Part I
Opening Ceremonies

Opening Address: President of IMU

Ingrid Daubechies

It is a great pleasure for me to have the opportunity to address you, during this opening ceremony for the 12th International Congress on Mathematical Education, in my capacity as President of the International Mathematical Union, or IMU.

Officially, that is, with respect to the International Council for Science (or ICSU), which itself reports to UNESCO, IMU is the umbrella organization concerned with matters of global interest to mathematicians worldwide. The International Commission on Mathematical Instruction (or ICMI for brevity), which organizes the quadrennial ICME meetings, is the most important sub-organization of the IMU. In fact, and as ICMI President Bill Barton likes to remind me good-humoredly, ICMI is older than the IMU itself, since it was created in 1908—IMU was created only in 1920, and even then it was an earlier incarnation that stopped functioning in the 1930s; in its present version, it was reborn in 1951.

An extremely important charge for the IMU is to organize the prestigious quadrennial International Congresses of Mathematicians, or ICMs, the first one of which dates back to 1893; it is probably no exaggeration to state that the IMU was first started to ensure a regular and orderly organization of the ICMs. This is similar to the role ICMI plays with respect to the ICME congresses, which are all held under ICMI's auspices and principles. Once the ICME series hit its quadrennial rhythm, it became customary to hold the ICMs and ICMEs in interleaved even-numbered years, keeping stride nicely with the World Cup in Soccer/Football and the Olympic Games, which one could view as a "warm-up" for our more serious pursuits. The next ICM will thus take place in 2014, coincidentally in this very same city, in this very same Conference Center.

Over the years, IMU has come to stand for much more than just the umbrella organization ensuring continuity for the ICMs. In the past few decades, IMU has become more concerned with assisting developing countries build up their own

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strong mathematics communities. IMU is also solidly and seriously invested in helping develop and sustain excellent mathematics education everywhere, and at all levels—although the work of my colleagues on the Executive Committee of the IMU, as well as my own, is anchored in mathematics research, we all realize fully the importance of teaching mathematical insights, understanding and skills in the best possible way, and we are committed to help ICMI as much as we can in pursuing this goal. These are not empty words—we are acting on our beliefs! The following are just two examples. In setting up the new stable central Secretariat for the IMU, it was viewed as an essential and core part of its charge that it provides a stable administrative support and archival role for ICMI as well. On a different note, IMU is also actively helping ICMI in finding and providing funding for the very important CANP workshops, which build networking for mathematics educators in less developed regions in the world.

I am personally thrilled by this tighter connection between mathematical researchers and experts on, or researchers in, mathematical education. Whether we decide to contribute to mathematical research, or whether we decide to invest our creative energy in mathematics education—you and I, ICME or ICM participants, we are ALL mathematicians, united in our love for mathematics. It was a proud moment in my life when my son announced his decision to become a high school teacher in mathematics; he now teaches in one of the inner city schools in Chicago, and works hard to ignite and keep alive an interest in mathematics among his students, bringing to this the energy and drive that he could easily have taken to graduate school. I respect and value the commitment and engagement of teachers like him, and I encourage all professional research mathematicians to do likewise.

Dear ICME-12 Participants, fellow mathematicians, focused on bringing the best possible mathematics education to future generations, I salute you!

And I wish you a wonderful Congress.

Opening Address: President of ICMI

Bill Barton

Honourable Mr Lee, Minister of Education

Professor Sung Je Cho, Convenor of this wonderful conference

ICMI Colleagues and friends

Our moment has arrived. Isn't this wonderful!

I am delighted to be here, to open the 12th International Congress of Mathematics Education—to be honest, it is a moment I have been looking forward to for more than 4 years. Our community is very fortunate to have attracted a conference bid from Korea, and our Korean friends are already proving to us that we made a very good decision to accept their bid.

These few minutes are my opportunity to address the wider ICMI community about the things that I believe are important about mathematics education on the international stage. I cannot detail all the many, many activities of ICMI as an organisation: ICMI Studies, Regional conferences, Affiliated organisations, and on and on. I urge everyone in this room to find out who their ICMI country representative is, and ensure that they become part of their national network. You should also subscribe to the ICMI Newsletter (on line) or become a Facebook Friend. We survive as an organisation through your participation.

I wish to mention three topics: our major development project; the Klein Project; and finally some comments on how our community communicates.

Since the last ICME in Mexico, ICMI as an organisation has changed dramatically. We have extended our development activities significantly. It is no longer true that we are primarily an organisation of professionals in mathematics education. Now we spend at least half our efforts and resources on worldwide development activities. A major part of this effort is the Capacity and Networking Project, that we call CANP.

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The aim of CANP is to support developing regions to form self-sustaining networks of mathematics educators, mathematicians, government officials, and, of course, teachers. What ICMI does is to organise a two-week Workshop in a different region every year. Last year the first was held in Mali, this year the second will be held in Costa Rica, and next year it will be Cambodia. A region of four or five countries is selected, and a Scientific Committee is formed of four people from the international community and four from the region. The Workshop is usually about fifty people representing all the groups in the network. The focus of the Workshop is secondary teacher education, but the aim is really to get key people in the region working together. Funds for each CANP programme are raised separately, we have had significant support from IMU, UNESCO, CIMPA and other organisations.

My second topic is the Klein Project. I invite everyone to turn ON their smartphones or open their computers—please go to the Klein Project Blog <http://blog.kleinproject.org> … or at least write this down, and log in at your first opportunity. The Klein Project is a worldwide project to produce writing on contemporary mathematics for secondary school teachers. Note: it is not designed for use in classrooms, but for the pleasure and satisfaction of teachers. In the Klein Blog you will find Klein Vignettes—these are short (4–6 pages) on a contemporary topic, written for secondary school mathematics teachers.

Over the next months you will see the Klein Blog grow—both with new Vignettes, but also as we translate the Vignettes into any and every language. This is a major task for our community, and I seek your help to offer to translate the Vignettes into your languages.

Eventually there will also be a Klein Project book—a small volume aimed at secondary teachers, that they will be able to dip into in the spare moments of their busy teaching lives. A book that will sustain and inspire teachers mathematically.

Please will you have a look, feed back to the project with your reactions, offer to help write more materials, and, most importantly, spread the Blog address amongst your secondary teacher friends and networks—or anyone whom you think would be interested.

I mention the Klein Project not because it is ICMI's only project—it is not, we have several others—but because it illustrates for me an very important point: that ICMI works more closely than ever with IMU, the world body of mathematicians. The Klein Project is a joint project with IMU, and every piece of writing is the result of collaborations between mathematics teachers, educators, and mathematicians.

And lest you think that ICMI is focused only on secondary teachers and mathematicians, let me quickly say: "Look out for the next ICMI Study announcement—it will be on Primary Mathematics". Watch for the announcement in December.

Finally, allow me to note that ICMI is changing in another respect—it is changing in the way the world is changing. New technologies, new modes of communication, new groupings, new social imperatives, new problems to be solved and questions to be answered. ICMI must and does change, and in particular we

change in the way we communicate. We have a Facebook page, we have a bank of digitised publications, we have an ever increasing website. In what new ways will we meet and communicate in four years time? We need the new members of our community to lead us in this matter—and I call on you all to embrace the movement forward into new worlds.

But face-to-face communication will, in my opinion, always be highly valued. Being able to Skype my grandchildren or my research colleagues on the other side of the world only makes me want to actually see them and spend time with them so much more.

And this is why we are here. To greet and see and talk to each other. To make new friends and affirm old ones. And we do this with great pleasure at the same time as we work hard to improve the learning of mathematics in classrooms at all levels in every country.

Thus I regard it as one of the greatest honours of my career to declare the 12th International Congress on Mathematics Education Officially open.

Welcome Address: Chair of IPC

Sung Je Cho

I would like to express my utmost gratitude to His Excellency Lee Myung-bak, the President of the Republic of Korea for preparing a welcoming message for us despite his busy schedule.

Your Excellency Lee Ju Ho, Minister of Education, Science, and Technology, Professor Ingrid Daubechies, the President of IMU, Professor Bill Barton, the President of ICMI, Ladies and Gentlemen, distinguished guests and participants from all around the world, I would like to extend my warmest welcome to you all.

We, the Korean Mathematics Society and Korean Mathematics Education Society, are very proud to host the 12th International Congress on Mathematical Education. Our International Programme Committee has worked tirelessly through two face-to-face meetings and numerous internet discussions. It is needless to say that this Congress would not be possible without the dedicated and coordinated efforts of members of the various committees, presenters and participants. We thank all of you for making this a reality.

Mathematics has been at the heart of human culture, philosophy, technology and advancement since the dawn of civilization. We cannot think of our modern society apart from mathematics because mathematics influences every facet of our daily lives. Due to the far reaching effects of mathematics in our world, mathematics education may be one of the most efficient ways to influence betterment of mankind. For the week starting today, we are gathered here to nurture and cultivate the mathematics educational environment for our future generation so that they may become significant part of the solution and advancement of our society.

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It is our sincere hope that this Congress would inspire wider and tighter mathematics education research network as well as inviting and stimulating mathematics classrooms all over the world.

Thank you,

Congratulatory Remarks: Minister of Education and Science, and Technology

Ju Ho Lee

First of all, congratulations on the opening of the 12th International Congress on Mathematical Education.

I am glad that this important math event is being held in Korea this year.

Also, it is a great pleasure to welcome math education researchers and math teachers from more than 100 countries.

With the aim of transforming Korea into a nation of great science and technology capacity, and a nation of outstanding human talent, the Ministry of Education, Science and Technology of Korea is focusing on three important points in designing and implementing its policies.

The three points are "creativity", "convergence", and "human talent". Creativity enables us to think outside the box, convergence allows us to go beyond the traditional boundaries between disciplines, and finally human talent builds the very foundation that make all these possible.

Without a doubt, these are the most essential elements in today's knowledge-based society.

Math is the very subject that can foster much needed creativity and convergence, and is becoming a core factor in raising national competitiveness.

Math is behind everything.

The ICT revolution would have been impossible without the binary system.

The technology behind the CT scans can be traced back to simultaneous equations.

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ICMI Awards Report

Carolyn Kieran

A wonderful part of the opening session of the ICME congresses is the ICMI Awards ceremony. The 2012 ceremony, which was presided over by Prof. Carolyn Kieran, the chair of the ICMI Awards Committee, was no exception. Congress participants shared in congratulating the recipients of the 2009 and 2011 competitions for the Klein and Freudenthal awards. The Korean Minister of Education, Science, and Technology, the Honorable Mr. Ju-Ho Lee, did us the honor of presenting each award.

In 2000, the International Commission on Mathematical Instruction decided to create two prizes given in recognition of outstanding achievement in mathematics education research:

- the Felix Klein Award, which honours lifetime achievement in our field, and
- the Hans Freudenthal Award, which honours a major cumulative programme of research.

Each award consists of a medal and a certificate, accompanied by a citation. The two awards are given in odd-numbered years. A six-person Awards Committee is responsible for selecting the awardees and for producing the citations explaining the merits of the awardees. The members, of whom only the Chair is known, are appointed by the President of ICMI and serve on the Committee for 8 years.

Scientific and scholarly quality is of course the fundamental characteristic involved in reviewing the candidates' work and merits. The first Committee, which was appointed in 2002, agreed on four aspects of quality, four criteria of evaluation: impact, sustainability, depth, and novelty. These criteria have been maintained throughout the Committee's work. Nevertheless, the field is influenced by social and cultural conditions, traditions, values, norms, and priorities. So, there are, inevitably, delicate balances to be struck between different dimensions, different traditions, different cultural and ethnic regions, and—indeed—different schools of

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thought. Past Klein awardees have been Guy Brousseau (2003), Ubiritan D'Ambrosio (2005), and Jeremy Kilpatrick (2007). Past Freudenthal awardees have been Celia Hoyles (2003), Paul Cobb (2005), and Anna Sfard (2007).

At the 2012 ICMI Awards ceremony, the following four individuals were honored for their contributions to the field.

- *The Felix Klein Medal for 2009*: awarded to IAS Distinguished Professor and Professor Emerita Gilah C. Leder, La Trobe University, Bundoora, Victoria, Australia.
- *The Hans Freudenthal Medal for 2009*: awarded to Professor Yves Chevallard, IUFM d'Aix-Marseille, France.
- *The Felix Klein Medal for 2011*: awarded to the Elizabeth and Edward Connor Professor of Education and Affiliated Professor of Mathematics, Alan H. Schoenfeld, University of California at Berkeley, USA.
- *The Hans Freudenthal Medal for 2011*: awarded to Professor Luis Radford, Université Laurentienne, Sudbury, Canada.

Gilah Leder's citation, which was read by ICMI President Bill Barton, acknowledged her more than thirty years of sustained, consistent, and outstanding lifetime achievement in mathematics education research and development. Her particular emphasis on gender success and equity in mathematics education, but also more broadly her work on assessment, student affect, attitudes, beliefs, and self-concepts in relation to mathematics education from school to university, as well as her research methodology, and teacher education, have contributed to shaping these areas and have made a seminal impact on all subsequent research.

Yves Chevallard's citation, which was read by ICMI Vice-President Mina Teicher, recognized his foundational development of an original, fruitful, and influential research programme in mathematics education. The early years of the programme focused on the notion of didactical transposition of mathematical knowledge from outside school to inside the mathematics classroom, a transposition that also transforms the very nature of mathematical knowledge. The theoretical frame was further developed and gave rise to the anthropological theory of didactics (ATD), which offers a tool for modelling and analysing a diversity of human activities in relation to mathematics.

Alan Schoenfeld's citation, which was read by ICMI Past-President Michèle Artigue, recognized his more than thirty years of scholarly work that has shaped research and theory development in mathematical learning and teaching. His fundamental theoretical and applied work that connects research and practice in assessment, mathematical curriculum, diversity in mathematics education, research methodology, and teacher education has made a seminal impact on subsequent research. Another significant component of his achievements has been the mentoring he has provided to graduate students and scholars, nurturing a generation of new scholars.

Luis Radford's citation, which was read by ICMI Vice-President Angel Ruiz, acknowledged the outstanding contribution of the theoretically well-conceived and highly coherent research programme that he initiated and brought to fruition over

the past two decades. His development of a semiotic-cultural theory of learning, rooted in his interest in the history of mathematics, has drawn on epistemology, semiotics, anthropology, psychology, and philosophy, and has been anchored in detailed observations of students' algebraic activity in class. His research, which has been documented in a vast number of scientific articles and in invited keynote presentations, has had a significant impact on the community.

The image of the four awardees standing on the stage together, receiving their medals and accompanying certificates from the Minister of Education—as well as the beautiful bouquets of flowers presented by young Koreans in traditional dress—is one that will stay with us for quite some time.