

30th October 2007

Dr Peter Andrews
Queensland Chief Scientist
Queensland Government
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Dear Dr Andrews

Response to STEM discussion paper

I'm writing on behalf of the Australian Mathematical Society, to endorse the STEM discussion paper and express our admiration for the strong, pro-active stance that the paper takes. It seems clear that in the years ahead, Australia's economic performance, and our capacity for addressing the major problems that face us (for example, climate change), will be constrained by our success in delivering the advanced skills we need. The better we can plan to provide skills, the greater will be the opportunities we shall leave for our children. The Queensland government is a leader in this process.

In terms of providing skills in the mathematical sciences, at least two broad issues are of paramount importance.

(1) *School mathematics education.* Ultimately, the quality and quantity of the mathematics skills we can deliver are limited by the number, and level of training, of school mathematics teachers. This point has been made in many forums during the last two years. See, for example, the 2007 Productivity Commission Review of *Public Support for Science and Innovation*, the 2006 Australian Council of Deans of Science study, and the 2006 *National Strategic Review of Mathematical Sciences Research in Australia*. As a nation we have the capacity to achieve great heights in the mathematical sciences, if only we can get the school education part right.

The main difficulty we are experiencing is a debilitating shortage of adequately trained school mathematics teachers. Approaches to overcoming this problem include (a) making fee-free, or fee-reduced, places available for university training of mathematics teachers; (b) ensuring that training opportunities are widely available (for example, by having excellent and innovative mathematics programs in regional universities as well as in their capital-city counterparts); (c) providing salary loadings for school mathematics teachers; (d) supplying income support for career-change professionals, (e) raising the profile of teaching as a profession; and (f) encouraging greater participation in mathematics education, particularly in relatively advanced courses.

In connection with points (a) and (b) above, I'm concerned by reports I've seen relating to potential redundancies in the mathematical sciences at USQ. Actions such as this will reduce still further Queensland's opportunities for training mathematics teachers. Point (c) above was raised in the Productivity Commission Review, and, as noted there, it is an important step towards remedying the mathematics teacher supply problem. On the subject of (d), until we can manage to increase the number of undergraduate mathematics students, bringing graduates to the teaching profession from other areas will be one of the main ways in which mathematics teacher shortages are addressed. In connection with point (e), could I suggest that Queensland consider conferring annual awards for mathematics and science teachers, not unlike the Prime Minister's national prize for science teachers, and advertise to promote the esteem in which teachers are held in Australia?

Concerning point (f), a major problem experienced across Australia is a consistent and long-term drift from higher- to lower-level school mathematics courses. Although the number of students studying mathematics at school is staying approximately constant, the number doing anything but basic mathematics is currently in rather steep decline. The deficit is most striking among young women, and I note that this problem is highlighted in the STEM discussion paper. We must increase the number of students enrolled in high-level mathematics courses, and heighten the participation of young women in mathematics, if we are to have a chance of adequately addressing the mathematics skills crisis that we face. Particularly in a small nation like Australia, and one with very low levels of unemployment, we cannot address skills shortages without raising education levels across all sectors of the population.

I cannot emphasise enough the role that university-level mathematics education, as well as proper teacher training, must play in the preparation of school mathematics teachers. To quote a 2000 report by the US National Commission on Mathematics and Science Teaching for the 21st Century, "The most consistent and most powerful predictors of higher student achievement in mathematics and science are: (a) full certification of the teacher and (b) a college major in the field being taught."

(2) *University mathematics education.* The mathematics review, which reported last year, drew the nation's attention to the strongly negative impact that federal government university funding models have had on the nation's ability to train and retain mathematical scientists. The federal government has now accepted at least part of the responsibility for these problems, and in the federal budget last May the level of funding per mathematics and statistics student was substantially increased.

This money will start to flow into Australia's universities next year, but it is far from clear that the new funding will actually reach the mathematics groups that need it. This is despite the clear signals that the federal government sent in the

budget last May, and also last month when the government awarded a CASR grant to the Australian Mathematical Sciences Institute. The federal government now understands that our universities need to grow their involvement in mathematical sciences education, but it is not clear that university managers appreciate this point. Perhaps the Queensland government could help to promulgate the message.

In this context, let me return to the issue of redundancies in mathematics and statistics at USQ during 2008. These difficulties are caused by budget shortfalls, but will nevertheless occur in the very year when new money for mathematics and statistics starts flowing into the university. Particularly in the context of mathematics teacher training, USQ has played a very important and significant role in Queensland. It would be discouraging in the extreme if at this point, when the need for high levels of mathematics is being recognised by state and federal governments across the country, university managers were to act to reduce access to mathematics courses.

Likewise, I'm very concerned that a degree program in mathematics is no longer offered at CQU. Two long-serving mathematicians will leave the university next week, after receiving voluntary separation packages. They will be joined by a statistician. Despite employers in industry, business and government being unable to find the trained staff in mathematics and statistics they need; and notwithstanding the critical shortage of university-trained mathematics teachers, and the new federal funding that will flow to mathematics education in 2008; these CQU academics will not be replaced. Indeed, the critical mass of expertise for a mathematics program no longer exists at CQU. Clearly, mathematics education and learning programs in Queensland need serious attention, including better resourcing.

Last year's mathematics review pointed to demands for mathematics at all levels, including in research. I'm sure it was not necessary to make this point to the Queensland government, which has taken pains to develop high-level programs in areas such as genomics and engineering that rely fundamentally on the mathematical sciences. However, it is worth repeating here the challenges that all Australian states are facing in mathematics research, as enunciated by the review's international members after interviewing hundreds of mathematicians, employers of mathematicians and users of mathematics:

Australia's distinguished tradition and capability in mathematics and statistics is on a truly perilous path. The decline has already taken its toll: the university presence has been decimated, in part by unanticipated consequences of funding formulas and by neglect of the basic principle that mathematics be taught by mathematicians, and the supply of students and graduates is falling short of national needs.

The mathematical sciences skill base in any country is too important for its future prosperity to let short-term market mechanisms act alone. We sincerely

hope that leaders in Australian Government, academia and industry will collaborate with the mathematics and statistics community to develop an appropriate vision, and spark an Australian renaissance in our field.

For “Australian Government” here, read “state and federal governments,” since the resources for higher education and research training are coming increasingly from the states. It is at the state level that the edge will be found in the competition for skills in Australia.

Sincerely

Peter Hall

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