Study Groups Websites

The homepages of the five ICMI Affiliated Study Groups are located at the following addresses:

HPM:	http://www.clab.edc.uoc.gr/HPM/
ICTMA:	http://www.infj.ulst.ac.uk/ictma/
IOWME:	http://www.stanford.edu/~joboaler/iowme/index.html
PME:	http://igpme.org/
WFNMC:	http://www.amt.edu.au/wfnmc.html

A Report from WFNMC

Petar S. Kenderov

To recognize persons with outstanding contribution to the identification and inspiration of mathematical talent through competitions and related activities, as well as to recognise those who have played a significant role in the development of mathematical challenges with essential impact on mathematics learning, the World Federation of National Mathematics Competitions (WFNMC) regularly (every two years) gives a certain number of awards named after the famous Hungarian mathematician Paul Erdös. Paul Erdös was born in Hungary (1913). His mathematical talent was identified and developed through mathematics competitions. He influenced a great number of mathematicians by his deep mathematical insight and by disseminating mathematics challenges to researchers in many countries of the world. He authored or co-authored 1500 publications (articles and books) and collaborated with more mathematicians than anyone else. He died in 1996 in Warsaw.

According to the regulations of WFNMC, the nominations for this year awards were collected by the *Awards Committee* (chaired by Professor Peter Taylor, the past President of WFNMC). The Awards Committee assessed the nominations and recommended the candidates for awards to the Executive Committee of WFNMC for making the final decision. The Executive Committee of WFNMC approved the candidates and the Paul Erdös Awards for 2006 go to (given in alphabetic order):

Alexander Soifer (USA)
Ali Rejali (Iran)
Simon Chua (Philippines)

What follows is a brief (and very incomplete!) description of the main contributions of these persons. It reflects partially the report of the Awards Committee.

Alexander Soifer is a professor at the University of Colorado at Colorado Springs. His publications include more than 100 articles and four books: *Mathematics as Problem Solving* (1987); *How Does One Cut a Triangle?* (1990); *Geometric Etudes in Combinatorial Mathematics* (1991, with V. G. Boltyanski); and *Colorado Mathematical Olympiad: The First Ten Years and Further Explorations* (1994). These books are oriented toward helping the students develop their problem solving skills.

In a recent list of top 25 articles, most frequently downloaded from the *Journal of Combinatorial Theory, Series A*, there are three papers where Alexander Soifer is an author or co-author. They are ranked first, third and twenty-first! He is also Editor and Founder of the research quarterly *Geombinatorics* (since 1991).

Alexander Soifer has presented a number of lectures at WFNMC meetings. The topics have covered the four color theorem, contemporary aspects of geometrical combinatorics such as the chromatic numbers in 2 and 3 dimensions, and historical studies on the life of algebraist B. L. van der Waerden under the Nazi years and during the W.W.II's aftermath. His engagement with mathematics competitions is permanent and decades old. It started with his school years in Russia when he

participated successfully in the Russian mathematics competitions and culminated in the Colorado Springs Mathematical Olympiad which he founded in 1984 and guided ever since. The Colorado Mathematical Olympiad is an essay-type mathematical competition (rather unique for USA) in which annually 600 to 1000 participants compete for different prizes.

Ali Rejali is also well-known to the members of WFNMC. He is the founder of the Iranian national mathematics competitions and has a very strong record of establishing enrichment activities in his country, including the *mathematics houses* which he has established in difficult and unusual conditions. He has had considerable influence in setting the scene for the national mathematics syllabus in mathematics and statistics via lectures at national conferences. He plays an important role in supporting teachers.

Ali Rejali was involved in at least three major studies for improvement of mathematics education in Iran (lack of interest in students for studying mathematics, problems of national university entrance examinations, and the WMY 2000 project). He has also been involved in activities related to popularizing ICT in schools and among teachers and many in-service courses for teachers.

On the international scene, Ali has been actively involved in WFNMC since its beginning and he had a major role in many committees of the Federation, as well as being the chair and coordinator of the Geometry sections of two WFNMC conferences in China and Australia.

He is a member of the International Programme Committee of the16th ICMI Study and an active participant of ICMEs. Ali is also the representative and organizer of the International Mathematics Tournament of Towns Competitions in Iran.

Simon Chua is a principal of a school in Zamboanga, the southern province of Mindanao. In difficult conditions he has established the Mathematics Trainers Guild of the Philippines (MTG) which organizes identification of talented students and training them for events such as international competitions. Simon still takes a leading role in these activities and the MTG celebrated its 10th anniversary in October 2005. Simon also is an academic contributor, composing problems and, for example, working on small juries in events such as the international Junior Olympiad, to which he takes Philippine teams.

The official ceremony with the presentation of the Awards will take place during the opening of the fifth Conference of WFNMC in Cambridge, 22-28 July 2006.

In case somebody wants to make nominations for the Paul Erdös Awards (to be given in 2008), I copy below the relevant information.

Requirements for Nominations for the Paul Erdös Award of WFNMC
The following documents and additional information must be written in English:

- A one or two page statement which includes the achievements of the nominee and a description of the contribution by the candidate which reflects the objectives of the WFNMC.

- Candidate's present home and business address and telephone/telefax number.

Nominating Authorities
The aspirant to the Awards may be proposed through the following authorities:

- Directly to the Chair of the Awards committee, Peter J Taylor, Australian Mathematics Trust, University of Canberra ACT 2601, Australia, or by email to pjt@olympiad.org.
- Petar Kenderov (kenderovp@cc.bas.bg), President of the World Federation of National Mathematics Competitions.
- Members of the World Federation of National Mathematics Competitions Executive Committee or Regional Representatives (see http://www.amt.edu.au/wfnmc.html).

The Federation encourages the submission of such nominations from Directors or Presidents of Institutes and Organizations, from Chancellors or Presidents of Colleges and Universities, and others.

Petar S. Kenderov, Chair of WFNMC
Institute of Mathematics and Informatics,
Acad. G. Bonchev-Street, Block 8,
1113 Sofia, BULGARIA
kenderovp@cc.bas.bg

Announcement of a New Publication on PME Research

A volume presenting a compilation of the research produced since its creation, 30 years ago, by the International Group for the Psychology of Mathematics Education (PME), an Affiliated Study group of ICMI, has recently appeared:

> Angel Gutiérrez and Paolo Boero (Eds.). (2006). *Handbook of Research on the Psychology of Mathematics Education*. Rotterdam, The Netherlands: Sense Publishers.

The chapters offer summaries and synthesis of the research produced by the PME Group, presented to let the readers grasp the evolution of paradigms, questions, methodologies and most relevant research results during last 30 years. They also include extensive lists of references. The chapters raise also the main current research questions and suggest directions for future research.

The volume is the result of the effort of 30 authors and 26 reviewers. Most of them are recognized leading international researchers, members of the PME Group, with great expertise on the topic of their chapter. It includes 15 chapters, divided into five sections, devoted to the main research domains of interest to the PME Group. The first to third sections summarize cognitively oriented research on learning and teaching specific content areas (algebra, geometry and measurement, numerical

thinking), transversal areas (ATM, proof, visualization, young children's mathematical thinking), and based on technology rich environments (use of technology for teaching and learning algebra, calculus, and geometry). The fourth section is devoted to the research on social, affective, cultural and cognitive aspects of Mathematics Education (affectivity, constructivism, equity, socio-cultural practices). Finally, the fifth section includes two chapters summarizing the PME research on teachers training and professional life of mathematics teachers.

This handbook shall be of interest to both experienced researchers and doctoral students needing detailed synthesis of the advances and future directions of research in Mathematics Education, and also to mathematics teacher trainers who need to have a comprehensive reference as background for their courses on Mathematics Education. More information of the book is available from Sense Publishers' web page at

http://www.sensepublishers.com/books/otherbooks/90-77874-19-4.htm

A nonprintable PDF version of the book can also be downloaded from this website.

A Report on the 10th ICMI Study: *The Role of the History of Mathematics in the Teaching and Learning of Mathematics*

Fulvia Furinghetti

Note of the Editor: This report has appeared in *L'Enseignement Mathématique* 51 (2005) pp. 365-372, and is reproduced in this *Bulletin* with kind permission of the Editors.

1. ICMI Study 10

ICMI Study 10 is entitled "The role of the history of mathematics in the teaching and learning of mathematics". The discussion document [4] initially appeared in 1997; the Study Conference took place at CIRM, the country retreat of the French Mathematical Society at Luminy (near Marseille, France) from 20 to 25 April 1998. The volume resulting from the Study and edited by the two co-chairs [9] was presented at ICME-9 in Japan (2000). The argument of this ICMI Study is far more wide-ranging than discussing the opportunity of teaching some elements of the history of mathematics in the mathematics courses of the various school levels and at university: it concerns the goals of mathematics teaching and the way to reach them through history. As the editors of the Study volume put it (p. xvii), the ICMI Study "is posited on the experience of many mathematics teachers across the

world that its history makes a difference: that having the history of mathematics as a resource for the teacher is beneficial. School mathematics reflects the wider aspect of mathematics as a cultural activity."

The theme of ICMI Study 10 had never been considered in previous ICMI Studies, but the relation between mathematics and its history has interested the world of mathematics education for a long time. This happened especially around the end of the nineteenth and the beginning of the twentieth century. At those times the history of mathematics was developing as an autonomous discipline: journals specifically dedicated to this subject were founded, treatises and important editions of classic authors were published, and a few universities launched the first courses on history of mathematics. Historians of mathematics such as Hieronymus George Zeuthen, Florian Cajori and Gino Loria supported the use of history in teacher education. The reasons for promoting this use were not only to foster the cultural enrichment derived from knowing something about the development of mathematical thinking, but also to provide a means suitable to revisit elementary mathematics from an advanced standpoint.

Around the end of the nineteenth century the way of looking at the history of mathematics was also influenced by the developments of biology, which were introducing new views in the scientific world. One of the most famous manifestations of this influence was the transposition of the biological law of recapitulation to the psychological development. According to this law, which may be summarised by the motto "ontogenesis recapitulates phylogenesis", the claim that in their intellectual development students naturally traverse more or less the same stages as mankind has been taken as a guarantee (sometimes implicitly) to ensure the link between the domains of history and of mathematics education. This view is echoed in the writings of some mathematicians. According to Klein ([12], p. 248), "the scholar must naturally follow the same course of development on a smaller scale, that the science itself has taken on a larger." Poincaré writes:

> "The educators' task is to make children follow the path that was followed by their fathers, passing quickly through certain stages without eliminating any of them. In this way, the history of sciences has to be our guide."
>
> ([13], p. 159, my translation)

The claims of these mathematicians have to be set in the context of the debate of their times about mathematical invention/discovery, and, in particular, about the role of intuition and rigour. In successive years the recapitulation law has been subject to deep revision, because of the developments of biological studies and the emergence of new concepts about the role of culture in the way we come to know and think (see [11], [14]).

These different kinds of stimuli (flourishing of historical studies, biological research and mathematicians' contributions to the debate of foundation of mathematics) influenced the school world. Around the end of the nineteenth century and the beginning of the twentieth we find works of mathematics education advocating the use of history in mathematics teaching, and documents which report on this use in classroom practice. Particularly remarkable is the paper [1], by a teacher of the Training Department of Alexandra College (Dublin), who introduced girls aged sixteen and seventeen

to "a little of the story of mathematical growth" ([1], p. 72). In this report there is a plan for putting into practice the parallelism between the mathematics curriculum and the historical development of mathematics, in accordance with the ideas presented in Benchara Branford's book *A Study of Mathematical Education* (1908). Another example of the presence of history in the classroom is offered by an Italian mathematics teacher, who founded in 1895 and edited for about 20 years a mathematics journal for secondary students called *Il Pitagora* with the aim of attracting young people towards mathematics. In presenting the journal the editor wrote explicitly that one of the main means of making mathematics attractive would be the history of mathematics (games were another means mentioned). The journal, indeed, published historical anecdotes, excerpts of ancient works and historical notes on elementary mathematical subjects such as arithmetic and geometry. Most authors of the articles were secondary teachers. What they wrote shows that in choosing the historical materials they actually cared for their students' needs. The historical aspect of this journal is analysed in [10].

In the past mathematics education was not developed as a scientific discipline and experiments (if any) were not reported and analysed according to modern methods. At present the development of mathematics education not only has changed the way of looking at the history of mathematics, but also provides the means for evaluating its use in teaching and learning from a scientific point of view. The International Study Group on the Relations between the History and Pedagogy of Mathematics, HPM, was in fact one of the first study groups (together with the group of Psychology of Mathematics Education, PME) affiliated to ICMI (this happened in 1976). Since then, many activities have provided materials (mainly historical documents and reports of experiments) which constitute the background to studying the role of the history of mathematics in the teaching and learning of mathematics. In the early 1980s the Summer Universities on the History and Epistemology in Mathematics Education were organised by the French Mathematics Education community with the French IREMs (*Instituts de Recherche sur l'Enseignement des Mathématiques*). In the UK the HIMED (History In Mathematics EDucation) conferences started in 1990; the British Society for the History of Mathematics was the organiser. A selection of the French papers documenting the experiments with the use of history in the classroom was translated into English, see [8]. In all these initiatives school teachers were active participants, as well as historians of mathematics and mathematics educators.

We may say that the theme of ICMI Study 10 is at the crossroads of different streams of research, the main ones being the history of mathematics, mathematics, pedagogy, and epistemology. The discussion document for the Study was elaborated by scholars belonging to these different streams and touched the main points of the theme at issue :

- why, how and when to use history in mathematics teaching;
- strategies to be used for the effective use of history at school, university and in teacher preparation;
- the state of the art (in research and in practice).

The discussion document attracted preparatory papers that were distributed to the participants so as to arouse critical reflections in the subgroups involved in the meeting. Each subgroup had one or more coordinators, but the atmosphere was such that the activities and the resulting book were very

democratic, since all participants were given the opportunity to express their opinions, to report their experience and to record their interventions in the book edited by John Fauvel and Jan van Maanen [9] as a result of ICMI Study 10. The 62 contributors listed at the end of this book came from 26 countries of the five continents. Some of them were involved in tertiary education, mostly in the field of mathematics education. There was a minority of secondary teachers, but no teachers from primary schools. There is a remarkable isomorphism between the activities in the meeting and the resulting book, so that the analysis of the latter reflects what happened in the former.

2. ICMI Study 10 as a bridge between research and practice

One of the problems of ICMI activities is the multifaceted nature of the potential audience. Different communities with their specific needs and competencies compose the community of ICMI: mathematicians, curriculum developers, mathematics teachers, researchers in mathematics education. The community of students is the silent component in the background of ICMI activities. It is expected that an ICMI Study will affect decisions of the members of these communities who have responsibilities in mathematical instruction. Since I take the component 'teacher' as a pivot of the process of implementation in the classroom of whatever innovation, I deem that it is particularly interesting to investigate what impact ICMI Study 10 will have among teachers. Chapter 4 ("History of mathematics for trainee teachers") provides valid reasons to use the history of mathematics in teacher training courses and I myself have experienced this. After the publication of the ICMI Study book, when I carried out courses for in-service secondary school teachers I decided to use this book and gave it directly into participants' hands. My aim was twofold: on one hand to foster the reflection on the problems of mathematics teaching from a different point of view, and to provide materials for planning teaching sequences; and on the other hand it was my intention to see the effect of the ICMI Study in school practice. I outline some of the feedback in what follows.

At a first glance the chapter that most attracted the participants was that titled "Historical support for particular subjects" (Chapter 8). It provides a repertoire of historical materials suitable for developing the topics of mathematics treated in school: algebra, analysis, numbers and numerical systems, trigonometry, probability. This chapter evidences a powerful character of the ICMI Studies, that of bringing together different scholars from all around the world who represent different cultures. Since the history of mathematics is embedded in various cultures this emerged specifically in ICMI Study 10. The teachers attending my courses became aware of the multicultural character of mathematics and of the multifaceted aspects of human culture. In this way they were led to reflect on the meaning of 'humanistic mathematics' in teaching, by taking into account both senses discussed in [2] of "teaching humanistic mathematics" and "teaching mathematics humanistically." The theme of multiculturality pervades all this ICMI Study, as evidenced in Chapters 6 ("History in support of diverse educational requirements — opportunities for change") and 7 ("Integrating the history of mathematics in the classroom : an analytical survey"). In elaborating all these chapters the presence of secondary teachers who brought to the working groups their first-hand experience in different contexts was important.

The chapters mentioned earlier provided teachers with good examples of how history can be used in the classroom. The next step was to reflect on why the use of history can be an efficient means in the construction of mathematical knowledge, or, in other words, to identify reasons why the history of

mathematics can meet the pedagogical goals characterising mathematics teaching. The development of this step is in the chapters which provide the theoretical background to the use of history in the teaching and learning of mathematics. This background encompasses research in mathematics education, epistemology, history of mathematics, and ethnomathematics. Chapter 2 ("Philosophical, multicultural and interdisciplinary issues") focuses on the discussion about the nature of mathematics and the embedding of mathematics in cultures. The history of mathematics offers hints to deepen these aspects and reveals itself as a good reason to go across disciplines.

Chapter 3 ("Integrating history: research perspectives") deals with the problem of judging the effectiveness of history in mathematics teaching. According to the authors of this chapter the techniques of quantitative experimental research are not suitable to this aim, instead qualitative research paradigms such as those developed in anthropology and ethnography may tell us if the introduction of history in mathematics teaching works. In this chapter nine articles written by teachers who have experienced the use of history are analysed in order to study its positive effects. In an article the genetic approach to calculus is considered; this brings to the fore a theme that pervades the book: the relation between the development of concepts in students' minds and in the history of mankind. In particular, this relation is analysed in Chapter 5 ("Historical formation and students' understanding of mathematics"). Studying this relation requires a clear epistemological approach which involves interpretations of students' understanding of mathematics and explanations of the history of mathematics. One of the themes faced in this chapter is the law of recapitulation that we mentioned at the beginning. It is recognised that the relation between ontogenesis and phylogenesis presents problems that its ancient supporters have neglected: for example, the links between knowledge and the context are underestimated, and historical facts are viewed from our modern point of view. Referring to my courses for teachers I have observed that the reflection on the issues faced in this chapter was very suitable to help the participants gain an appropriate understanding of relations between knowledge and historical development.

The discussion of the formation of mathematical concepts brings to the fore the need for using primary sources to exploit the power of history in mathematics teaching at its best. In Chapter 9 ("The use of original sources in mathematics classroom") this need is justified through reasons that I summarise as follows. Usually in schools mathematical concepts are presented in a polished way, which is satisfying from a mathematical point of view, but may be meaningless for students. To recover the meaning it may be useful to go back to the original words of the mathematicians who have conceived such concepts. In their very words the cognitive roots of the mathematical concepts, e.g. the key ideas around which the concepts have grown up, are made evident. This way of looking at the use of history applies also to teacher education: the primary sources may help teachers to reshape their conception of mathematics teaching by promoting the reflection on the nature of mathematical concepts and their genesis. Having said that, I must point out that the use of primary sources is not an easy task. Firstly, for school teachers without university contacts, there is the practical problem of the access to primary sources. Afterwards there is the problem of understanding them: primary sources are often written in foreign or dead languages, and the very words of ancient authors are subject to interpretation. Once this preliminary work has been done, there is the need of choosing the primary sources in such a way that they fulfil the educational needs of the classroom. As Burn puts it, "the

selection of primary sources is of critical importance; badly chosen historical material may be as inaccessible as the most abstract mathematics" ([3], p. 212).

In the ICMI Study book the theoretical and the practical considerations previously mentioned are supported by rich lists of references at the end of each chapter. Moreover, the final Chapter 11 ("Bibliography for further work in the area") is an annotated bibliography of publications in different countries. Equally useful from the informative point of view is Chapter 10 ("Non-standard media and other resources"). This chapter sets a bridge between traditional ways of communicating mathematical culture and new ways: dramatisation, exhibitions, software, ancient mathematical instruments, surfing the internet. It was particularly useful for the teachers attending the course to have information on the web sites that allow them to reach original sources and to visit science museums all around the world (cf. [5] and references therein). This technological dimension has changed the environment in which teachers face the work with history and provides them with some chance of using history successfully in their classroom. The importance of this chapter as a projection to new styles of teaching is stressed by the fact that the themes treated there are central in the discussion document of ICMI Study 16, whose focus is on investigating how mathematics education can satisfy the demand of making mathematics accessible to more people.

3. ICMI Study 10 in the classroom

The international survey of political issues provided by the first chapter ("The political context") shows that, in theory, no obstacles exist to the use of history in mathematics teaching; in many countries there is a tradition of looking at the history of mathematics as a means for widening the concept of mathematical culture. In some cases the use of history is advocated in order to recover a population's identity through the identification of the cultural mathematical heritage. In practice, the history of mathematics is absent from the university courses of many countries; the same happens in courses for teacher education. Obviously, teachers' lack of historical knowledge is a great obstacle to the use of history in teaching. Sometimes there is a contradiction between the indications by the Ministries of Education towards introducing a historical and epistemological approach into mathematics teaching and the scant freedom allowed teachers in dealing with official programmes. Thus these indications may be the source of problems or, more frequently, may be ignored.

There is a need for political action to make the mass of stimuli provided by the ICMI Study really applicable. For this reason not only did I use this ICMI Study regularly in the courses for teachers, but it was also my concern to see its outputs (if any) in the school environment. I observed that the Study was received with interest and that teachers were sometimes stimulated to look for books dealing with the history of mathematics on the shelves of bookshops. It was more difficult to find an actual application of the ideas discussed in the ICMI Study. The problems we hinted at in browsing the Study book (teachers not sufficiently confident in their historical knowledge, difficult access to primary sources, constraints of the school system) were making it difficult to realise the ideas put forward in the Study. It was difficult, but not impossible, as shown by the following example. A secondary teacher after having attended a course of mine organised a permanent working group with four colleagues. Together they collected primary sources suitable for grades 5 onwards in school. The historical materials were accompanied by proposals of activities in the classroom aimed at introducing a given mathematical topic or viewing it more critically. At the end of the work a book

[6] containing these materials was edited. The same group of teachers has produced materials for primary schools based on the first printed book of mathematics *Larte de labbacho* (*Treviso Arithmetic*).

It is remarkable that this teacher has also taken into account the historical activities in assessing students. This fact evidences that history was not an optional activity, but was actually integrated into school teaching. The same teacher has also carried out another original experiment, which consisted of showing students historical pictures taken from ancient texts of mathematics accompanied by the following assignment:

- In our society, we communicate by using images: television, computer, posters and so on.
- Mathematics was born and developed in a social context. Many people have used it.
- Interpret the attached picture, i.e. look at the people in the picture and describe what you think they are doing. Examine the context and the details; try to use your mathematical knowledge.

What makes this task interesting is the fact that it focuses on a particular aspect of the history of mathematics, i.e. the charm and the informative value of the illustrations in antique historical sources. The central idea in the experiment is to use historical iconography for stimulating students' reflection on mathematical activity and its relation with social life. The report of the experiment was presented at a conference, see [7]. When I read this report it was natural for me to link the author's inspiration with something that the late John Fauvel liked a lot, e.g. the iconography in ancient mathematical books. The enjoyment in this aspect of history emerges in the ICMI Study book. It is moving for me to see in a teacher's work a tangible and spontaneous sign of Fauvel's cultural heritage.

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Fulvia Furinghetti
Dipartimento di Matematica dell'Università di Genova
Via Dodecaneso 35, I-16146 Genova
ITALY
furinghe@dima.unige.it

In Memoriam
Shokichi Iyanaga (1906–2006)

Reflections by Hyman Bass and Bernard R. Hodgson

Professor Shokichi Iyanaga, former President of ICMI (1975-1978), was born on April 2, 1906 and passed away on June 1, 2006, just after completing a century of good works and leadership. These reflections began as a tribute on behalf of ICMI, and as an expression of warm greetings and congratulations to our distinguished centenarian. However destiny decided otherwise, and sadly transformed this tribute to a memoriam.

We cannot fail to admire, but hardly aspire to emulate, a mathematician who publishes a substantial mathematical paper in a first class international journal on his 100th birthday! The paper "Travaux de Claude Chevalley sur la théorie du corps de classes: Introduction" by Shokichi Iyanaga was published online on April 2, 2006, in the *Japanese Journal of Mathematics* (3rd series) 1 (2006) 25-85.

Iyanaga was a natural author of this tribute to Chevalley's work, since they became friends and colleagues while attending the 1928 lectures of Emil Artin in Hamburg, just after the proof of the general law of reciprocity, work that inspired the subsequent research of both Chevalley and Iyanaga in class field theory. Iyanaga's very first paper was also published in the *Japanese Journal of Mathematics*, written when he was a second year undergraduate at Tokyo University. In his third, and final, undergraduate year, he attended Takagi's Seminar on class field theory, and wrote his third paper published while he was an undergraduate, solving a problem posed by Takagi. Iyanaga went on to earn his PhD, under the direction of Takagi, in 1929. At the time of his retirement from Tokyo University in 1967, he was Dean of the Faculty of Science.

Iyanaga became widely known and appreciated in mathematical circles internationally — particularly in France (where he was friendly with mathematicians such as Henri Cartan, Claude Chevalley, Jean Dieudonné and André Weil, some of the founding members of Bourbaki), in Germany, and in the U.S. The war years of course created stressful conditions and dislocation in Japan. In Iyanaga's own words, he was instrumental in efforts made

> "to rebuild our science and culture in a better form. (…) I was particularly busy in editing textbooks from primary and secondary schools (…) I continued to give courses and organise seminars, in which I used to discuss class field theory with my younger friends."
>
> Iyanaga's biography, posted on the
> *MacTutor History of Mathematics* archive
> (http://www-history.mcs.st-andrews.ac.uk/history/index.html)

At the invitation of Marshall Stone, Iyanaga became a member of the 1952-54 Executive Committee of the International Mathematical Union, the first EC elected when the Union was re-established after the Second World War. In this role he helped organize the International Congress of Mathematicians (ICM) held in Amsterdam in 1954. As a member of the Science Council of Japan he was the main organizer of the landmark International Symposium on Algebraic Number Theory held in Japan in 1955.

Iyanaga served as Vice-President of ICMI from 1971 to 1974, and in 1975 he succeeded Sir James Lighthill as the President. International work in mathematics education had been mainly centered in Europe and the Americas, so Iyanaga's incumbency set a new direction, of which Iyanaga was fully aware, and approached with dignity and humility. In his first message to the ICMI community in his capacity of President of the Commission, Iyanaga wrote:

> "I have had the pleasure of sharing, together with Professor J. Surányi, the work of the Executive Committee as Vice-President under the Presidency of Professor Sir James Lighthill, and of learning, thus, how this work is to be

> conducted. However, as my home country, Japan, lies far from Europe and America, where the study of mathematics and of mathematical education has its longest history, I am sure that I shall have to make a greater effort to secure and develop this work. Fortunately, world communication has been greatly improved (…) and [I] hope that our effort will bear fruitful results."
>
> *ICMI Bulletin* 5 (April 1975) p. 3-4

His term as the President of the Commission, ending in 1978, included the Third International Congress on Mathematical Education (ICME-3) held in Karlsruhe in 1976, as well as an ICMI-symposium, organized during ICM-1978 in Helsinki, on the theme of the mathematical education of mathematics teachers. Reports on these two activities, and on other ICMI-related symposia that took place in Africa, Europe, India, Latin America or Southeast Asia during Iyanaga's presidency, can be found in the *ICMI Bulletin* Nos. 5 to 11. These were published between 1975 and 1978 by Yukiyoshi Kawada, the Secretary of ICMI during that period. In Iyanaga's "Remembrances," written in 2001, at the age of 95, he mentions his participation in some of these conferences, noting: "I was still young and could enjoy these" — he was only in his early seventies at that time! (See *ICMI Bulletin* 50 (June 2001), pp. 6-7.)

In his farewell message to the ICMI community published in the *ICMI Bulletin* 11 (December 1978), p. 4, President Iyanaga wrote, in passing the baton to the incoming Executive Committee: "Development of mathematics and of mathematical instruction should be [an] ever-continuing human activity. We have made our efforts for the past four years for promoting mathematical instruction but left certainly undone many things for the future." Jean-Pierre Kahane, who was to become President of ICMI four years later, vividly remembers the man he met during that period. In a recent message to us, after the passing of Professor Iyanaga, Kahane speaks of his predecessor as being "highly respected and influential among mathematics teachers and educators. He always spoke very quietly, in a low voice, and it was not necessary for him to shout in order to be heard. He wrote messages in incredibly small characters. I remember [during a congress held in Tokyo in 1983] a complex set of instructions to use the metro from the spot of the congress to the Maison Franco-Japonaise, written on a metro ticket! He was at the same time one of the greatest figures of mathematics in Japan, and a very simple and gentle human being." Kahane also stresses the common views on scientific international relations shared by Iyanaga and his "old friend" Henri Cartan, President of IMU from 1967 to 1970. Kahane concludes by characterizing him as cautious and diplomatic.

A charming account of the period when Iyanaga was President of ICMI, as seen through his own eyes, can be found in his "Remembrances," mentioned above. In this text he recalls a dominant, and controversial, event in mathematics education, begun in the 50s "in the wake of the success of the Bourbaki movement", the so-called "New Math" Reforms. In the U.S. this movement was spearheaded in large part by the SMSG (School Mathematics Study Group) directed by Edward Begle — who was to become an active member of the ICMI EC under the presidency of Iyanaga. Still, in his remembrances, Iyanaga notes that "the excess of this [reform movement of mathematical education] was warned by mathematicians like André Weil or M. Kline." This remark suggests that, by the time of his presidency, Iyanaga's believed that the influence of the New Math had waned. He further judged that, "Fortunately, the tradition of the ICMI is rather apolitical."

We are honored to pay grateful homage to Professor Shokichi Iyanaga, for a century of lofty service to mathematics, to education, and to international culture.

Hyman Bass, President of ICMI
2413 School of Education, 610 E. University
University of Michigan, Ann Arbor, MI 48109-1259 USA
hybass@umich.edu

Bernard R. Hodgson, Secretary-General of ICMI
Département de mathématiques et de statistique
Université Laval, Québec G1K 7P4 Canada
bhodgson@mat.ulaval.ca

Reflections by Shigeru Iitaka, colleague at Gakushuin University (Tokyo)

On June 1, 2006, Dr. Shokichi Iyanaga passed away at Seibo Hospital near his home in Tokyo, Japan, at the age of 100. His wife Sumiko had already passed away five years earlier. He is survived by three sons and a daughter.

Shokichi Iyanaga at the age of 95

Professor Iyanaga was a Professor Emeritus of the University of Tokyo and a member of the Japan Academy. He was well known as a mathematician, and also as a leader of the mathematics education community in Japan. In the 1950s he founded a society on mathematics education in Japan as well as a regular workshop where mathematicians and mathematics educators could tightly cooperate and frankly discuss issues in mathematics education. He was loved and respected by many people. Actually he organized an extensive movement supported by mathematicians, scientists and engineers to promote mathematical sciences, which resulted in foundation of the Research Institute of Mathematical Sciences in Kyoto.

Shokichi Iyanaga was born in Tokyo on April 2, 1906. His father was a banker. He studied and earned his PhD in mathematics at the University of Tokyo. He then studied in France and Germany, which stimulated his mastering of several languages. He was a professor of mathematics at the University of Tokyo from 1942 to 1967, and then at Gakushuin University from 1967 to 1977.

On several occasions between 1950-71, he was elected President of the Mathematical Society of Japan. He was a member of the Executive Committee of the International Mathematical Union (1952-55), and he was the President of the International Commission on Mathematical Instruction (1975-78).

As the chief editor of mathematics textbooks for senior high school he wrote many textbooks, which were written very mathematically. The first version of the *Encyclopedic Dictionary of Mathematics* was edited by him in 1954 — a later version was translated into English and published by the MIT Press. In 1999 and 2002 he published two books on the mathematician Évariste Galois. In 2004, when he was 98 years old, his autobiography was published by Iwanami Publisher. His last article is "Travaux de Claude Chevalley sur la théorie du corps de classes: Introduction" which has appeared in the *Japanese Journal of Mathematics* 1 (2006) 25-85, a journal published by the Mathematical Society of Japan. It is amazing that he kept very active and a clear mind up to his late 90's.

Shigeru Iitaka
Gakushuin University
1-5-1, Mejiro, Toshima, Tokyo 1718588
JAPAN
851051@gakushuin.ac.jp

Note of the Editor: Professor Iitaka is one of the "academic grandsons" of Shokichi Iyanaga. He was in 1980 the recipient of the Iyanaga Prize of the Mathematical Society of Japan. Besides Shigeru Iitaka, the Editor wishes to express his deep gratitude to Hiroshi Fujita and Yukihiko Namikawa for their help in having this homage to Professor Shokichi Iyanaga be concretised.

A Call for Papers — IJSME

The *International Journal of Science and Mathematics Education* (IJSME) is planning a special issue on "Language, Mathematics Literacy, and Science Literacy". The Guest Editors — Larry D. Yore, (University of Victoria, Canada), David Pimm (University of Alberta, Canada) and Hsiao-Lin Tuan, (National Changhua University of Education, Taiwan) — invite the submission of research articles on the roles and influences of language in achieving mathematical/scientific literacy. They are particularly interested in manuscripts (no longer than 35 pages) exploring the influence of oral and written language (including mathematical symbol systems, argumentation, information communication technologies, multiple representations, and visual elements such as diagrams, etc.) on mathematical and scientific understanding and on the broader definition of such technical literacies in the everyday world. Manuscripts should be submitted no later than October 15, 2006 to the IJSME Springer on-line reviewing system (http://www.editorialmanager.com/ijma/).

Building Bridges between Theoretical Frameworks in Mathematics Education

Michèle Artigue and Bernard R. Hodgson

Nobody doubts that Mathematics Education seen as a *field of practice* is especially sensitive to cultural contexts. This is also the case as regards Mathematics Education seen as a *field of research*, and partially explains the diversity of theoretical frames and constructs that have been developed in the last decades for a better understanding of learning and teaching processes in mathematics.

This theoretical diversity has had positive outcomes, but it also makes exchanges and capitalization of knowledge difficult. Building bridges between theoretical approaches and frames, looking for possible connections and complementarities, identifying common concerns but also potential incompatibilities and conflicts, become more and more a necessity of the research agenda. For that purpose, understanding better where do the main research paradigms come from and what are their underlying principles, how they have evolved, how they shape the views of educational 'reality' of those who use them, thus the kind of questions they address and the kind of results they produce, is certainly helpful.

ICMI has as an ambition to contribute to the reflection on cultural diversity in mathematics education and its effects, both from the point of view of research and practice. ICMI Study 13 for instance, whose Study Volume has just come out, is devoted to the comparison of mathematics education in different cultural traditions.[1] And, with this issue of its *Bulletin*, ICMI inaugurates a new column, whose goal is to contribute to a better mutual understanding of the most influential approaches in mathematics education. A conference organized in Spain for the 25 years of the *theory of didactic transposition* provided a nice opportunity for introducing this new column.

The *First International Conference on the Anthropological Theory of the Didactic* — in French: *Théorie Anthropologique du Didactique* ; in Spanish: *Teoría Antropológica de lo Didáctico* — was held at the International University Antonio Machado in Baeza, Spain, on October 27-30, 2005. This theory, based on the phenomenon of didactic transposition presented for the first time by Yves Chevallard twenty-five years earlier, in 1980, provides a research framework used nowadays by over a hundred researchers in Spanish, French and South American universities. The aim of the Baeza conference (see http://www4.ujaen.es/~aestepa/TAD) was to assemble, for the first time, most of the researchers working in the frame of anthropological theory of didactics, or interested in its developments, so to allow them to create their own scientific exchange forum and thus encourage the study of the main problems emerging in the educational systems and in didactics research.

[1] Frederick K.S. Leung, Klaus-D. Graf and Francis J. Lopez-Real (eds) (2006). *Mathematics Education in Different Cultural Traditions — A Comparative Study of East Asia and the West: The 13th ICMI Study*. (NISS 9) Springer.

We have invited Mariana Bosch and Josep Gascón, the organizers of this Conference, to write a text for the *ICMI Bulletin* where they would present their personal view on this theory, on its development and on its outcomes. We asked them to keep in mind that this text had to be accessible to all those interested in mathematics education, whatever their cultural context was, and we hope that the reader will appreciate the substantial efforts the two authors have made in order to explain in a few pages the essence of a genuine approach in mathematics education that has been developing for more than two decades. We also hope that this text will be the first in a long series, and that through these ICMI will offer a useful contribution, even if modest, to the increase in mutual understanding that the field of mathematics education requires so much.

We are grateful to Carmen Batanero, our colleague of the ICMI Executive Committee, for calling our attention to the Baeza conference and for her support in bringing this project to completion.

Michèle Artigue, Vice-President of ICMI
IREM, Case 7018, Université de Paris VII
2 place Jussieu, 75251 Paris — Cedex 05, FRANCE
artigue@math.jussieu.fr

Bernard R. Hodgson, Secretary-General of ICMI and Editor of the *ICMI Bulletin*
Département de mathématiques et de statistique
Université Laval
Québec G1K 7P4 CANADA
bhodgson@mat.ulaval.ca

Twenty-Five Years of the Didactic Transposition

Marianna Bosch and Josep Gascón

In novels, the most important is to solve the point of view:
who contemplates reality and who offers this contemplation to others.
Manuel Vázquez Montalbán (2003)

In October 2005 a group of researchers, either working on the Anthropological Theory of the Didactic or interested in its developments, met in a conference in Baeza, a charming medieval town in the south of Spain. They shared and took stock of their researches carried out over the last 25 years,

since the term 'didactic transposition' was introduced into the newborn paradigm in mathematics education called 'didactics of mathematics'. We now have enough perspective to present what we understand as the three main contributions of the theory of didactic transposition in the progress of mathematics education as a field of research.

Contents

1. The diffusion of the theory of 'didactic transposition'

The time of ideas often passes much slower than the time of people. Just over 25 years ago, at the 'First Summer School in Didactics of Mathematics' in Chamrousse (France, 7-19 July, 1980), Yves Chevallard gave his first course on the didactic transposition. We were at the early stages of a new paradigm set up by Guy Brousseau in the 70s with his Theory of Didactic Situations (Brousseau 1997a).

The notion of didactic transposition was rapidly integrated into the set of notions that gave this paradigm the beginning of an existence: didactic system, didactic and a-didactic situations, didactic contract, conceptual scheme, tool/object dialectic, didactic engineering, etc. Along with the notion of didactic transposition, other new terms appeared naming — and thus bringing into existence — new 'cuttings' of the social reality which didactics of mathematics planned to study: the bodies of knowledge, the 'noosphere' (or sphere of those who think about education), proto and para-mathematical knowledge and, methodologically, the 'illusion of transparency' of educational reality researchers should overcome by means of an enduring 'epistemological surveillance'.

With time, what was beginning to be called the 'theory of didactic transposition' started to spread in a very varied way, depending on the countries, the linguistic communities and the scientific or cultural affinities of the groups of researchers. The first edition of *La transposition didactique. Du savoir savant au savoir enseigné* (Chevallard 1985a) had its effect in the French-speaking community. It was followed by an important number of researches in the didactics of mathematics and experimental sciences that seemed to open a new domain of study, at least in the French-speaking community. Gilbert Arsac accurately depicts this evolution of the didactic transposition from its starting point till the 90s (Arsac 1992).

In the Spanish-speaking community, soon a 'grey' translation of the book done by Dilma Fregona appeared. Some years later, the Argentinean publishing house Aique took out a second translation that ended up spreading this theory widely, even outside the field of mathematics education: language, experimental sciences, philosophy, physical education, technology, social science, music and even chess! The diffusion in the international English-speaking community has been much slower, despite the fact that renowned investigators like Jeremy Kilpatrick soon knew how to put the new approach

into practice (as, for instance, in Wan Kang's doctoral dissertation: Kang 1990, Kang and Kilpatrick 1992). Very few followed his footsteps. A fast check in Google shows that the French expression 'transposition didactique' has over 27 000 entries, the Spanish 'transposición didáctica' has more than 11 000 but there are less than 500 in English (including both translations: 'didactic transposition' and 'didactical transposition').

What does the didactic transposition consist of and what new elements does it provide for the research in mathematics education? Most of all, it formulates the need to consider that what is being taught at school ('contents' or 'knowledge') is, in a certain way, an exogenous production, something generated outside school that is moved — 'transposed' — to school out of a social need of education and diffusion. For this purpose, it needs to go through a series of adapting transformations to be able to 'live' in the new environment that school offers. For certain knowledge to be taught at school *transpositive work* needs to be carried out so that something that was not made for school changes into something that may be reconstructed inside school.

The process of didactic transposition starts far away from school, in the choice of the bodies of knowledge that have to be transmitted. Then follows a clearly creative type of work — not a mere "transference", adaptation or simplification —, namely a process of de-construction and rebuilding of the different elements of the knowledge, with the aim of making it 'teachable' while keeping its power and functional character. The transpositive work is done by a plurality of agents (the 'noosphere'), including politicians, mathematicians ('scholars') and members of the teaching system (teachers in particular), and under historical and institutional conditions that are not always easy to discern. It makes teaching possible but it also imposes a lot of limitations on what can be and what cannot be done at school. It may happen that, after the transposition process, school loses the rationale of the knowledge that is to be taught, that is, the questions that motivated the creation of this knowledge: Why are triangles so important? What were limits of functions made for? Why do we need polynomials? In this case, we obtain what Chevallard (2004) called a 'monumentalistic' education, in which students are invited to contemplate bodies of knowledge the rationale of which have perished in time.

25 years ago research in mathematics education was very much influenced by the psychological aspects of learning. Making the existence of transpositive processes clear meant opening the field of study beyond the mathematical activities carried out by students and beyond the work done by teachers in the classroom. Taking didactic transposition into consideration also meant questioning the concrete way in which this process was carried out, the kind of constraints that limit it, the mechanisms that explain why a certain transposition is being done and not another. In short, considering the restrictions bearing on educational institutions contributes to explain, in a more comprehensive way, what teachers and students do when they teach, study and learn mathematics. In this sense, the theory of didactic transposition contributed to widen the object of study of research in mathematics education, bringing into existence a dimension of educational reality that had remained unnamed and, thus, unconsidered till then.

However, it was more than that. As we will see, with this broadening of the considered empirical reality, a new way of formulating and approaching mathematics educational problems appeared: what

was called the 'anthropological approach' or 'Anthropological Theory of the Didactic' (Chevallard 1992, 1999, Chevallard, Bosch, Gascón 1997). It is thus not surprising that the notion of didactic transposition, seen now as the germ of this new approach, has spread at a different pace and in different ways through the work of mathematics education researchers, following transpositive phenomena that this time affects the didactics of mathematics itself as a discipline. What, for some of us, appeared as a 'classic term' in mathematics education, something that has always been here, can be even now a notion to discover for some other members of the community.

2. The didactic transposition within the field of the 'didactics of mathematics'

The meaning and relevance of the theory of didactic transposition cannot be understood unless we start from the original project giving it sense: the new programme of research in mathematics education started by Guy Brousseau with the Theory of Didactic Situations (TDS). Actually, the TDS caused a radical change in our way of studying problems related to the teaching and learning of mathematics. This revolution has led to a change, not only in the notions used to study learning and teaching processes, but also in the particular way of questioning educational reality. The TDS has changed the problems, the used models and the system that is to be studied through a methodology that starts questioning mathematical knowledge as it is implicitly assumed in educational institutions: what is geometry, what is statistics, what are decimal numbers, what is counting, what is algebra, etc. It then proposes *specific epistemological models* of mathematical knowledge — the *situations* or 'games against a *milieu'* — that are used at the same time as ways of designating mathematical notions as well as ways of constructing them in the classroom. In Brousseau's own words:

> A situation is the set of circumstances in which a person finds him/herself and the relations which unite him/her to a milieu. Taking as the object of study the circumstances that preside over the diffusion and learning of bodies of knowledge thus leads to study these situations. (Brousseau 1997b, p. 2, our translation.)
>
> *Situations* are minimum models that 'explain' how such knowledge intervenes in the specific relations a subject establishes with a milieu to exert a determined influence in that milieu. (Brousseau 2000, p. 2, our translation.)
>
> In didactics of mathematics, these 'models' are essentially used as research instruments, as means to prove the consistence of the analysis and explanation of didactic phenomena. Even when used to build up didactic engineering, they have never been presented as 'examples' to reproduce, not even as principles to be directly used to guide teachers' decisions and to train future teachers. On the contrary, [they show] the complexity of the system society/teacher/pupil and the dangers of improvising extrapolations that ignore the validity field of these models and the misuse of metaphors. (Brousseau 2005, p. 56, our translation)

It was Brousseau who first postulated the existence of *didactic phenomena* which appear as unintentional regularities in the processes of generation and diffusion of mathematics in social institutions and are irreducible to the corresponding cognitive, sociologist or linguistic ones. It also supposes that 'teaching' and 'learning' mathematics are not primary objects of research any more and

become secondary ones (which does not mean less important!) because they can be defined in the primitive terms of the considered epistemological model. The necessity to bring into question spontaneous epistemological models, commonly accepted, to elaborate our own models for research and improvement of teaching and learning call for the emergence of what we have named the 'epistemological programme' (Gascón 2003).[1]

By stressing the necessity of carrying out an 'epistemological enquiry', the theory of didactic transposition clarified the project of the TDS, contributing to the shattering of the illusion of a unique mathematical knowledge already defined and for which the best teaching method was to be found. Bodies of knowledge are constructed outside school as the answer to some particular needs and formulated according to some very specific conditions. There exists a process, a social construction with multiple actors and different temporalities, through which some of these bodies of knowledge have to be selected, delimited, reorganised and, thus, redefined until reaching the classroom. The study of this process is an important step towards understanding what is being done in the classroom, even if the teaching act itself has to deny the existence of this process (that is, the reality of all these redefinitions) and maintain the illusion of the uniqueness of the knowledge that legitimizes its teaching.

> To the didactician, [the concept of didactic transposition] is a tool that allows to stand back, question the evidence, erode simple ideas, get rid of the tricky familiarity on the object of study. It is one of the instruments of the *rupture* didactics should make to establish itself as a proper field; it is the reason why the 'entrance through the knowledge' into didactic problems passes from power to action: because the 'knowledge' becomes *problematic* through it and, from now on, can figure as a term in the formulation of problems (either new or reformulated ones), and in their solution. (Chevallard 1985a, p. 15, our translation.)

The audacity of the project of a science of didactics put forward by the TDS was in this way reinforced at the time that its empirical unit of analysis started to extend considerably. Since mathematics is knowledge brought about, taught, learnt, practised and diffused in social institutions, to be able to understand which mathematics is done at school it is necessary to know the mathematics that motivates and justifies its teaching as well as how this mathematics is being interpreted in the different teaching institutions.

3. First contribution: the enlargement of the empirical unit of analysis

One of the first contributions of the theory of didactic transposition was to make clear that it is not possible to interpret school mathematics properly without taking into account the phenomena related to the school reconstruction of mathematics, whose origin has to be found in the institutions that produce mathematical knowledge. A distinction is established among: the 'original' or 'scholarly' mathematical knowledge as it is produced by mathematicians or other producers; the mathematical

[1] This expression derives from the fact that Brousseau initially designated as 'experimental epistemology' what was then baptised as 'didactics of mathematics'. It stresses the importance of the knowledge questioning and avoids other more exclusive designations as referring to geography or language (neither is all research of the epistemological programme French, nor does all the French didactics take part in it).

knowledge 'to be taught' as it is officially designed by curricula; the mathematical knowledge as it is actually taught by teachers in their classrooms and the mathematical knowledge as it is actually learnt by students and that can be considered at the same time the end of the didactic process and also the starting point of new ones. Figure 1 illustrates the steps of the didactic transposition process.

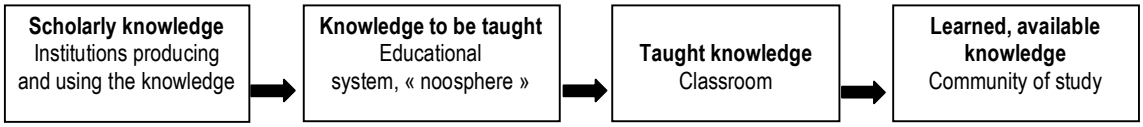

Fig. 1. The didactic transposition process

Didactic transposition processes underline the *institutional relativity of knowledge* and situate didactic problems on an institutional level, beyond individual characteristics of the subjects of the considered institutions. Its main consequence is that the *minimum* unity of analysis of any didactic problem must contain all steps of the process of didactic transposition. It is essential to take as an empirical basis data coming from each and every one of these institutions.

The first step corresponds to the study of the *formation* of the 'teaching text' pointing out the 'knowledge to be taught' through the productions of the noosphere (official programmes, textbooks, recommendations to teachers, didactic materials, etc.) and highlights the conditions and constraints under which the 'knowledge to be taught' is constituted and evolves (or remains fixed) in time. Thus, the analysis of the didactic transposition of a teaching domain (which includes the delimitation and designation of the domain itself) cannot be reduced to the reviewing of mathematics textbooks, even if they constitute a privileged empirical material for researchers. What is important is the kind of questions that are asked (why teaching this? why in this organisation? where does it come from?) and the kind of phenomena textbooks show (or hide).

The term 'scholar' was used — in quite an ironical way — to characterise knowledge that guarantees and legitimates the teaching process. Quoting Kang and Kilpatrick (*op. cit.*, p. 2): 'A scholarly body of knowledge is nothing other than knowledge used both to produce new knowledge and to organize the knowledge newly produced into a coherent theoretical assemblage.' The difficult reception of the expression 'scholarly knowledge' testifies the difficulty of considering it at the same level as the knowledge to be taught (the one proposed by standards and official programmes) or the knowledge as it is actually taught at school. What bodies of knowledge are chosen? How are they named? Why these ones and why with this kind of organisations? What are the reasons to these choices? Etc. It is no longer enough to study the 'knowledge to be taught' and the 'taught knowledge'. It is also necessary to analyse — examine minutely and break down — the spontaneous models of the 'scholarly knowledge' that are taken for granted in educational institutions. For this reason, 'scholarly knowledge' cannot appear in any case as the 'reference knowledge' (as called by Astolfi & Develay 1989): it certainly is the reference point of educational institutions, but not of researchers who consider these institutions as an object of study.

We are not commenting here on the other steps of the transposition process that delimit the degree of freedom left to teachers and students when carrying out their work in the classroom. They have been more studied as they correspond to the place where the teaching process is usually located. What we want to stress is the following: considering the transposition process as a new object of study allows researchers in mathematics education to free themselves from spontaneous epistemological models that are implicitly imposed by the educational institutions to which we belong. When looking at this new empirical object that includes all steps from scholarly mathematics to taught and learnt mathematics, we need to elaborate our own 'reference' model of the corresponding body of mathematical knowledge. Figure 1 can thus be completed by what we call the 'reference epistemological knowledge' (Bosch and Gascón 2005) that constitutes the basic theoretical model for the researcher and can be elaborated from the empirical data of the three corresponding institutions: the mathematical community, the educational system and the classroom (see figure 2).

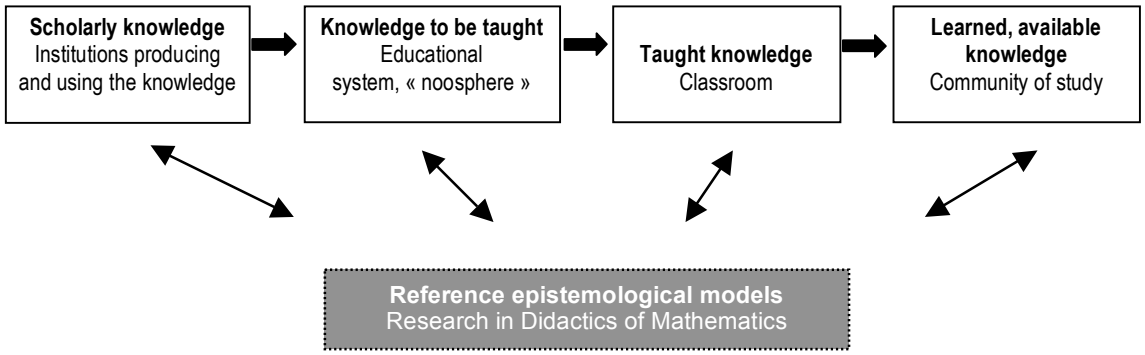

Fig. 2. The 'external' position of researchers

Research in didactics needs to elaborate its own models of reference to be able to avoid being subject to the different institutions observed, especially the 'dominant' ones. There is no privileged reference system for the analysis of the different bodies of knowledge of each step of the didactic transposition process. A reference model needs to be continuously developed by the research community and submitted to the proof of the facts. This is the sense we can attribute to the 'epistemological analysis' in didactics:

> Since 'scholarly knowledge' has been assigned its right place in the process of transposition, far from replacing epistemological analysis, in the strict sense, by the analysis of the didactic transposition, it turns out that it is indeed the concept of didactic transposition which allows the linking of the epistemological analysis to the didactic analysis, and from then on the guide of proper use of epistemology in didactics. (Chevallard 1985a, p. 20, our translation.)

Whatever the considered didactic problem may be, its study requires adopting a particular 'point of view' about the involved mathematical practices. For instance, what are the 'limits of functions' taught at undergraduate level? Or what kind of 'proof' or 'problem solving' are we considering? Is it

something existing in 'scholarly mathematics'? In what way? Does it exist as knowledge to be taught? Since when? In what terms? What kind of restrictions does it impose on the teachers' practice? On the students' practice? Etc. From this point of view, the TDS appears as a 'machine' producing reference epistemological models. Situations are classically considered as tools to implement mathematical knowledge in the classroom (didactic engineering) and to analyse phenomena related to learnt and taught knowledge. However, they have also shown their pertinence to describe scholarly knowledge and the evolution of knowledge to be taught, as for instance in Brousseau's preliminary study on the teaching of decimal numbers (Brousseau 1980).

Over the last 25 years, didactic transposition processes of some of the main specific areas of the 'mathematics to be taught' have been analysed. For instance, concerning secondary school teaching we can mention among others: elementary algebra (Chevallard 1985b, Kang 1990, Coulange 2001), proportionality and magnitudes (Bolea *et al.* 2001, Comin 2002, Hersant 2005), geometry (Tavignon 1991, Chevallard and Jullien 1991, Matheron 1993, Bolea 1995), 'idecimal' and irrational numbers (Assude 1992, Bronner 1997), functions and calculus (Artigue 1993, 1998, 2000; Ruiz Higueras 1994, 1998; Chauvat 1999; Amra 2004; Barbé *et al.* 2005), linear algebra (Ahmed and Arsac 1998, Dorier 2000, Gueudet 2000), arithmetic (Ravel 2002), demonstration (Arsac 1989, Cabassut 2004), modelling (García 2005), statistics (Wozniak 2005), mathematics and economics (Artaud 1993, 1995), mathematics and sciences (Arsac *et al.* 1994).

These researches show that most phenomena related to the teaching of mathematics have as a main component a particular phenomenon of didactic transposition. It is in this sense that we can say that *phenomena of didactic transposition are at the very core of any didactic problem*. At the same time, these phenomena cannot be separated from those related to the production, use and diffusion of mathematics. School mathematical activity is thus inseparably integrated into the much larger problem of institutional mathematical activities which leads to a more general definition of didactics of mathematics: the 'science of specific (imposed) diffusion conditions of the mathematical bodies of knowledge useful to people and human institutions' (Brousseau 1994). This definition enlarges the field of didactics beyond educational institutions to include all institutions in which any kind of mathematical activity takes place.

Guy Brousseau has always insisted on the importance for mathematics education to remain close to the mathematical community because of the central role of epistemological analysis in didactics. However, in order to progress in their widened field of investigation, researchers have to get rid of their positions of 'teachers' and 'mathematicians', guardians of orthodoxies. A new position is necessary. Resort to the 'anthropological didactics' (Chevallard 1992) will highlight the need to work on the construction of this position.

4. Second contribution: the description of mathematical and didactic activities

Between 1980 and 1995, the study of phenomena of didactic transposition was formulated in terms of *objects of knowledge* and *relations to objects* in the broader frame of the *institutional ecology of knowledge objects* (Chevallard 1992, Artaud 1993, 1995). The search for a more detailed tool to model mathematical practice, including its material dimension, and mathematical bodies of knowledge, as inseparable from this practice, gives rise to the notion of *mathematical praxeology* or

mathematical organisation within the frame of the 'Anthropological Theory of the Didactic' (Chevallard 1999, 2002a, 2002b). This theory is based on the assertion that mathematical activity has to be interpreted as an ordinary human activity, along with other forms of activity, and thus proposes a general model of human activities (the *praxeologies*) that links and gives the same importance to their theoretical (knowledge) and practical (know-how) dimension. According to Chevallard (2006):

> *A* praxeology is, in some way, the basic unit into which one can analyse human action at large. […] What exactly is *a* praxeology? We can rely on etymology to guide us here — one can analyse any human doing into two main, interrelated components: *praxis*, i.e. the practical part, on the one hand, and *logos*, on the other hand. "*Logos*" is a Greek word which, from pre-Socratic times, has been used steadily to refer to human thinking and reasoning — particularly about the cosmos. […] [According to] one fundamental principle of ATD — the anthropological theory of the didactic —, no human action can exist without being, at least partially, "explained", made "intelligible", "justified", "accounted for", in whatever style of "reasoning" such an explanation or justification may be cast. *Praxis* thus entails *logos* which in turn backs up *praxis*. For *praxis* needs support just because, in the long run, no human doing goes unquestioned. Of course, a praxeology may be a *bad* one, with its "praxis" part being made of an inefficient technique — "technique" is here the official word for a "way of doing" —, and its "logos" component consisting almost entirely of sheer nonsense — at least from the praxeologist's point of view!

In order to have the most precise tools to analyse the institutional didactic processes, Chevallard (1999) classifies mathematical praxeologies into a sequence of increasing complexity. The "simpler" ones — *point*-mathematical organisations —, built up around a single kind of problem, can be linked according to their theoretical background to give rise to *local*, *regional* or *global* praxeologies that cover respectively a whole mathematical theme, an sector or a domain. The analysis of didactic transposition processes acquires a new functionality since the modelling in terms of praxeologies can be used to describe all steps of the didactic transposition process: from the 'official' scholarly bodies of knowledge that can be found in mathematical treatises or those more informal ones 'activated' by researchers in their daily work, till the contents explicitly taught in classrooms or the less explicit mathematical knowledge learnt by, and thus available for, a group of students. It particularly becomes a very useful tool to clarify the reference epistemological models that guide researchers pointing out the strict constraints 'praxeologies to be taught' may bear onto teachers' and students' practice.

Bolea, for instance, presents an original specific model of elementary algebra that allows describing didactic restrictions on the teaching of algebra as a modelling tool (Bolea *et al*. 2004). Garcia (2005) extends this model to reach the link between algebraic and functional modelling, showing the isolated character of proportionality in Spanish curricula (García & Ruiz 2006). A very simple model in terms of a double-sided praxeology can show the extremely narrow space in which a Spanish high school teacher when teaching limits of functions can move (Barbé *et al*. 2005). Other analyses of didactic transposition processes in terms of praxeologies can be found in recent doctoral dissertations, such as: Cabassut (2004) analysing what he calls a 'double transposition' on the teaching of proofs as a mathematical and a social knowledge; Hersant (2005) depicting the evolution of the teaching of

proportionality in France and questioning it on the poor place devoted to the study of magnitudes; Ravel (2004) studying the difficult reintroduction of arithmetic at high school level in France; Amra (2004) on the teaching of functions; Rodríguez (2005) on the teaching of problem solving and metacognitive skills; and Wozniak (2005) on statistics.

We have said that mathematical knowledge can be described in terms of praxeologies. What about the teaching and learning of mathematics, that is, the didactic process itself? In fact, in the same way knowledge is never a definitive construction, *mathematical praxeologies* do not emerge suddenly and do not acquire a definite form. They are the result of complex and ongoing activities, with complex dynamics, that in their turn have to be modelled. There appear two aspects very close to the mathematical activity: the process of mathematical construction — the *process of study* — and the result of this construction — the *mathematical praxeologies*. Once again, this process of study, as a human activity, is to be modelled in terms of praxeologies, which are now called *didactic praxeologies* (Chevallard 1999). Thus the notion of *study* provides a unitary field to describe didactic praxeologies the object of which is the setting up of mathematical praxeologies in different institutions (production, diffusion, using and teaching institutions).

We are not developing this point here, but let us just say that a new conception of didactics of mathematics appears in which *didactics* is identified to anything that can be related to *study* and *aid to study*:

> Didactics of mathematics is the science of study and aid to study mathematics. Its aim is to describe and characterize the study processes (or didactic processes) in order to provide explanations and solid responses to the difficulties of people (students, teachers, parents, professionals, etc.) studying or helping others to study mathematics. (Chevallard, Bosch, Gascón 1997, p. 60, our translation).
>
> The concept of praxeology enables us to completely formulate the object of didactics: *didactics is devoted to study the conditions and restrictions under which praxeologies start living, migrating, changing, operating, dying, disappearing, reviving, etc., within human groups*. Naturally there is a considerable enlargement of the field of research of didactics: *the* didactics studies *the* didactic, whenever it can be found, whatever form it can take. Giving its proper object, didactics can hope to progressively escape from a status dominated by disciplinary fields established at school. (Chevallard 2005, our translation)

If we replace 'conditions and restrictions' by 'ecology', we can say, in a shorter way, that didactics is devoted to the study of the institutional *ecology of mathematical and didactic praxeologies*. As was showed some years ago by Artaud (1993, 1995), the didactic transposition appears as a particular form of institutional transposition, that is of social diffusion of mathematical knowledge.

5. Third contribution: constraints at different levels of determination

The study of the ecology of mathematical and didactic praxeologies states that, when the teacher and the students meet around a knowledge to be taught, what can happen is mainly determined by

conditions and restrictions that cannot be reduced to those immediately identifiable in the classroom: teacher's and students' knowledge, didactic material available, software, temporal organisation, etc. Even if these conditions and restrictions play an important role, Chevallard recently proposed to consider a scale of 'levels of determination' (see figure 3) that may help researchers to identify conditions that go beyond the narrow space of the classroom and the subject that has to be studied in it (Chevallard 2002b, 2004).

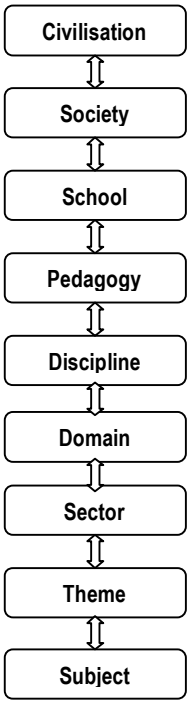

Figure 3. Scale of levels of determination

Why such a new broadening of the object of study with the corresponding complexity of the theoretical framework? The answer is always the same: to get free from the spontaneous conceptions of mathematical knowledge that researchers could assume without bringing them into question. 'Specific', 'local', 'regional' and 'global' praxeologies correspond to the low levels of the topic, the theme, the sector and the domain. Maybe due to the closeness to the 'teacher's problem' (the simplest formulation of which could be: 'given a mathematical content to be taught to a group of students, which is the best way to do it?'), researchers often took for granted the specific delimitation of contents that is given by scholarly or educational institutions. Why are mathematical contents divided in these or those particular blocks? Which are the criteria for this division and what kind of restrictions on the concrete activity of teachers and students does it cause?

Within the discipline of mathematics, the high value attributed to geometry to approach reasoning and proof, the lower consideration of elementary algebra and the difficulty in some European countries to introduce the teaching of statistics as a 'normal' block of contents, are phenomena that originate at higher levels of determination (school, society and civilisation). Not to mention the closing of mathematics in itself and the difficult relationships between mathematics and other disciplines. These are clearly strong constraints against, for instance, the learning of modelling, statistics or other practices that require the construction of mathematical praxeologies mixed up with non-mathematical objects (more developments can be found in Wozniak 2005).

The main problem is to know which kind of restrictions, coming from which level, are becoming crucial to the ecology of mathematical praxeologies. At the beginning of this paper we mentioned the process of monumentalization of mathematical knowledge. Nowadays it really appears as an essential transpositive phenomenon that goes beyond mathematical education and affects almost all kinds of praxeologies taught at school. The most recent works of Chevallard (2004, 2005, 2006) call for the

construction of a new school epistemology that places the rationale of bodies of knowledge and their functionalities at the core of learning:

> [We need] an updating of mathematics to turn it, in a sense, into *responsible* mathematics. Mathematics clearly showing to new generations that school will not let them down but is, on the contrary, highly concerned about endowing them with the necessary tools to think about the world around them and step into it armed with knowledge and reason. (Chevallard 2004, our translation)

The scale of levels of determination clarifies a new opening in the field of study of didactic phenomena that was incipient in the first formulations of the theory. 25 years ago Chevallard's work impelled us to take into account constraints coming from the didactic transposition process and the concrete way this process organises mathematical contents at school: from the division into disciplines and blocks of contents, till the low-level concatenation of subjects. A further step seems necessary now, looking at constraints coming from the way Society, through School, organises the study of disciplines. It concerns, more generally, the status and functions our societies assign to disciplines and 'study activities'. It seems that this last development will allow us to reassess our common views about education and learning and establish the 'alternative epistemology' that Kang and Kilpatrick (1992, p. 2) were able to make out in the original transposition theory:

> We may need an alternative epistemology if we admit that most of the knowledge in school mathematics is a compound of knowledge that fits observations together with our values, instructional purposes, mathematical skills, and so on. […] Can we construct and epistemology that allows us to treat knowledge at least "as if" it existed independently outside of the knower without violating much of the constructivist position? One epistemological model that gives a positive answer can be found in the didactic transposition theory of Chevallard.

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Marianna Bosch
FUNDEMI - Facultat d'Economia IQS
Universitat Ramon Llull
c/ Torrent de les Flors, 68
08024 Barcelona, SPAIN
mbosch@fundemi.url.edu

Josep Gascón
Departament de Matemàtiques
Universitat Autònoma de Barcelona - Edifici C
08193 Bellaterra, SPAIN
gascon@mat.uab.es

The International Centre for Pure and Applied Mathematics (CIMPA) and Mathematics within Developing Countries

Michel Jambu

Note of the Editor: This paper is based on an article by the author published in a special issue of the *Lettre de l'Académie des sciences* (No 18, Hiver 2005, pp. 8-9) on the theme "Sciences and the Third World". This bulletin is accessible at http://www.academie-sciences.fr/publications/lettre.htm.

In a letter dated July 2, 1830, and sent to Adrien-Marie Legendre, Carl G.J. Jacobi wrote:

> *It is true that Mr. Fourier had the opinion that the principal aim of mathematics was public utility and explanation of natural phenomena; but a philosopher like him should have known that the sole end of science is the honor of the human mind, and that under this title a question about numbers is worth as much as a question about the system of the world.*

Even though mathematicians often drew their inspiration from problems stemming from physics or, inversely, even though the mathematicians' discoveries went a long way towards understanding the phenomena of the world of Physics, mathematics has essentially expanded for ages without considering its applications as a main preoccupation. Until quite recently, mathematics has been regarded as a luxury that only wealthy countries can afford. However, the situation has substantially changed over the last decades. The extremely fast evolution of technologies requires more and more elaborated mathematical tools, and mathematicians had to leave their "ivory tower" in order to collaborate with multidisciplinary teams. These collaborations benefit as much mathematics as other disciplines. At the same time, efforts were made to explain to the general public the usefulness of mathematics. One may refer to the recent publication of the Société Mathématique de France, entitled *L'explosion des mathématiques*, in which authors aim at explaining to non-specialists the very important part mathematics takes in the development of various areas of activities of our daily life (the publication is accessible at the url http://smf.emath.fr/Publications/ExplosionDesMathematiques/).

The access to scientific knowledge is necessary to maintain both economical and technological development and as a consequence, there is an ever-increasing rift between wealthy countries and Third World countries. The most brilliant young people are attracted to a better quality of life that affluent countries offer and the brain drain of the elite worsens the situation even more, decreasing then the chances of future development in the Southern countries, which then become an open market for richer countries to draw from.

However, efforts are made by certain organizations in an attempt to develop sciences within the more disadvantaged countries and to combat these trends. Without disregarding the importance of these organizations, there is room for a strong collaboration based on academic structures and dealing with basic science — mathematics and physics in particular —, especially since numerous contacts do already exist through scientists from these countries trained in developed countries. In mathematics and within certain areas of physics, financial investments to support these projects are not very substantial and there is a possibility of creating a network of college graduates of a good level, which, for instance, may be playing the role of interlocutors for actors of the economical life who settle in their own countries and, therefore, accordingly help the economic growth.

Most of the participants to this cooperation act individually with or without a specific support. Even though actions of international cooperation are part of the missions of the teachers-researchers, hence of the university, their status remains ambiguous and often leads to a voluntary service.

In parallel to these individual actions, some organizations have turned themselves towards the support to fundamental sciences in developing countries.

The most famous one must certainly be the Abdus Salam Centre of Trieste, the *International Centre for Theoretical Physics* (ICTP) — http://www.ictp.it/. It was established in 1964 and its goals are to promote research in physics and mathematics within developing countries, to allow scientists to organize and to attend to seminars, to act as a forum for scientists throughout the world, and to provide excellent working conditions to researchers. The associates' programme is for sure the main originality of this centre. Most activities of ICTP take place in Trieste. In 2000, for instance, about 4000 researchers gathered at ICTP, including some 2500 coming from developing countries. The ICTP budget is in the region of about 17 millions euros, approximately 85% of which is provided by the Italian government.

In 1961, the Swedish government founded the *International Science Program* (ISP) — http://www.isp.uu.se/ — at the Uppsala University. This institute, that supports research in physics and chemistry in developing countries, recently opened up to mathematics. ISP mainly assists research teams, the development of North-South and South-South networks as well as visits to Northern countries of researchers from the South (mainly Africa). Its budget is about 5,2 millions euros. A remarkable fact is that the Swedish support for basic sciences has remained stable for more than 40 years, which allows having a long term scientific policy with all the advantages and efficiency it provides.

The *International Centre for Pure and Applied Mathematics* (CIMPA — *Centre International de Mathématiques Pures et Appliquées*) — http://www.cimpa-icpam.org — is an association of the type "Loi de 1901" (1901-Law), established in 1978 on the initiative of the French mathematical community and in response to Recommendation 2124 of the 18th Session of the UNESCO General Conference that took place in 1974:

> *"One will examine the possibility of establishing an international centre of mathematics, in cooperation with the International Mathematical Union and interested member states."* (My translation)

Several French Universities expressed the wish to host such a centre and in 1978, Nice asserted itself over other choices. The vocation of the CIMPA is to organize schools and seminars and to sustain networks of researchers for the benefit of developing countries, in accordance with the wishes expressed by UNESCO:

> *"… the training of mathematicians coming in priority from developing countries (training sessions throughout the academic year and summer schools), documentation (gathering, creation and diffusion). The CIMPA has a interdisciplinary vocation: the study of mathematics and its applications to concrete problems, notably those linked to development…"* (My translation)

To implement its scientific policy, the CIMPA is supported by the Ministry of Research, the International Relations and Cooperation Direction (DRIC) of the Ministry of National Education, Higher Education and Research, UNESCO — whose contribution is on the decline —, and also by the University of Nice (UNSA). In 2006, the total of the subventions amount to 240 000 euros and its consolidated budget is of the order of 650 000 euros. The first Evaluation Committee of the CIMPA that met in November 2001, under the presidency of Professor P.L. Lions, mentions in its conclusions:

> *"… The committee wishes to underline the fact that despite modest means and financial resources, the impact of CIMPA's activities is by far more important than the figures themselves. As a matter of fact, the communities of mathematicians that the CIMPA has created or developed around the world act as a noteworthy lever. (…)*
>
> *The global evaluation is excellent: despite financial and structural instabilities, the CIMPA has definitely come to maturity and its impact continues to grow. The impact it has around the world is considered by the Committee as outstanding (indeed miraculous!). The CIMPA is ideally placed to be the world leader for this type of activity. (…) The CIMPA itself is fragile: everything rests on both the enthusiasm and the commitment of one or two persons. (…) We believe that [this] objective is attainable upon the condition that CIMPA is provided with an annual consolidated budget amounting to 1,5 to 2 millions Euros."* (My translation)

In order to fulfil its mission, the CIMPA organizes schools and supports researchers' networks, preparatory training sessions for research, along with seminars always for the benefit of developing countries. The scientific activities organized by the CIMPA encompass all mathematical themes, from fundamental aspects to the most applied ones, from theoretical physics to biology, from economy to theoretical computer science, all the way to engineering sciences.

Schools are intended for young or experienced researchers coming from the Southern countries and who wish to update their knowledge or to get acquainted with a new domain. The activities of the CIMPA must not be short-lived. Results are obtained in the long term and we can be pleased about being behind numerous theses and collaborations.

The CIMPA thus contributed to the emergence of certain structured groups of research; its action on site allowed CIMPA to gain a true expertise of situations to which Southern scientific communities are confronted and to create essential links between Northern and Southern mathematicians. CIMPA's priorities are to bring out of isolation mathematicians from the most disadvantaged countries, to allow them to become integrated into the international scientific community, to give them access to documentation and to offer them the possibility of defining the best scientific policy for their country. For instance, the CIMPA is very active in Africa, mainly with the French-speaking mathematicians' community, and has many ongoing projects. The CIMPA has also undertaken the planning of activities in other African countries. In South East Asia, the CIMPA has just been launching a project to support the training of mathematicians in Cambodia and in Laos, together with the assistance of the *Agence Universitaire pour la Francophonie* (AUF) and the International Mathematical Union (IMU). In response to a request from Paraguayan mathematicians, another project launched by the CIMPA is in the process of elaboration and should gather partners of countries close to Paraguay who have strong communities of mathematicians, such as Brazil, Chile Argentina and Uruguay, as well as Spanish and French researchers.

Since its inception, the CIMPA has organized 134 schools and more than 50 seminars, training sessions and doctoral trainings benefiting mathematicians from developing countries; this activity has been on the increase for a number of years. During the first fifteen years, these activities took place mainly in France; then, exclusively within 41 Southern countries, 15 of which are in Africa, 7 in South-East Asia and India, 10 in Latin America and Caribbean, 6 in Middle East and 3 in Central Europe and Eastern Europe (outside EU). About 7000 trainees from Africa, Latin America, South East Asia, Middle East and Europe benefited from these training sessions and they were supervised by more than 700 lecturers. The proceedings of more than 35 schools have been published and most of lecture notes for the courses are available on line, on CIMPA's website.

An international scientific council examines the different projects and is responsible for the scientific quality and the interest of themes — considering the region where the school or the training session will take place.

As for the Southern countries, they got themselves organized so to help mathematicians by establishing their own institutions such as UMALCA (*Unión Matemática de America Latina y el Caribe* — http://umalca.usach.cl/), SEAMS (*Southeast Asian Mathematical Society* — http://seams.math.nus.edu.sg/), UMA (African Mathematical Union — http://www.math.buffalo.edu/mad/AMU/AMU-index.html), and initiatives from prestigious scientists such as AMMSI (*African Mathematical Millenium Science Initiative* — http://www.ammsi-maths.org/) are being set up. Research centres at the highest level and internationally recognized, such as the *Instituto Nacionale de Matemática Pura e Aplicada* (IMPA — http://www.impa.br/) of Rio de Janeiro, the *Centro de Modelamiento Matemático* (CMM — http://www.cmm.uchile.cl/) of Santiago de Chile, the Tata

Institute — http://www.tifr.res.in/ — of Mumbai, to only mention 3 of them, attest to the quality of mathematics in Southern countries. The CIMPA endeavours to coordinate its activities with these different institutions. However, despite all these efforts, many countries are not in a position to develop, on their own, scientific activities at an international level.

Even though the CIMPA is an institution governed under a French law status, it is first and foremost an international institution and it does not represent the French scientific policy. However, the CIMPA organizes its activities in close connection with the French mathematicians. It is probably worthwhile reminding of the leading role that the French mathematical community has played, from time immemorial, in the development of mathematics.

Nothing could be done without the support of mathematicians coming from developed countries who accept to devote some of their time in order to prepare and supervise projects and, afterwards, to maintain relationships with Southern mathematicians. Some Canadian mathematicians were involved as lecturers in schools organized by the CIMPA, and it is hoped that Canadian colleagues who cooperate with developing countries could associate themselves with the CIMPA. The CIMPA has undertaken becoming even more of an international institution. Its scientific council is a true reflection of this fact. Recently, the Spanish mathematicians have offered to participate in a training project launched by the CIMPA in Paraguay. This is a further step towards CIMPA's internationalization. Similar moves allowed German mathematicians to become interested in the project of the development of mathematics in both Cambodia and Laos. The US National Committee for Mathematics (USNC/Math — http://www7.nationalacademies.org/usnc-math/) examines the possibility of joining the Cambodian project. We must carry on with these efforts and involve a larger number of mathematicians and institutions from developed countries in actions of support for colleagues of Southern countries.

Efforts are being made to bring together the different organizations we have been mentioning here, in order to strengthen their efficiency. ICTP very often provides financial support to our schools. The French embassies' cultural and scientific services are sensitive to the quality of our activities and to their impact on the Southern countries. They assist us by taking charge of the travelling expenses of one or several French lecturers. Other learned societies such as the *Société Mathématique de France* (SMF), the *Société de Mathématique Appliquées et Industrielles* (SMAI), the European Mathematical Society (EMS) and the International Mathematical Union (IMU) are also sensitive to the problems of developing countries. The CIMPA and the International Commission on Mathematical Instruction (ICMI) are currently examining possibilities of collaboration around the needs in mathematics education in developing countries, in particular as regards the preparation of the mathematics school teachers. However, the task remains tremendous when considering the increasing gap between wealthy countries and developing countries.

Michel Jambu, Directeur du CIMPA
Le Dubellay, 4 avenue Joachim
06000 Nice, FRANCE
jambu@unice.fr

L'Enseignement Mathématique Now Available on the Web

The well-known international journal *L'Enseignement Mathématique*, the official organ of ICMI since the inception of the Commission in 1908, is now available on the web.

As a part of SEALS (Swiss Electronic Academic Library Service), the Consortium of Swiss Academic Libraries has launched the project *E-Archiving*, dealing with the improvement of the accessibility of electronic contents in universities, as well as with the long-term preservation of digital objects in accessible and usable form. The project *E-Archiving* aims at providing a platform for making Swiss journals accessible online. Two Swiss scholarly journals related to mathematics, *L'Enseignement Mathématique* and *Commentarii Mathematici Helvetici*, have been digitized from printed originals and recently made available on the web. The project is based on the idea of accompanying the digitization process by an OCR system (Optical Character Recognition), making possible a fulltext search in the digitized journals.

The following issues of *L'Enseignement Mathématique* are currently freely available on the web: *1st series*, volumes 1 to 40 (1899-1954), and *2nd series*, volumes 1 to 46 (1955-2000) — more than 40 000 pages altogether.

The online version of *L'Enseignement Mathématique* is accessible at the address

http://retro.seals.ch

ICMI on the Web

The ICMI website, which is part of the site of the International Mathematical Union, is hosted at the Konrad-Zuse-Zentrum für Informationstechnik Berlin in Germany. This website can be accessed at the address

http://www.mathunion.org/ICMI/

Readers are encouraged to visit the site and provide the Secretary-General with comments and suggestions for its improvement.

Interested readers should also note the address for the homepage of IMU

http://www.mathunion.org/

as well as the homepage of ICSU (International Council for Science), to which ICMI belongs through IMU:

http://www.icsu.org/

Three New Journals Related to Mathematics Education

International Journal for the History of Mathematics Education

As mentioned in the report of HPM — an ICMI Affiliated Study Group — appearing elsewhere in this issue of the *ICMI Bulletin*, the success of the Topic Study Group 29 on *The History of Learning and Teaching Mathematics*, at the International Congress on Mathematical Education (ICME-10) held in Copenhagen in 2004, demonstrated the need for a permanent and stable international forum for scholarly research in the history of mathematics education. Therefore, a new journal, the *International Journal for the History of Mathematics Education*, has been established. It is published electronically by the Teachers College, Columbia University, and in printed form by COMAP. The first issue is due for September 2006 and the second for March 2007. The current address (to be updated shortly) of its website is http://www.tc.edu/centers/ijhmt/.

International Electronic Journal of Mathematics Education (IEJME)

The *International Electronic Journal of Mathematics Education* (IEJME) is a new international peer-reviewed educational journal publishing articles in the field of mathematics education. Its editor is Ziya Argun, Gazi University, Ankara, Turkey, and the first issue will appear in October 2006. IEJME encourages submissions from authors throughout the world. Original articles will be considered for publication. All articles will be critically reviewed by the editor and invited referees within 6-8 weeks. Articles should be submitted by e-mail at iejme@iejme.com. Information can be accessed on the website http://www.iejme.com/.

RADISMA

In the context of the 2005 call for projects of the *Agence Universitaire de la Francophonie* (AUF), aiming at the establishment of online scientific journals published in French, a project entitled *Revue africaine de didactique des Sciences et des Mathématiques* (RADISMA) — *African Journal of Science and Mathematics Education* — has met with the approval of the Scientific Council of AUF. This project results from a partnership between four institutions of higher education involved in the education of teachers, namely the *Institut Universitaire de Formation des Maîtres* (IUFM) of Lyon (France), the *École Normale Supérieure* (ENS) of Rabat (Morocco), the *Faculté des Sciences et des Technologies de l'Éducation et de la Formation* (FASTEF) of Dakar (Senegal) and the ENS of Nouakchott (Mauritania). Among the aims of RADISMA is to foster reflection, communication and sharing of experiences on issues about the teaching and learning of sciences and mathematics, notably in contexts of multilingualism and of changing educational systems. Of particular interest is the linguistic issue connected to the teaching and learning of sciences and mathematics in French used as a second language. Based on a North-South and South-South collaboration, RADISMA has as an objective to disseminate high level original research in the didactics of experimental sciences and mathematics and to facilitate its implementation in African research fields.

The first issue of RADISMA can be accessed at the (temporary) url

http://www.mr.refer.org/radisma/sommaire.php?id=20

AMUCHMA Newsletter on the History of Mathematics in Africa

AMUCHMA, the African Mathematical Union Commission on the History of Mathematics in Africa, announces that the issue 30 of the *AMUCHMA Newsletter on the History of Mathematics in Africa* is now available, like all the earlier issues, available on the web page:

http://www.math.buffalo.edu/mad/AMU/amuchma_online.html

An electronic version of the Newsletter can be obtained, as an attachment, from Paulus Gerdes at pgerdes@virconn.com.

The AMUCHMA Newsletter is published in various languages. It is available free of charge upon request, as follows:

For the English version, send requests to

Paulus Gerdes
Chairman of AMUCHMA
Centro de Investigação Etnomatemática
C.P. 915, Maputo, Mozambique
Fax: 258-1-49 45 04
e-mail: pgerdes@virconn.com

For the French and Arabic versions, send requests to:

Ahmed Djebbar
Secretary of AMUCHMA
Département de mathématiques, Bt. M 2
Université de Lille 1
59655 Villeneuve D'Asq Cedex, France
Fax: 33-1-45 33 14 74
e-mail: ahmed.djebbar@agat.univ-lille1.fr, Ahmed.Djebbar@wanadoo.fr

ICMI Study Volumes

Readers are reminded that
individuals may purchase the ICMI Study Volumes
published by Springer in the
New ICMI Study Series (NISS)
at a discount of 60% for the hardback and
a discount of 25% for the paperback.

It is understood that the books ordered are
for personal use only.

To obtain the ICMI discount, individual orders
must be placed online through the NISS homepage
http://www.springeronline.com/series/6351
on the Springer website.

The appropriate ICMI Discount Token Number
should be entered on the payment screen:
Token for Hardbound: YSwE925dq6SEdhk
Token for Softbound: C6zHr25NZDdFAay

For further information contact the Secretary-General of ICMI at
bhodgson@mat.ulaval.ca

ICMI Activities on the Web

For up-dated information about coming ICMI activities and ICMI related activities, please consult the following sites:

- **ICMI Study 16** (June 2006) http://www.amt.edu.au/icmis16.html
- **PME 30** (July 2006) http://pme30.cz/
- **WFNMC 2006** (July 2006) http://www.wpr3.co.uk/wfnmc/info.html
- **ICM 2006** (August 2006) http://www.icm2006.org
- **ICMI Study 17** (December 2006) http://www.math.msu.edu/~nathsinc/ICMI
- **Second Africa ICMI Regional Congress** (May 2007) http://www.jkuat.ac.ke/ICMI
- **ICMI EARCOME-4** (June 2007) http://www.usm.my/education/earcome4
- **PME 31** (July 2007) *congress site to come*
- **XII CIAEM** (July 2007) http://www.furb.br/ciaem/
- **ICTMA-13** (July 2007) http://www.ku.edu.np/ictma13.htm
- **ICMI Study 18** (July 2008) http://www.ugr.es/~icmi/iase_study/
- **ICME-11** (July 2008) *congress site to come*
- **PME 32** (July 2008) *congress site to come*

A Note on Copyright

Conferences on Technology in Mathematics Education

Bernhard A. Kutzler (Austria) is managing a website about various aspects of the relationship between technology and mathematics education. In particular information about conferences with an emphasis on the use of technology in mathematics education can be found at the address

http://www.kutzler.com

under the heading “Events”.

Future Conferences

(Prepared with the collaboration of Carmen Batanero)

ICMI Study 16: "*Challenging Mathematics In and Beyond the Classroom*", June 2006, Norway

Recent attempts to develop students' mathematical creativity include the use of investigations, problems, reflective logs, and a host of other devices. These can be seen as ways to attract students with material that challenges the mind. Initiatives taken around the globe have varied in quality and have met with different degrees of success. New technologies have enabled us to refine our efforts and restructure our goals. It is time to assess what has been done, study conditions for success and determine some approaches for the future.

Accordingly, ICMI has embarked, on its 16th Study, to examine challenging mathematics in and beyond the classroom, and is planning a Conference to be held in Trondheim, Norway, from 27 June to 03 July 2006. The Conference will be a working one and every participant will be expected to be active. Participation is by invitation only, based on a submitted contribution. Among the attendees, it is planned to represent a diversity of expertise, experience, nationality and philosophy. Such attendance should be drawn broadly from the mathematics and mathematics education community. It is hoped that the Conference will attract not only long term workers in the field but also newcomers with interesting and refreshing ideas or promising work in progress. In the past, ICMI Study Conferences have included about 80 participants.

More information can be obtained from the Co-Chairs, Edward J. Barbeau, Canada (barbeau@math.toronto.edu) and Peter J. Taylor, Australia (pjt@olympiad.org) or by visiting the Study web page

http://www.amt.edu.au/icmis16.html

ICTM-3, July, 2006, Turkey

Following two very successful International Conferences, ICTM-1 (1998) in Samos, Greece, and ICTM-2 (2002) in Crete, Greece, the 3rd International Conference on the Teaching of Mathematics at the Undergraduate Level will address new ways of teaching undergraduate mathematics. The conference will be held in Istanbul on June 30-July 5, 2006.

ICTM-3 will provide a unique international and centralized forum and bring together faculty members from countries with different educational and pedagogical systems around the world who are committed to introducing and using innovative teaching methods. The conference will be of great interest to mathematics faculty as well as anyone involved in the teaching and learning process of undergraduate mathematics.

The conference presentations will be centred around the following themes: Educational Research; Technology; Innovative Teaching Formats; Distance Learning; Specific Courses; and Other Disciplines.

More information from the Chair Ignatios Vakalis (ivakalis@capital.edu), or by visiting
http://www.tmd.org.tr/ictm3/

ICOTS-7, July 2006, Brazil

The International Association for Statistical Education (IASE) and the International Statistical Institute (ISI) are organising the Seventh International Conference on Teaching Statistics (ICOTS-7) which will be hosted by the Brazilian Statistical Association (ABE) in Salvador (Bahia), Brazil, July 2-7, 2006. The major aim of ICOTS-7 is to provide the opportunity for people from around the world who are involved in statistics education to exchange ideas and experiences, to discuss the latest developments in teaching statistics and to expand their network of statistical educators. The conference theme, "*Working Cooperatively in Statistics Education*", emphases the idea of cooperation, which is natural and beneficial for those involved in the different aspects of statistics education at all levels.

Information can be obtained for the Chair of the International Programme Committee, Carmen Batanero (batanero@ugr.es) and from the Chair of the Local Organising Committee, Pedro Alberto Morettin (pam@ime.usp.br), or by visiting the congress homepage
http://www.maths.otago.ac.nz/icots7

Creativity in Mathematics Education and the Education of Gifted Students, July 2006, Czech Republic

The Fourth International Conference on "Creativity in Mathematics Education and the Education of Gifted Students" will be held in Ceske Budejovice, in the Czech Republic, from July 5-8, 2006. Experts in mathematics education from all parts of the world are invited to present their ideas and experiences on issues such as: How to promote the creativity of our children? How to further our gifted children? How to stimulate our teachers? How to enrich mathematics education with creative activities?

This conference will be close in time and distance to some other important conferences like ICMI Study 16 conference in Trondheim, Norway (27 June - 3 July), CIEAEM 58 in Srni, Czech Republic, (9-16 July) and PME 30 in Prague, Czech Republic (16-21 July).

More information available from the chair of the Local Organising Committee, Alena Hospesova (Hospes@pf.jcu.cz), or from the web site
http://www.pf.jcu.cz/stru/katedry/m/creativity/

General information on this initiative around the issue of Creativity in Mathematics Education and the Education of Gifted Students can be obtained from Hartwig Meissner (meissne@math.uni-muenster.de) or by visiting the website

http://wwwmath1.uni-muenster.de/didaktik/u/meissne/WWW/creativity.htm

International Workshop on Research in Secondary and Tertiary Mathematics Education, July 2006, Turkey

This 5-day workshop is to be held in Baskent University, Ankara, Turkey, on July 7-11, 2006 and will focus on theoretical and empirical research in mathematics education at the secondary and tertiary levels.

In addition to invited talks by internationally known researchers in mathematics education, there will be contributed papers and discussion groups. Topics are anticipated to include: theories of learning mathematics, the transition from secondary to tertiary, the mathematical preparation of teachers, uses of technology, the teaching/learning of specific mathematical topics such as function, calculus, and differential equations, and applications of research to instruction.

Information is available from Prof. Dr. Seref Mirasyedioglu (serefm@baskent.edu.tr) or from the web page

www.mathed.baskent.edu.tr

CIEAEM-58, July 2006, Czech Republic

This Conference is organized by CIEAEM (*Commmission internationale pour l'étude et l'amélioration de l'enseignement des mathématiques*). Since its foundation in 1950, the CIEAEM — International Commission for the Study and Improvement of Mathematics Teaching — has intended to investigate the actual conditions and the possibilities for the development of mathematics education in order to improve the quality of mathematics teaching. The annual conferences, which are the essential means for realizing this goal, are characterized by exchange and discussion of the research work and its realization in practice and by the dialogue between researchers and educators in all domains of practice.

The next meeting of the CIEAEM will take place in Srni, in the Czech Republic, on July 9-15, 2006. The conference theme is "Changes in Society: A Challenge for Mathematics Education".

More Information is available from the chair of the International Programme Committee, Michaela Kaslova (michaela.kaslova@pedf.cuni.cz), or from the conference web page:

http://www.pef.zcu.cz/cieaem58/en/index.shtml

PME 30, July 2006, Czech Republic

The International Group for the Psychology of Mathematics Education came into existence at the Third International Congress on Mathematics Education (ICME-3) held in Karlsruhe, Germany, in 1976. Its former presidents have been Efraim Fischbein (Israel), Richard R. Skemp (UK), Gérard Vergnaud (France), Kevin F. Collis (Australia), Pearla Nesher (Israel), Nicolas Balacheff (France), Kathleen Hart (UK), Carolyn Kieran (Canada), Stephen Lerman (UK), Gilah Leder (Australia), and Rina Hershkowitz (Israel). The current president is Chris Breen (South Africa). The major goals of PME are:

- To promote international contacts and the exchange of scientific information in the field of mathematics education.
- To promote and stimulate interdisciplinary research in the aforesaid area.
- To further a deeper and more correct understanding of the psychological and other aspects of teaching and learning mathematics and the implications thereof.

The PME 30 conference will be held on July 16-21, 2006, in Prague, Czech Republic. The theme of the conference is "Mathematics in the Centre". The conference is hosted by the Faculty of Education of Charles University in Prague and will take place at this Faculty.

More information is available from the conference chair Jarmila Novotná (jarmila.novotna@pedf.cuni.cz) or by visiting the web page

http://pme30.cz/

DES-TIME, July 2006, Germany

The Dresden International Symposium on Technology and its Integration into Mathematics Education 2006 Conference is to be held on July 20-23, 2006 in Dresden, Germany.

This event combines two conferences: the Austrian Centre for Didactics of Computer Algebra (ACDCA) Summer Academy and the Seventh International Derive and TI-CAS Conference. The ACDCA conferences deals primarily with didactical issues connected with the use of technology. The Derive conferences are geared towards exploring the use of software and symbolic calculators in education (at the high school, lycée, college and university levels) and towards using these tools in programming and research

More information from Sylvia Neumann (sneumann@intercom-dresden.de) or by visiting the web page at

http://www.des-time-2006.de/en/

WFNMC 2006, July 2006, UK

The World Federation of National Mathematics Competitions (WFNMC), an Affiliated Study Group of ICMI whose interests are in competitions and related activities and their role in enriching the learning process, holds every four years a conference covering all aspects of mathematics competitions. The last conference was in Melbourne in 2002.

The WFNMC 2006 conference will be held in Robinson College, Cambridge, England from Saturday 22 to Friday 28 July 2006. Among the plenary lecturers are Simon Singh and Robin Wilson. Each day will include small working groups focusing on "problem creation and improvement". The plans are to have groups to cover most of the obvious domains — including some new ones: these will distinguish

- different ages — primary (roughly Grades 3-5), Junior (Grades 6-8), Intermediate (Grades 9-10), and Senior (Grades 11-12),
- target groups (popular multiple choice or "Olympiad"),
- content (traditional, or applied), and
- formats (individual timed written, take-home, team, or student problem journal).

The collection of problems that result from this exercise will be circulated after the conference, provided delegates agree to embargo publication for 12-15 months (so that the problems can be used in national competitions during the ensuing period).

More information is available from the chair of the Organising Committee, Tony Gardiner (A.D.Gardiner@bham.ac.uk), or from the website

http://www.wpr3.co.uk/wfnmc/info.html

YESS-3, August 2006, Finland

The Third YERME Summer School (YESS-3) will be held at the University of Jyväskylä, Finland on August 7-13, 2006. This School is jointly promoted by ERME (European Society for Research in Mathematics Education) and YERME (Young European Researchers in Mathematics Education). In line with the ERME Manifesto, the aims of the School are:

- to let people from different countries meet and establish a friendly and co-operative style of work in the field of mathematics education research;
- to let people compare and integrate their preparation in the field of mathematics education research in a peer discussion climate and with the help of highly qualified and differently oriented experts;
- to let people present their research ideas, theoretical difficulties, methodological problems, and preliminary research results, in order to get suggestions (from other participants and experts) about possible developments, different perspectives, etc. and open the way to possible connections with nearby research projects and co-operation with researchers in other countries.

People engaged in the apprenticeship of Mathematics Education research (in particular, Ph.D. students, but also M.A. students, post-graduate students and other people entering the field) are invited to take part in YESS-3. Further information can be obtained from the Scientific Coordinator of the School, Paolo Boero (boero@dima.unige.it), or by visiting the ERME website

http://ermeweb.free.fr/news.php

IMEC-8, August 2006, Iran

The 8th Iranian Mathematics Education Conference (IMEC-8) will be held in Shahre Kord, Chahar Mahal & Bakhtiari, Iran, on August 15-17, 2006. This conference is organized by the Ministry of Education and Education Organization of Chahar Mahal & Bakhtiari, in cooperation with the Iranian Mathematical Society, the Iranian Statistical Society, the Iranian Association for Mathematics Teachers' Societies, Shahre Kord University, the Chahar Mahal & Bakhtiari Mathematics Teachers Society and the Iranian Mathematics Houses Council. The conference themes include the theoretical foundations of mathematics education, the present state and challenges of mathematics education in Iran, the professional development of mathematics teachers and popularization of mathematics.

More information can be obtained from Ali Rejali, Isfahan University of Technology (a_rejali@cc.iut.ac.ir) or from Zahra Gooya, Shahid Beheshti University (zahra_gooya@yahoo.com).

ICM 2006, August 2006, Spain

The next International Congress of Mathematicians (ICM), held under the auspices of the International Mathematical Union (IMU), will take place in Madrid, Spain, on August 22-30, 2006. As with the last ICMs, one of the sections of the scientific program will be devoted to the theme "*Mathematics Education and Popularization of Mathematics*". The programme of this section includes three invited speakers:

- Petar Kenderov (Bulgaria) "Mathematics competitions: who wins?"
- Alan Siegel (USA) "Understanding and misunderstanding the Third International Mathematics and Science Study: what is at stake and why K-12 education studies matter"
- Ian Stewart (UK) "Mathematics, the media, and the public"

as well as three panels:

- "Controversial questions in K-12 education: a debate"
  Panelists: Ehud de Shalit (Israel) and Anthony Ralston (USA); moderator: Michèle Artigue (France)
- "What are PISA and TIMSS? What do they tell us?"
  Panelists: Jan de Lange (Netherlands) and William Schmidt (USA); moderator: Pengyee Lee (Singapore)
- "The role of mathematicians in K-12 mathematics education"
  Panelists: Shiu-Yuen Cheng (Hong Kong, China), Konrad Osterwalder (Switzerland) and Hung-Hsi Wu (USA); moderator: Father Ben Nebres (Philippines)

More information can be obtained from Manuel de León, President of the Local Organizing Committee of ICM 2006 (icm2006@unicongress.com), or by visiting the website

http://www.icm2006.org

Thailand International Conference on 21st Century Information Technology in Mathematics Education, September 2006, Thailand

The Chiang Mai Rajabhat University, in collaboration with Lahore University of Management Sciences, Pakistan, is organizing its first Thailand International Conference on 21st Century Information Technology in Mathematics Education in Chiang Mai, Thailand, on September 17-20, 2006. The purposes of this conference is to bring research mathematicians from Europe, USA, South East Asia and Central Europe to present their latest research and for useful discussion to uplift the standard of mathematical education and research and the use of Information Technology in classroom at higher level in the country. The conference will provide a useful opportunity to the participants to share knowledge of their latest researches in different fields of mathematics education and to develop future collaborations across disciplines and borders.

Information is available from the Conference Secretariat at icitm06@cmru.ac.th, or on the web page

http://www.cmru.ac.th/conference/index.php

International Symposium on Elementary Grades, November 2006, Lebanon

In cooperation with the Mathematics Education into the 21st Century Project, an International Symposium will be held at the American University of Beirut, Lebanon, on November 8-10, 2006. This symposium is organised by Marj Henningsen and Madeleine Long and the theme is "*Policy and Practice in Mathematics and Science Teaching and Learning in the Elementary Grades*". Further information is available from the Project coordinator, Alan Rogerson (arogerson@inetia.pl).

ICMI Study 17: "*Technology Revisited*", December 2006, Vietnam

The 17th ICMI Study on the theme *Digital Technologies and Mathematics Teaching and Learning: Rethinking the Terrain* will be concerned with the use of digital technologies in mathematics teaching and learning in countries across the world. In particular it will focus on:

- Cultural diversity and how this diversity impinges on the use of digital technologies in mathematics teaching and learning particularly in developing countries.
- A set of themes to serve as the organising framework: Mathematics and mathematical practices; Learning and assessing mathematics with and through digital technologies; Teachers and teaching; Design of learning environments and curricula; Implementation of curricula and classroom practice; Access, equity and socio-cultural issues; Connectivity and virtual networks for learning.

The Study Conference will be hosted by the Hanoi Institute of Technology in Hanoi, Vietnam, on December 3-8, 2006. As is the normal practice for ICMI studies, participation in the Study conference will be by invitation only, given on the basis of a submitted contribution.

Information is available from the Study Co-chairs Celia Hoyles (c.hoyles@ioe.ac.uk) and Jean-Baptiste Lagrange (jb.lagrange@reims.iufm.fr) or the web page

www.math.msu.edu/~nathsinc/ICMI

Second Africa ICMI Regional Congress, May 2007, Kenya

The Second Africa Regional Congress of ICMI will be held at the Jomo Kenyatta University of Agriculture and Technology, Juja, Kenya, on May 23-27, 2007. The theme of the congress is *Embracing Innovative Responses to Challenges in Mathematics Instruction*. This conference has officially been recognised by the Executive Committee of the Commission as an ICMI Regional Conference. The aims of the conference are: enhancing mathematics education collaboration and activities initiated in the 1st Africa Regional Congress; promoting regional and global contributions and interactions in mathematics; providing a forum for follow up on issues pertinent to mathematics education and highlighting new developments since the first congress; and developing a common stand and purpose on mathematics education activities and issues in and across countries in the region.

The theme of the congress will be addressed under four strands:

- Responding to challenges of content selections, structure, duration, delivery and pedagogy in pre- and in-service mathematics teacher education at all levels.
- Responding to challenges of content selections and pedagogy in mathematics teaching at primary, secondary and tertiary levels.
- Innovative responses to the effects on mathematics education of emerging and existing issues: curriculum issues such as assessment, diversity (ability, gender, socio-economic), and continuing education; and social issues such as HIV and AIDS, democratization, conflict and post conflict and political instability.
- Innovative responses to change in general educational policy such as Education For All (EFA), Free Primary Education (FPE), as well as curriculum policies including introduction of technology.

The Scientific Committee is co-chaired by Peter Mutunga (pmutunga@nbnet.co.ke) and Johana Sigey (jksigey2002@yahoo.com). Cecilia Mwathi (cecilia_mwathi@yahoo.com) is chair of the Local Organising Committee.

Further information on the Second ICMI Africa Regional congress can be found on the congress webpage

http://www.jkuat.ac.ke/ICMI

MACAS2, May 2007, Denmark

The Second International Symposium on Mathematics and its Connections to the Arts and Sciences is to be held in Odense, Denmark in May 29-31, 2007. The first symposium (MACAS1), which grew out of the collaborations of TSG21 participants at the conclusion of ICME-10, was held in Schwäbisch Gmünd and hosted by the initiative of Astrid Beckmann. Given the success in bringing together researchers interested in connections between mathematics, the arts and sciences, it was decided to make the Symposium a biennial event.

More information is available from Claus Michelsen (claus.michelsen@ifpr.sdu.dk), Bharath Sriraman (sriramanb@mso.umt.edu) or Astrid Beckmann (astrid.beckmann@ph-gmuend.de), or from the website

jttp://www.mathematik.ph-gmuend.de/macas/

ICMI-EARCOME 4, June 2007, Malaysia

The East Asia Regional Conferences on Mathematics Education (EARCOME) is a series of international conferences hosted in East Asian countries. The first three EARCOMEs were held in Chungbuk, Korea (1998), Singapore (2002) and Shanghai, China (2005). Universiti Sains Malaysia will hold the 4th EARCOME on June 18-22, 2007, in Penang, Malaysia, on the theme "*Meeting the Challenges of Developing a Quality Mathematics Education Culture*". EARCOME-4 has been recognised as an ICMI Regional conference.

The East Asian nations are made up of diverse cultural groups. However, these nations share similar aspects of culture such as education system and cultural beliefs about education. EARCOME-4, which embraces the cultures of both East Asia and South East Asia, is especially significant in celebrating differences and yet finding common ideas and issues for discussion and exchange. The participants from countries around the world are welcome to this conference whose objective is to provide a forum for mathematics educators, teachers and graduate students from the region and beyond to discuss issues, exchange ideas and to present their research findings pertaining to mathematics education.

More information from the Conference Secretariat (earcome4@usm.my) or by visiting the web page

http://www.usm.my/education/earcome4

PME 31, July 2007, Korea

The 31st Conference of the International Group for the Psychology of Mathematics Education will be held on July 8-13, 2007, in Seoul, Korea. The First Announcement will be available in September 2006. More information from the Conference chair, Prof. Jeong Ho Woo (wjh@plaza.snu.ac.kr).

XII CIAEM, July 2007, México

The Interamerican Committee on Mathematics Education (*Comité Interamericano de Educación Matemática* — CIAEM) and the Mexican National Association of Teachers of Mathematics (*Asociación Nacional de Profesores de Matemáticas* — ANPM)) will host the 12th Interamerican Conference on Mathematics Education (*XII Conferencia Interamericana de Educación Matemática*) in Queretaro, Mexico, from July 15 to 18, 2007. More information can be obtained from the President of CIAEM, Maria Salett Biembengut (salett@furb.br), or by visiting the CIAEM website at

http://www.furb.br/ciaem/

The Coordinator of the Local Organising Committee is Roberto Ramírez (toliman1305@ hotmail.com).

ESU-5, July 2007, Czech Republic

Continuing the tradition of organizing the European Summer University (ESU) on the History and Epistemology in Mathematics Education every three years, the 5th Summer University (ESU-5) will take place at Charles University in Prague on July 19-24, 2007.

The ESU mainly aims

- to provide a forum for presenting research in mathematics education and innovative teaching methods based on a historical, epistemological and cultural approach to mathematics and their teaching;
- to give the opportunity to mathematics teachers, educators and researchers to share their teaching ideas and classroom experience;
- in this way, to motivate further collaboration in this perspective among members of the mathematics education community in Europe and beyond.

The ESU's focus is not only to stress the use of history and epistemology in the teaching and learning of mathematics, in the sense of a technical tool for instruction, but also to reveal that mathematics should be conceived as a living science, a science with a long history, a vivid present and an as yet unforeseen future. This conception of mathematics should not only be the core of the teaching of mathematics, but it should also be the image of mathematics spread to the outside world.

The program of ESU-5 will be built around the following six themes: History and Epistemology as tools for an interdisciplinary approach in the teaching and learning of Mathematics and the Sciences; Introducing a historical dimension in the teaching and learning of Mathematics; History and Epistemology in Mathematics teachers' education; Cultures and Mathematics; History of Mathematics Education in Europe; and Mathematics in Central Europe.

Further information can be obtained from Constantinos Tzanakis (tzanakis@edc.uoc.gr), chair of HPM (ICMI Affiliated Study Group) or by visiting the conference website

http://web.pedf.cuni.cz/kmdm/esu5/

ICTMA-13, July 2007, Nepal

The 13th International Conference on the Teaching of Mathematical Modelling and Applications (ICTMA-13) is to be held at Kathmandu University, Dhulikhel, Nepal, on 23-27 July 2007. This historic city is situated only 30 km east of the capital city Kathmandu on the Arniko highway leading to Tibet, China. The theme for ICTMA-13 is *Applicable Mathematics — Computer — Mathematical Modelling*. The conference covers the following sub-themes: Mathematics in Non-Technical Disciplines; Mathematical Curriculum Development; Mathematical Education for Trainers; Mathematics Education in Schools; Mathematics in Decision Making; Computer in Mathematics Education; Computer in Modelling; Modelling of Environmental Problems; and Modelling of Social Behaviours.

The International Community of Teachers of Mathematical Modelling and Applications (ICTMA), through its membership, research and other activities, is recognized as *The International Study Group for Mathematical Modelling and Applications* (ICTMA) by its affiliation to the International Commission on Mathematical Instruction (ICMI).

More information from the Secretariat of ICTMA13 (ictma13@ku.edu.np) or by visiting the webpage
http://www.ku.edu.np/ictma13/

SRTL-5, August 2007, UK

The Fifth International Research Forum on Statistical Reasoning, Thinking and Literacy is to be held in England on August 11-17, 2007, hosted by the Institute of Education, University of Warwick. This gathering offers an opportunity for a small, interdisciplinary group of researchers from around the world to meet for a few days to share their work, discuss important issues, and initiate collaborative projects.

The topic of the fifth Forum will be *Reasoning about Statistical Inference: Innovative Ways of Connecting Chance and Data*. As new courses and curricula are developed, a greater role for informal types of statistical inference is anticipated, introduced early, revisited often, and developed through use of simulation and technological tools. Research papers are encouraged that address reasoning about statistical inference at all levels of education including the professional development of elementary and secondary teachers.

There are three possible roles for participants in the Forum. The first role is to present current research on reasoning about inference, the second is to discuss and react to research presentations, while the third is to present a poster, which is ideal for doctoral students who are not yet ready to present full research but want to participate. As with the previous Research Forums, the participation of young promising scholars is encouraged.

More information from Dave Pratt (dave.pratt@warwick.ac.uk) or by visiting the website
http://srtl.stat.auckland.ac.nz/

IASE Conference on Assessing Student's Learning in Statistics, August 2007, Portugal

Papers are invited on all aspects of assessing student learning in statistics. We expect, for example, to have papers on writing effective exam questions, on exam implementation strategies, and on alternative assessment methods such as projects, lab assignments, and writing assignments. We also encourage submissions on how to use assessment to improve student learning, and on developing and administering assessments items to conduct research into student learning.

This conference is to be held on August 19-21, 2007, in Guimarães, Portugal, as a satellite conference to ISI 56, the 56th Congress of the International Statistical Institute (Lisbon, Portugal, from 22-29 August). Guimarães is approximately 50 km from Porto and about 350 km from Lisbon.

More information from the programme co-chairs: Brian Phillips (bphillips@swin.edu.au) and Beth Chance (bchance@calpoly.edu), or from the conference web site

http://www.stat.auckland.ac.nz/iasesat07

9th International Conference of the Mathematics Education into the 21st Century Project, September 2007, USA

The Mathematics Education into the 21st Century Project, an international educational initiative coordinated by Alan Rogerson (UK/Australia/Poland) and Fayez Mina (Egypt), has recently completed its eighth successful international conference in Malaysia, following conferences in Egypt, Jordan, Poland, Australia, Sicily, Czech Republic and Poland. The project was founded in 1986 and is dedicated to the planning, writing and disseminating of innovative ideas and materials in Mathematics and Statistics Education. These conferences are renowned for their friendly and productive working atmosphere. They are attended by innovative teachers and mathematics educators from all over the world — 25 countries were represented at the last conference for example.

The next conference is planned for September 7-13, 2007, in Charlotte, NC, USA. The chairman of the Local Organising Committee is David K. Pugalee, of the University of North Carolina Charlotte. The title of the conference is "*Mathematics Education in a Global Community*". Papers are invited on all innovative aspects of mathematics education. Further information is available from the Project coordinator, Alan Rogerson (arogerson@inetia.pl) or on the Project website

http://math.unipa.it/~grim/21project.htm

Joint ICMI /IASE Study Conference (ICMI Study 18), July 2008, México

This Study is organised in collaboration by ICMI and IASE (International Association for Statistics Education. The Study topic is *Statistics Education in School Mathematics: Challenges for Teaching and Teacher Education*.

This Study aims is to reflect on the teaching of statistics at school level and on the current situation with respect to the training of mathematics teachers to face the challenge of teaching statistics. The Study is intended to develop recommendations and produce materials that can be used in the training of both prospective teachers at University level and in-service teachers who never had adequate preparation for teaching school statistics.

The Discussion Document will be published by October 2006. An Informative Open Session and the first meeting of the International Programme Committee are to be held in Salvador (Bahia), Brazil, on July 2-7, 2006, in connection with ICOTS-7 (http://www.maths.otago.ac.nz/icots7).

The Study Conference will be merged with the IASE Round Table Conference in 2008, and will be hosted by the Instituto Tecnológico de Estudios Superiores de Monterrey, Monterrey, México (http://www.mty.itesm.mx), in July 2008.

More information from the Study IPC Chair Carmen Batanero (batanero@ugr.es) or from the Study Web site

http://www.ugr.es/~icmi/iase_study/

ICME-11, July 2008, México

The Eleventh International Congress on Mathematical Education (ICME-11) will be held in Monterrey, México, from July 6 to 13, 2008. The International Programme Committee of ICME-11, appointed by ICMI, is chaired by Prof. Marcela Santillán, Rectora at the Universidad Pedagógica Nacional, Mexico City (m.santillan@upn.mx). The members of the IPC are listed in the June 2005, No. 56, issue of the *ICMI Bulletin.* The Local Organising Committee of ICME-11 is chaired by Prof. Carlos Signoret of the Universidad Autónoma Metropolitana, Mexico City (casi@xanum.uam.mx).

Information about various aspects of the organisation of ICME-10 will be accessible on the congress website, to be launched soon.

PME 32 Conference, July 2008, México

The 32nd Conference of the International Group for the Psychology of Mathematics Education will be held on July 17-21, 2008, in Morelia, México, just after ICME-11. The First Announcement will be available in September 2007. Information is available from the conference chair, Olimpia Figueras (figuerao@cinvestav.mx).

ICMI REPRESENTATIVES

(Readers are asked to notify the Secretary-General of any error in or change to this list. ICMI Representatives whose e-mail addresses do not appear below should provide this information to the Secretary-General at their earliest convenience.)

ARGENTINA
Professor **Norma Cristina Pietrocola**
Olimpiada Matematica Argentina
Santa Fe 3312 - 9o Piso
(1425) Buenos Aires ARGENTINA
norma@oma.org.ar

ARMENIA
Not known

AUSTRALIA
Dr **Michael Bulmer**
Department of Mathematics
University of Queensland
Queensland 4072 AUSTRALIA
mrb@maths.uq.edu.au

AUSTRIA
Professor, Dr. **Wolfgang Schlöglmann**
Institut für Didaktik der Mathematik
Universität Linz
A-4040 Linz AUSTRIA
wolfgang.schloeglmann@jku.at

BANGLADESH
Professor **S.M. Sharfuddin**
58 Lake Circus
Kalabagan, Dhaka-1205 BANGLADESH

BELGIUM
Professor **Dirk Janssens**
Kath. Universiteit Leuven
Department of Mathematics
Celestijnenlaan 200B
B-3001 Leuven BELGIUM
dirk.janssens@wis.kuleuven.ac.be

BOSNIA AND HERZEGOVINA
Not known

BOTSWANA
Mr. **B.J. Radipotsane**
Ministry of Education
Private Bag 005, Gaborone BOTSWANA

BRAZIL

Dr. **Marcio Soares**
Dep. Matematica – ICEx
Federal University of Minas Gerais
Av. Antonio Carlos 6627
31270-901 Belo Horizonte BRAZIL
msoares@mat.ufmg.br

BRUNEI DARUSSALAM *Not known*

BULGARIA

Academician **Blagovest Sendov**
Bulgarian Academy of Sciences
1,7 Noemvry
Sofia 1040 BULGARIA
bsendov@argo.bas.bg

CAMEROON

Professor **Henri Hogbe-Nlend**
Société Mathématique du Cameroun
BP 12041 Yaoundé CAMEROUN
hhogbenlend@yahoo.fr, h2n@camnet.cm

CANADA

Professor **Eric R. Muller**
Department of Mathematics
Brock University
St. Catharines, Ontario L2S 3A1 CANADA
emuller@brocku.ca

CHILE

Professor **Rubi Rodriquez**
Facultad de Matemáticas
Pontificia Universidad Catolica de Chile
Casilla 306, Correo 22
Santiago CHILE
rubi@mat.puc.cl

CHINA

Chinese Mathematical Society
Professor **Li Daqian**
Institute of Mathematics
Fudan University
Shanghai 200433 CHINA
dqli@fudan.edu.cn

Mathematical Society located in Taipei, China
Professor **Fou-Lai Lin**
Institute of Mathematics
National Taiwan Normal University

Taipei TAIWAN
linfl@math.ntnu.edu.tw

COSTA RICA — Professor **B. Montero**
Associación Matemática Costarricense
Escuela de Matemática
Universidad de Costa Rica
San José COSTA RICA

CROATIA — Professor **Mirko Polonijo**
Matematicki odjel PMF
Bijenicka cesta 30
41000 Zagreb CROATIA

CUBA — Dr. **Virginia Alvarez Suarez**
Dpto. de Teoría de Funciones, Facultad de Matemática y Computación
Universidad de la Habana
San Lazaro y L, Vedado
Habana 4 CUBA
virginia@matcom.uh.cu

CZECH REPUBLIC — Professor **Jan Chvalina**
Mathematics Department, Pedagogical Faculty
Masaryk University
Porící 31, 603 00 Brno CZECH REPUBLIC
chvalina@jumbo.ped.muni.cz

DENMARK — Professor **Hans Christian Hansen**
Copenhagen College of Teacher Education
Bybjergvej 25
2740 Skovlunde DENMARK
Hans.Christian.Hansen@skolekom.dk

EGYPT — Professor **Attia A. Ashour**
Faculty of Science
Cairo University
Giza EGYPT
ashour@frcu.eun.eg

ESTONIA — *Not known*

FINLAND — Professor **Pekka Koskela**
Department of Mathematics and Statistics
P.O. Box 35 (MaD)

	University of Jyväskylä FIN-40014 Jyväskylä FINLAND pkoskela@maths.jyu.fi
FRANCE	Professor **Alain Kuzniak** IUFM Orléans-Tours La Guignière — Bel air — B.P. 16 F-37230 Fondettes FRANCE alain.kuzniak@orleans-tours.iufm.fr
GEORGIA	Professor **Tengiz Buchukuri** A. Razmadze Mathematical Institute Georgian Academy of Sciences 1, M. Aleksidze Str. Tbilisi 0193 GEORGIA buchuk@rmi.acnet.ge
GERMANY	Professor, Dr. **Günter Törner** Fachbereich Mathematik Gerhard-Mercator-Universität Gesamthochschule Duisburg, Lotharstr. 65 D-47048 Duisburg GERMANY toerner@math.uni-duisburg.de
GHANA	Professor **D.A. Akyeampong** Department of Mathematics University of Ghana P.O.Box 62, Legon, Accra GHANA
GREECE	*Not known*
HONG KONG	Mr. **Pak-Hong Cheung** Munsang College (HK Island) 26 Tai On Street Sai Wan Ho HONG KONG phcheung@imsc.edu.hk
HUNGARY	Professor, Dr. **Janos Szendrei** Juhász Gyula Teacher Training College Boldogasszony sgt. 6 H-6701 Szeged HUNGARY
ICELAND	Professor **Gudmundur Birgisson** Iceland University of Education

v/ Stakkahlid
IS-105 Reykjavik ICELAND
gbirgiss@khi.is

INDIA
Professor **R. C. Cowsik**
Department of Mathematics
University of Bombay, Vidyanagari
Bombay 400098 INDIA
cowsik@math.mu.ac.in

INDONESIA
Dr. **Sutarto Hadi**
Department of Mathematics Education
Faculty of Teacher Training and Education
Lambung Mangkurat University
d/a Kampus FKIP Unlam
Jl. Brigjen H. Hasan Basry
Banjarmasin – 70123 INDONESIA
sutarto_hadi@yahoo.com

IRAN
Professor **Ali Rejali**
School of Mathematics
Isfahan University of Technology
Isfahan 84156 IRAN
a_rejali@cc.iut.ac.ir

IRELAND
Professor **S. Kenneth Houston**
School of Computing and Mathematics
University of Ulster
Jordanstown, Newtownabbey
Co. Antrim, Northern Ireland, BT37 0QB UK
sk.houston@ulster.ac.uk

ISRAEL
Professor **Theodore Eisenberg**
Department of Mathematics
Ben-Gurion University
P.O.Box 653, Beer Sheva 84105 ISRAEL
eisen@black.bgu.ac.il

ITALY
Professor **Ferdinando Arzarello**
Università degli Studi di Torino
Dipartimento di Matematica
Via Carlo Alberto 10
10123 Torino ITALY
arzarello@dm.unito.it

IVORY COAST	Mr. **Soma Traore** Institut de Recherches Mathématiques (IRMA) 08 B.P. 2030 Abidjan 08 IVORY COAST traoresoma@yahoo.fr
JAPAN	Professor **Yukihiko Namikawa** Graduate School of Mathematics Nagoya University Nagoya, 464-8602 JAPAN namikawa@math.nagoya-u.ac.jp
KAZAKHSTAN	*Not known*
REPUBLIC OF KOREA	Professor **Sung Je Cho** Department of Mathematics Education College of Education Seoul National University Seoul, 151-742 REPUBLIC OF KOREA sungjcho@snu.ac.kr
KUWAIT	*Not known*
LATVIA	Dr. **Ilze France** IZM ISEC Valnu Street 2 LV-1050 Riga LATVIA ilze.france@isec.gov.lv
LITHUANIA	Professor **Eugenijus Stankus** Department of Didactics of Mathematics Faculty of Mathematics and Informatics Vilnius University Naugarduko 24, LT-03225 Vilnius LITHUANIA Eugenijus.Stankus@maf.vu.lt
LUXEMBOURG	Professor **Jean-Claude Delagardelle** Centre Universitaire de Luxembourg 162 A, avenue de la Faïencerie L-1511 Luxembourg LUXEMBOURG jean-claude.delagardelle@education.lu
MALAWI	Inspector for Mathematics c/o Secretary for Education & Culture

Ministry of Education & Culture
Private Bag 328, Capital City, Lilongwe 3 MALAWI

MALAYSIA — Professor **Abu Osman Md. Tap**
School of Mathematical Sciences , Faculty of Science and Technology
Universiti Kebangsaan Malaysia
43600 UKM Bangi, Selangor DE MALAYSIA.
abu@pkrisc.cc.ukm.my

MEXICO — Dr. **Emilio Lluis-Riera**
Instituto de Matemáticas
Universidad Nacional Autónoma de México
Circuito Exterior, Ciudad Universitaria
Coyoacan, D.F. 04510 MEXICO
emilio@matem.unam.mx

MOZAMBIQUE — Dr. **Abdulcarimo Ismael**
Head of Department of Mathematics
Higher Pedagogical Institute (I.S.P.)
C.P. 3276, Maputo MOZAMBIQUE
abdulcarimoismael@hotmail.com

NETHERLANDS — Dr. **Wim Kleijne**
Zwette 130
8446 ML Heerenveen NETHERLANDS
wim.kleijne@xs4all.nl

NEW ZEALAND — Dr. **Glenda Anthony**
Technology, Science and Mathematics Education
College of Education
Massey University
PB 11222, Palmerston North NEW ZEALAND
G.J.Anthony@massey.ac.nz

NIGERIA — Dr. **Sam O. Ale**
Abubakar Tafawa Balewa College
School of Science and Science Education
Ahmadu Ballo University
Bauchi Campus, Bauchi NIGERIA
samalenmc@yahoo.com

NORWAY — Dr. **Kari Hag**
Department of Mathematical Sciences
NTNU - Norwegian University of Science and Technology

	NO-7491 Trondheim NORWAY Kari.Hag@math.ntnu.no
PAKISTAN	*Not known*
PERU	*Not known*
PHILIPPINES	Professor **Bienvenido F. Nebres** S.J. Ateneo de Manila University P.O.Box 154, Manila PHILIPPINES bnebres@ateneo.edu
POLAND	Professor **Stefan Turnau** Institute of Mathematics Pedagogical University (WSP) P.B. 115, PL-35-959 Rzeszow POLAND sturnau@atena.univ.rzeszow.pl
PORTUGAL	Professor **Eduardo Marques de Sá** Centre for Mathematics University of Coimbra Apartado 3008 3001-454 Coimbra PORTUGAL emsa@mat.uc.pt
ROMANIA	Professor **Vasile Berinde** Department of Mathematics and Computer Science, Faculty of Sciences North University of Baia Mare Victoriei Nr. 76 430122 Baia Mare ROMANIA vberinde@ubm.ro, vasile_berinde@yahoo.com
RUSSIA	Professor **Yuri Nesterenko** Moscow State University Faculty of Mechanics and Mathematics 119899, Moscow RUSSIA nester@orc.ru
SAUDI ARABIA	*Not known*
SENEGAL	*Not known*
SERBIA AND MONTENEGRO	Dr. **Milosav Marjanovic** Union of Mathematicians Societies of Serbia and Montenegro

Kneza Mihaila 35/IV
11000 Belgrade SERBIA AND MONTENEGRO
nastava@matf.bg.ac.yu

SINGAPORE — Dr. **Peter Pang**
Department of Mathematics
National University of Singapore
2 Science Drive 2 SINGAPORE 117543
smsuser@math.nus.edu.sg

SLOVAKIA — Professor **Vladislav Rosa**
Faculty of Mathematics and Physics
Comenius University
Mlynská dolina
842 15 Bratislava SLOVAKIA

SLOVENIA — *Not known*

SOUTH AFRICA — Professor **Mamokgethi Setati**
School of Education
University of the Witwatersrand
Private Bag 3, P O Wits, 2050
Johannesburg SOUTH AFRICA
setatim@educ.wits.ac.za

SPAIN — Professor **Tomás Recio**
Departamento de Matemáticas, Estadística y Computación
Facultad de Ciencias
Universidad de Cantabria
39071 Santander SPAIN
tomas.recio@unican.es

SWAZILAND — Mr. **E.D. Bicknell**
William Pitcher College
P.O.Box 1473, Manzini SWAZILAND

SWEDEN — Dr. **Clas Löfwall**
Deparment of Mathematics
Stockholm University
SE-106 91 Stockholm SWEDEN
clas@math.su.se

SWITZERLAND — Professor **Urs Kirchgraber**
Mathematik ETH-Zentrum

	CH-8092 Zürich SWITZERLAND kirchgra@math.ethz.ch
THAILAND	Professor **Siriporn Thipkong** Faculty of Education Kasetsart University Bangkok 10900 THAILAND fedusit@ku.ac.th
TUNISIA	*Not known*
TURKEY	*Not known*
UKRAINE	*Not known*
UNITED KINGDOM	Dr **Sue Sanders** Department of Education University of Wales Swansea Hendrefoelan Swansea SA2 7NB UK s.e.sanders@swansea.ac.uk
UNITED STATES OF AMERICA	Dr **Daniel L. Goroff** c/o Dr. Tamae Maeda Wong National Academy of Sciences 500 Fifth Street, N.W. Washington, DC 20001 USA USNCMI@nas.edu
URUGUAY	*Not known*
VENEZUELA	Dr **Sabrina Garbin** Departamento de Matemáticas Puras y Aplicadas Universidad Simón Bolívar, Sartenejas. Caracas 1080 VENEZUELA sgarbin@usb.ve
VIET NAM	Professor **Nguyen Dinh Tri** Hanoi National University of Technology Dai Co Viet Road Hanoi VIET NAM ndtri@ifi.edu.vn
ZAMBIA	*Not known*

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ICMI SECRETARY-GENERAL:

Bernard R. Hodgson
Département de mathématiques et de statistique
Université Laval
Québec G1K 7P4 CANADA

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