Communications

The state of mathematical sciences in Australia

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Mathematics and statistics in Australia face substantial challenges. The recent Federal Budget and the important Bradley review of the higher education system in Australia barely mention the mathematical sciences. On the other hand, the National Strategic Review of Mathematical Sciences[1], released in 2006, identified a serious decline in mathematics education in both schools and universities. The 2009 Budget contained a number of measures to improve higher education, including ambitious targets for equity and access. It would seem that the problems in mathematical sciences will be a substantial obstacle to achieving these targets, especially in key areas such as engineering, economics and commerce, environment and climate change, bioinformatics and biostatistics, resource allocation and infrastructure. It is important to note that the mathematical sciences community has been producing evidence of the problems, strategic plans and submissions to numerous reviews for the last three years, with little effect, except requests for more submissions, plans and evidence!

Firstly, the problems[2]. To summarise, between 1995 and 2007, the number of Australian Year 12 students doing advanced mathematics dropped from around 25 000 to around 20 000. Moreover, in the international study of comparative performance 'Trends in International Mathematics and Science Study', Year 8 Australian students performance declined from above average to below average, in the period 1995–2007. Australia is now behind both the US and UK, whereas we were ahead of these countries in 1995. In 2007, 40% of senior mathematics teachers did not have a three-year university degree in mathematics — this has risen from 30% in 1999. Finally, perhaps the most worrying trend is that Australia graduates around 40% of the OECD average for university majors in mathematics and statistics, scaled for our population size. In 2001 there were around 2100 such graduates whereas in 2007 this had declined to 1800. Government figures show an increase in demand by the Australian economy of 52% for mathematicians and statisticians between 1998 and 2005. A related figure is that the number of academic positions in university Mathematics and Statistics Departments has declined by approximately 40% since 1995.

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[1] http://www.review.ms.unimelb.edu.au/Report.html
[2] For the full story, see www.amsi.org.au/pdfs/National_Maths_Strategy.pdf

Certainly the federal government has been focusing on big issues in the economy, climate change, industrial relations, but has also promised an education revolution. Resources have been put into computers in schools, new school and university buildings and super science projects. The main budget initiative, which is relevant to the above problems, is HECS reductions for students studying science and mathematics, who become teachers in schools. Although this is a commendable scheme, it may do little to address the serious shortage of mathematics teachers.

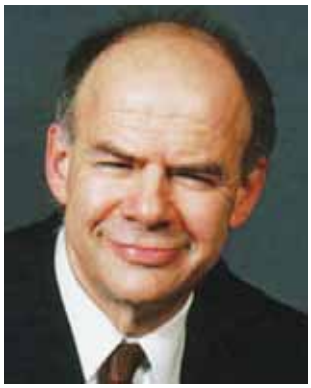
Firstly, Australia already produces more than 25 science graduates for every mathematics or statistics student. So the most likely outcome will be more science students going into teaching, whereas the opportunities for the very small numbers of mathematical sciences students are much better in industry than teaching. Secondly, most university science courses have few requirements for studying mathematics or statistics and the registration procedures for teachers, in terms of subject knowledge, vary greatly between different states in Australia. So we may well end up with underqualified science students teaching mathematics in schools.

All is not doom and gloom though. Australia produces marvellous talents in the mathematical sciences — Berkeley, Stanford, Caltech, UCLA, Chicago, MIT, Cambridge et cetera, have many outstanding mathematicians and statisticians who were educated in Australia. Invitations to speak at prestigious international conferences and being on editorial boards of top journals are common for Australian mathematical scientists. Australia has a wonderful tradition of excellence in mathematics competitions in schools, run by a small army of dedicated teachers and academics and coordinated by the Australian Mathematical Trust, with very little government support.

Finally the mathematical sciences community has banded together to set up the Australian Mathematical Sciences Institute, which recently won a National Innovation Award for its program of industry internships for mathematical sciences students. AMSI has been active in school education, producing an excellent series of modern mathematics textbooks suitable for schools across Australia, and fostering research and interaction with industry. AMSI is a model of the hub and spokes concept, coordinating national activities such as advanced summer courses in areas of interest for honours and graduate students, assisting with running focused workshops (Future models for Energy and Water Management is to be run in July in conjunction with UNESCO), but not yet recognised by the federal government.

Why are we struggling to gain attention? The resources involved are very small indeed — our budget request was less than 3% of the super science projects. I believe there are two reasons. Firstly, there is no 'mathematics industry' to lobby the government to take action. On the other hand, every industry needs and uses mathematics and statistics. Every time a company does a market survey, performs risk analysis, tries to make logistics more efficient, et cetera, they are using skills from the mathematical sciences. Computing power and software do not replace this; for example the advances in scheduling enabling very complex tasks like running airlines, relies on advances in mathematical algorithms much more than progress in computing speed.

Secondly, mathematical sciences are not science, in the sense that we use no equipment other than brain-power and computer-power. So we have no large impressive facilities that politicians can take credit for. But mathematics and statistics are becoming more and more important as tools to tackle the problems of society, from efficient use of infrastructure such as ports and airports, to climate change to the genetic revolution in medicine. If Australia continues to neglect its basic skills in the mathematical sciences, turning this around will become more and more difficult. To quote the international reviewers from 2006: '... we found the nation's distinguished tradition and capability in mathematics and statistics to be on a truly perilous path'.



Hyam is Chair of the National Committee for Mathematical Sciences and was the Chair of the working party of the National Strategic Review of Mathematical Sciences Research which was completed during 2006. He is interested in geometric topology, differential geometry, shortest networks and has been at Melbourne University so long that he gets to walk behind the Chancellor at academic processions for graduation ceremonies.