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New Zealand Institute of Mathematics & its Applications



## Following in Klein's footsteps

**In 1984, when Bill Barton went alone as a naïve secondary teacher to the four-yearly International Congress on Mathematical Education (ICME) in Adelaide, he never dreamed that he would end up as president of its organising body, the International Commission on Mathematical Instruction (ICMI). He spoke with Jenny Rankine**

"I had a lot of fun there and it put me onto mathematics education as a profession". Barton, bottom right, is now Professor of Mathematics Education at the University of Auckland and currently Associate Dean International for the Faculty of Science. His ICMI work is a voluntary addition.

He is the first president from the southern hemisphere, and looks forward to increasing the involvement of teachers in the organisation. ICMI was formed in 1908 and aims to improve the quality of mathematics teaching and learning around the world, partly by bringing together educational researchers, curriculum designers, educational policy makers, mathematics teachers, other mathematics educators and mathematicians.

"What makes ICMI different from other mathematics education organisations is its close ties with the professional mathematicians and mathematical educators and its breadth – thematic, cultural and regional," he says.

Barton says the Klein project, which he also chairs, may be one of ICMI's most interesting projects for New Zealanders. It was inspired by a 1908 book by ICMI's founding president, Felix Klein, top right, written for teachers and linking what was taught in schools to the whole of research mathematics. The project will produce a book in several languages that summarises every major field of mathematics, resource DVDs for teachers and a wiki-based website that will be continually updated.

"There'll be explanatory chapters, but it's the linking that makes the difference. We're anticipating up to 15 explanatory pages, with five to eight vignettes per chapter - examples of applications or a nice piece of mathematics, a particular proof that captures an essential idea of the topic."

Barton has two goals during his three-year presidential tenure, which started in January. Firstly, he wants to help establish a secure financial basis for the organisation. Currently it is funded by small

grants from its parent body, the International Mathematical Union, but it is not sustainable as a voluntary body.

"ICMI has networks of mathematics teachers in nearly every country, so we're ideally placed to bid for and win development contracts in mathematics education," he says.

The other is to strengthen ICMI's

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**Cohen Holloway in *The Amazing Adventures of Doctor Faustroll and his Search for the Luminiferous Aether* in 2010. See back page. Photo: Joe Bleakley.**



### Welcome

March 8 was due to be New Zealand census day. In this issue you'll find out more about the census process and history, as well as other applications of statistics. Mathematics education, maths and psychology and a visual look at group theory round out our tenth issue. We hope you enjoy it.

**Marston Conder and Vaughan Jones, Co-Directors**



◀ activities in developing countries. "There is still a tremendous amount of work to do in Africa, but areas like the Pacific and some parts of Asia and South America still need international support." A week-long invited workshop is being planned for teacher educators from Mali and neighbouring French-speaking African countries in September; "to build a network of educators with links to the developed world that will enable them to be self-sustaining." Similar annual events

are planned in English-speaking Africa and other regions.

ICMI also publishes regular conference and research reports and newsletters. "ICMI Studies produce books that are state of the art for that area at that time." Major studies have included mathematics and cognition, mathematics popularisation, assessment, gender and mathematics education, geometry, statistics and algebra teaching, university mathematics teaching, secondary teacher development, and digital technologies. These are gradually being made available free online.

ICMI also supports regional conferences on mathematics education. "There is a very strong Australasian group in mathematics education, the Mathematics

Education Research Group of Australasia (MERGA), but to link into major developments internationally, especially in Europe, Asia and North America you need the structure that ICMI supplies."

Teachers and mathematics educators can keep up with what ICMI is doing by getting on to the New Zealand representative's email list, or subscribing to the ICMI newsletter on the website.

#### See also

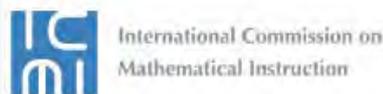
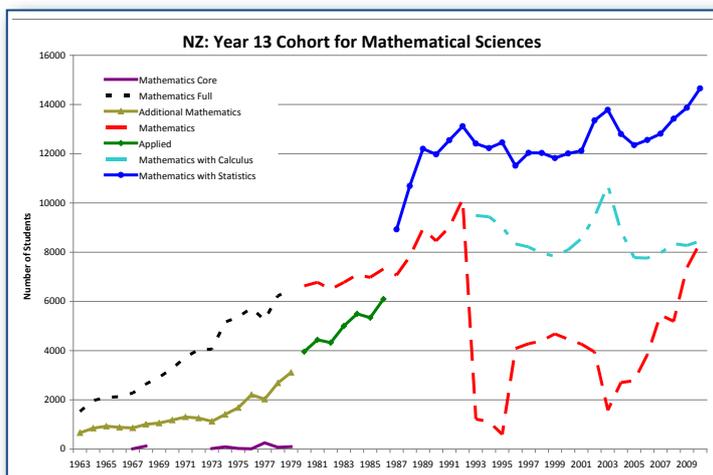
**Experiencing Mathematics! An interactive virtual exhibition:**

[www.experiencingmaths.org/](http://www.experiencingmaths.org/)  
**ICMI:** <http://mathunion.org/icmi/home>

**Klein Project:** [www.kleinproject.org/](http://www.kleinproject.org/)

**NZ representative:** Robin Averill,  
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**From top: Members of the ICMI executive working and relaxing; a meeting of the Klein Project design team at the University of Auckland. Photos: Jaime Carvalho e Silva, ICMI Secretary-General.**



## Flows of mathematics students

The numbers of mathematical science graduates at all levels are generally increasing, except for a few countries, according to the ICMI Pipeline project co-ordinated by ICMI president Bill Barton. This contradicts an international perception that the number of mathematics graduates is falling.

But the *percentage* of mathematical science graduates is declining slightly. This may be because more courses with mathematical content are attracting school leavers who would otherwise enrol in undergraduate mathematics.

Many senior secondary mathematics teachers in New Zealand, Australia, and the UK are also approaching retirement, and shortages of mathematics teachers are likely as fewer students enter teacher training.

The project was initiated at the request of ICMI's parent body, the International Mathematical Union, and has collected data from ten countries: New Zealand, Australia, Finland, France, Hong Kong, Portugal, Scotland, Taiwan, the UK and the USA.

It found that the situation differed markedly in different countries, so has focused on national

case studies of four transition points rather than a comprehensive comparison.

The transitions were from school to undergraduate courses; undergraduate to postgraduate courses, university into teaching, and university into other employment.

Results indicate that in New Zealand the number of school leavers qualifying in the mathematical sciences is increasing (see graph), as are the numbers of Bachelor, Masters and PhD graduates. However, mathematics graduates are a declining percentage of total graduates, and the median age for secondary mathematics teachers has grown to 45 - 49.

The project aims to provide data for educational decision making in different countries. Barton has presented results at conferences in Poland, Spain and New Zealand and the report is being finalised. The project will continue to update data from project countries and add other countries to the database.

#### See

[www.mathunion.org/icmi/other-activities/pipeline-project/](http://www.mathunion.org/icmi/other-activities/pipeline-project/)

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# Official statistics up with the best

**Former New Zealand Government Statistician, UK Chief Statistician and Chair of the NZIMA Board, Len Cook, above, spoke with Jenny Rankine.**

The cancellation of the 2011 Census, which was to have taken place on March 8, is only the third time a major event has stopped the Census. In 1931 it was abandoned because of the depression, and in 1941 it was cancelled due to a world war. This time it was deferred because of disruption caused by the Christchurch earthquake.

The Census was to have been processed in Christchurch, but Statistics New Zealand buildings in Christchurch have suffered extensive damage. A replacement date has yet to be determined but it is unlikely to be in 2011.

Cook says that for New Zealand, more than larger countries such as the United Kingdom, "the cancellation of a population census creates a hole in knowledge we have about ourselves that we cannot fill adequately by other means. The Census is fundamental to public trust in government and the quality of much public policy."

He ranks New Zealand's official statistics "right up there with the best with the use of statistics methods and information technology. We've been very innovative in releasing Census data with Spacetime mapping products, in the use of tax records for economic statistics, in automated scanning of forms and organising internet access for 2011."

Professor Stephen Haslett of Massey University is one of many who have worked on linking official statistics with administrative data records "to get better detail and accuracy for less money". For example, a linkage of the unemployment register and the Household Labour Force Survey obtained "much better estimates of the International Labour Organisation's definition of unemployment" than either data set alone. He had to take into account the changing relationship between the two data sets over time with different political decisions about benefit criteria.

Says Cook: New Zealand "put a lot of effort into high quality, regularly-updated design for the Household Labour Force Survey and the Household Income and Expenditure Survey, and business surveys such as monthly retail trade."



## Census numbers

**35 days to scan all returned forms, using 3 scanners doing 120,000 forms a day**

**150Gb image and back up servers to store the data and scanned forms**

**250 people work 2 shifts for 22 weeks to scan forms and check the information**

**7,000 collectors to deliver and pick up forms**

**7.8 million census questionnaires printed for 2011**



It can be difficult to get accurate information about attitudes, he says. "Surveys of wealth have been quite difficult; people don't always know what they're worth. Areas that are stigmatised, for example, alcohol consumption in household expenditure, are often quite significantly under-reported. Developing methods to adjust for that under-coverage is always a challenge."

"On questions of identity, official statistics are always going to follow how society responds. For example, if it's not common to ask people about their sexual identity for other reasons, it's very difficult to do so in a statistical enquiry. Initially when we started measuring same-sex partnerships, we did it indirectly."

"Being a small country is a great asset. For balance of payments data, we collect information from the invoices of the largest firms. Informal ways like newspapers are more reliable to identify what new firms we should look at, which is an advantage over larger countries."

"Official and research surveys have extraordinarily good response rates; neighbourhood tracking is very strong here. The Dunedin and Christchurch studies that follow people for a lifetime have been able to get world-leading response rates."

Cook says that in almost every field "there has been a huge increase in the information available from the public – such as state administrative records and welfare information. It has created tremendous opportunities to understand a lot more about our society without collecting information directly. We're able to produce a lot of geographic information about what's going on in small areas."

### See

[www.census.govt.nz/](http://www.census.govt.nz/)  
[www.gapminder.org](http://www.gapminder.org) for animations from official statistics around the world.

