

Department of Mathematics and Statistics,
The University of Melbourne,
Vic. 3010

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Higher Education Review Secretariat,
Department of Education, Science and Training,
Location 701,
GPO Box 9880,
Canberra ACT 2601

Submission to Review: Higher Education at the Crossroads

Thank you for the opportunity to make a submission to the review.

Australia needs a critical mass of highly trained individuals with expertise in the mathematical sciences, including statistics. As well as providing renewal in our institutes of higher learning, an advanced 21st century economy relies heavily on such expertise. For example, the recent Clunies Ross Award to Dr. E. van Leeuwin of BHPBilliton for new methods of mineral deposit detection is almost entirely a mathematical discovery.

Leaders in the emerging areas of quantum computing, bioinformatics and neuroinformatics, as well as the established disciplines of computer science and telecommunications point out the seminal nature of skills in the mathematical sciences as the essential underpinning of their discipline, and lament the dearth of sufficient, adequately trained graduates.

The banking and finance sectors are soaking up our graduates even before they complete their training¹. While it is good to see skilled people appropriately employed, it is clear that we are producing far too few higher level graduates for the needs of industry, of academe, and of the teaching profession.

Globally, mathematical talent is increasingly recognised and sought. You will be aware of the abundant evidence of the “brain drain” of highly trained mathematics professionals, as tellingly revealed in the FASTS occasional paper on this topic².

The frequently uttered response that inflow and egress of skilled professionals is in balance, according to official statistics, is dangerously misleading. As the FASTS paper shows, this is not the case in the mathematical sciences. The egress documented in the paper is of top academics from our better universities, our finest students, and outstanding overseas graduates. The ingress, which allegedly offsets this, includes a large proportion of people who would not be considered for employment at our

¹One of my PhD students, who is probably a year from completion, has already been offered a highly paid job at the ANZ bank upon completion of his PhD, while another is currently being courted by another financial house.

²FASTS Occasional Paper 3, and 2002 update

universities. Yet both groups are considered equivalent within official statistics.

Positions advertised in Australia, particularly in high demand areas such as statistics, financial mathematics and bioinformatics, rarely attract good candidates either from within Australia, and almost never from overseas. It is our mathematical infrastructure that is being eroded, and this can only be addressed by positive and decisive government action.

You will also be aware of the uncompetitive attractions of an academic position in mathematics and statistics in this country, with both superior remuneration and working conditions offered by private sector employment in this country, and by academic appointments overseas. A generation ago an academic position was remunerated at an internationally competitive level, and while unremarkable by comparison with salaries in local industry, academics enjoyed superior work place conditions. These latter included the security of tenure, the opportunity to devote extended time to intellectual enquiry and research, and to interact meaningfully with students. With internationally and locally uncompetitive salaries, the vanishing of tenure, increased class sizes and administrative loads, all these advantages have disappeared. As a result, very few of our best and brightest graduates have any intention of following an academic career in this country.

I currently have six Ph.D students studying under my supervision, and as they look around during the course of their studies they seem increasingly to shy away from pursuing an academic career in Australia. I cannot in all conscience fault their reasoning. For decades medical academics have enjoyed superior salaries to others, and more recently academics in business schools, and faculties of accounting and commerce have been similarly privileged. It now seems necessary to treat mathematicians similarly if the erosion of top people is not to continue.

While primary and secondary education are primarily issues for individual States to address, the Commonwealth wields enormous influence over State educational policies by virtue of financial controls.

In all States, and particularly in remote areas and lower socio-economic areas of our major cities, the educational system is facing a critical shortage of adequately trained mathematics and physical sciences teachers. Across Australia, already a number of schools are no longer offering advanced level Mathematics, which is often a prerequisite for entry into, for example, Engineering at The University of Melbourne.

While statistics appear unavailable, no-one has refuted the oft-quoted statement that nearly half the mathematics teachers in the critical junior secondary school years have little or no tertiary mathematics qualifications. If a teacher does not possess adequate subject knowledge, their students are hardly likely to develop adequate competence, let alone enthusiasm, for a critical subject. Yet NSW's response to this is to offer inadequate "retraining" programs. Most University Mathematics Departments in the State appropriately declined to be involved.

Current educational policies offer little incentive for individual teachers to address this inadequacy. In Canada, a teacher wishing to improve their qualifications will be given some time off from classroom duties to undertake their studies, financial assistance with

course fees, and a promotion and increased remuneration upon successful completion of a relevant course. In Australia, by contrast, a teacher would be given no time relief, would have to pay their own course fees, and would receive no substantive recognition of their improved qualifications.

Expectation of Australian students' achievements remain low. For too long the myth has been perpetuated that many people can't do mathematics. The 1999 repeat of the Third International Mathematics and Science Study (TIMSS Repeat) showed 93% of Singaporean students achieving the median benchmark compared with 73% of Australian students. 46% of the Singaporean students were in the top 10% of achievement, compared with 12% of Australian students³. The Singaporean experience clearly demonstrates that properly taught, all students, apart from those with learning disabilities, can achieve an adequate level of mathematical competence, and most can perform at a high level.

At the research level, Australia has also been handicapped by the refusal of governments, of any political persuasion, to fund mathematics research institutes. Despite findings of the discipline review several years ago that recommended two such institutes, one in industrial mathematics and one in the more general area of research mathematics, funding has been unavailable⁴. Such institutes are commonplace in all the countries we traditionally compare ourselves with, and in our immediate region Singapore established a well-funded such institute in 2000, while New Zealand has recently announced funding of several million dollars per annum for just such an institute. We welcome the interest in this concept expressed by the new Federal Minister and look forward to further discussions with him.

Another impediment, not restricted to mathematics and the sciences, is the increasing level of control exercised by government on the tertiary sector. The resources, both financial and in terms of time commitments that tertiary institutes and individual academics now need to devote to compliance and information gathering exercises is positively oppressive. One example is the publication gathering exercise, where even now papers in some of the most prestigious, rigorously refereed journals are excluded due to the obstinacy of the relevant government department. (I have the correspondence to prove this).

The currently floated idea of licensing academics to teach in tertiary institutes is yet another example of Australian educational authorities importing flawed ideas from the UK or the US. There is a pattern here of government receiving advice from self-styled experts or consultants, bereft of imagination, who lift ideas from other countries without regard to their merit or appropriateness. Let me say clearly that this is a bad idea. If governments want to improve universities, they should work to create an environment of enlightened enquiry, rather than moving in the opposite direction.

In a similar vein, overseas academics have commented that the biggest difference they see between Australia and, in particular the US, is the ubiquity of short-term planning here, and the absence of long-range planning. If numbers fluctuate in a course, instant

³http://timss.bc.edu/timss1999/math_achievement_report.html

⁴At the time of writing, a modest such proposal is being considered by the Victorian Government.

reaction is required. Funding and resource formulae, whether internal or government enforced, are excessively responsive to change, making it increasingly difficult to plan in any meaningful way to develop a discipline, or even to manage natural change.

If Australia is to become a 21st century economy, relying increasingly on intellectual capital rather than on raw materials, the problems relating to the mathematical sciences need to be urgently addressed. What is required is, among other developments:

(i) A reform of our school system to ensure that teachers have adequate subject knowledge, as well as their pedagogical training.

(ii) A system that encourages and rewards teachers to undertake serious professional development. If necessary, differential salaries to be paid to suitably qualified people in key disciplines.

(iii) Encouragement for talented young people to train as school teachers with the expectation of a rewarding and fulfilling career.

(iv) A reversal of the policies that have steadily eroded the working conditions of tertiary sector academics, to the extent that the evolutionary renewal of key disciplines is under threat. At the very least, this calls for enlightened intervention by the Minister to encourage the better universities to safeguard and develop the basic disciplines through appropriate internal funding arrangements, because this is so vital to the national interest.

(v) A reversal of recent policies imposing ever tighter controls and restrictions on tertiary institutions. An environment of enlightened enquiry needs to be created, if the brightest, most talented young people are to be attracted to an academic career in this country.

(vi) The setting of long-term goals and the development of mechanisms to achieve them. This includes less government intervention, and more government encouragement. Currently governments are viewed as impediments to development, rather than as partners.

(vi) Well funded institute(s) of mathematical sciences to provide a focus for mathematics research and development, which attracts expatriates and others, in order to provide training and expertise locally.

Once again, I appreciate the opportunity to make a contribution to the enquiry.

Yours faithfully,

Anthony J. Guttmann, FAA
Chair, Education Sub-Committee,
Australian Mathematical Society.
President-Elect, Australian
Mathematical Society