AMSI News

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Reports and reviews

Some recent Government reports and reviews should be of considerable interest to mathematicians.

World-wide, significant mathematical developments underpin recent advances in applied sciences such as medical imaging, genomic analysis and genetic diagnosis, computer security, telecommunications, financial portfolio design and engineering materials. Hence, it is expected that the demand for expertise in mathematics and statistics will grow. Indeed the recently published DEST SET Skills Audit shows that the period 1997–2005 has already experienced 52% employment growth in the mathematical sciences, compared to 37% over all natural sciences [1].

At the same time, mathematics enrolments in Australia are much lower than a decade ago. The very recently published preliminary report commissioned by the Australian Council of Deans of Science [2] reports a 34% decrease in the EFTSU mathematics teaching load for science students from 1989 to 2005.

The data for the year 2005 show that the decrease over the previous decade in school advanced and intermediate mathematics enrolments has still not bottomed out [3].

I hope that the boost to mathematics funding in the DEST Relative Funding Model, announced in the Federal Budget and discussed in my July column, will eventually help to increase enrolment numbers. As I said then, this increase reflects an acknowledgement by the Government that more money should actually be spent to educate a student in mathematics and statistics. We should be very interested to see if and how this money actually flows on to its intended purpose.

The Council of Australian Governments is currently conducting a National Numeracy Review. This might largely determine guidelines in mathematics education for trainee teachers. AMSI has made an invited formal submission, assisted by Hyam Rubinstein, chair of the 2006 mathematical sciences discipline review. This submission is important, given that the numeracy review committee and its advisory panel contain no academic mathematicians. Independently, the Senate Committee on Academic Standards has recently conducted a hearing. AMSI and ICE-EM have been prominent in their invited verbal presentations to both the numeracy review and the committee on standards.

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The role of applications in teaching and learning mathematics

These reviews have invoked the question of definition of functional numeracy, and have prompted discussion about the role of applications in teaching and learning mathematics. Some education experts have gone so far as to say that all school mathematics should be taught in the context of applications. However, at university undergraduate level, a study by Sandra Britton [4], found that some students succeed better in applying mathematics after they have learnt it in a decontextualised setting. It is my experience too that students find it harder learning new mathematics as they learn a new application along with it.

Therefore, students who have learnt some new mathematics in a decontextualised setting might be more confident with the techniques so that they are more likely to later use them successfully in applications. I have heard from many experienced facilitators of multi-disciplinary problem-based learning that without guidance, people will not commonly apply mathematical techniques that they have known for less than two years. However, it is also my experience that some students who learn new mathematics in the context of realistic applications are better motivated and have a better long-term appreciation of the material.

Practical utility and intrinsic elegance both play an important motivational role. I feel that a well rounded degree program should contain mathematical modelling courses as well as traditional courses in mathematical methods and deductive reasoning. However, the two distinguishable types of course need not be designed to appear to be so far apart. In my opinion, as a general rule, even in a mathematical modelling course, there should be opportunities to practise mathematical techniques apart from any practical context. On the other hand, assimilation of new abstract concepts is facilitated by referring to realistic applications or to other areas of mathematics that allow a more concrete visualisation.

By making such statements purely in the abstract form, I have immediately broken my own guidelines! However, many other contributors to past issues of the *Gazette* have provided examples of applications-inspired mathematics that are intrinsically interesting from the conceptual point of view.

Events

From 26 November to 14 December, AMSI and MASCOS will run a joint theme program, 'Concepts of Entropy and their Applications'.

Confirmed speakers so far include I. Müller (Berlin), R. Rubinstein (Technion, Haifa), R. Kleeman (New York), Roderick Dewar (Bordeaux), M. Baake (Bielefeld), A. Guttmann (Melbourne), C.A. Hurst (Adelaide), G. Morriss (UNSW), A. Dooley (UNSW), I. Enting (Melbourne) and G. Paltridge (Tas).

The topics, with some flexibility, are: 26 to 28 November, Thermodynamics; 28 to 30 November, Statistical Mechanics; 3 December, Environmental Data Modelling; 4 to 5 December, Dynamical Systems; 6 December, Information Theory; 10 December, Operations Research; 11 to 12 December, Signal Processing; 13 to 14 December, Partial Differential Equations.

On 7 December, AMSI will be hosting a one-day national symposium 'Mathematics Education for 21st C Engineering Students'.

Please consult the AMSI and ICE-EM websites for these and other upcoming events (http://www.amsi.org.au, http://www.ice-em.org.au).

References

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[2] Dobson, I. (2007). Sustaining Science: University Science in the Twenty-First Century. Australian Council of Deans of Science. http://www.acds.edu.au/ (accessed 23 August 2007).

[3] Barrington, F. and Brown, P. (2005). Comparison of Year 12 Pre-tertiary Mathematics Subjects in Australia 2004–2005. Website: http://www.ice-em.org.au/pdfs/year12maths.pdf (accessed 23 August 2007).

[4] Britton, S. (2002). Are students able to transfer mathematical knowledge? In: Boezi, M. (ed.) *Second International Conference on the Teaching of Mathematics*, Crete, July 2002. John Wiley & Sons, New York.

Director of AMSI since 2005, Phil Broadbridge was previously a professor of applied mathematics for 14 years, including a total of eight years as department chair at University of Wollongong and at University of Delaware.
His PhD is in mathematical physics (University of Adelaide). He has an unusually broad range of research interests, including mathematical physics, applied nonlinear partial differential equations, hydrology, heat and mass transport, and population genetics. He has published two books and more than 80 refereed papers, including one with 147 ISI citations. He is a member of the editorial boards of three journals and one book series.