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Gazette

David Yost and Sid Morris (Editors)

Eileen Dallwitz (Production Editor)

Gazette of AustMS, CIAO,
Federation University Australia, PO Box 663,
Ballarat, VIC 3353, Australia

E-mail: gazette@austms.org.au
Web: www.austms.org.au/gazette
Tel: +61 3 5327 9086

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- Reviews of books, particularly by Australian authors, or books of wide interest
- Classroom notes on presenting mathematics in an elegant way
- Items relevant to mathematics education
- Letters on relevant topical issues
- Information on conferences, particularly those held in Australasia and the region
- Information on recent major mathematical achievements
- Reports on the business and activities of the Society
- Staff changes and visitors in mathematics departments
- News of members of the Australian Mathematical Society

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Deadlines for the *Gazette* are 1 February for No. 1 (March), 1 April for No. 2 (May), 1 June for No. 3 (July), 1 August for No. 4 (September), and 1 October for No. 5 (November).

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Editorial

Sid and I welcome you to another issue of the *Gazette*.

Today performance targets and metrics are regarded in many sectors as an essential management tool. This occurs not just in higher education, which we are most familiar with, but in business, finance, health, public service, almost everywhere. Measurement has undoubtedly played an essential role in the development of the physical sciences since the seventeenth century. But the further one moves from mathematics and physical sciences, the less meaningful some measurements seem to be. Do the performance metrics in use in various fields measure inputs or outcomes? Do decisions based on such metrics lead to rational outcomes? In particular, do they encourage strategies aimed at better measurements rather than productive effort? Are measurements made originally to provide confidential feedback and guides for improvement now being used as a form of evaluation with possibly punitive outcomes? In this issue, Heiko Dietrich and Daniel Matthews contribute an eloquent discussion of the appropriateness of various metrics for mathematical research.

The need to equip the future Australian workforce with STEM skills is another topic that never goes away. Needless to say, our secondary school system should play a part in this. However the number of students taking more advanced mathematics in high school continues to decline. This is in no small part due to the persistent idea that students choosing easier courses will 'benefit' by getting a higher ATAR ranking. This is an example of a strategy designed to produce a better measurement leading to a perverse outcome. The myth that this strategy is even effective is debunked by Nicola Armstrong, who contributes the NCMS column this time. As she writes, "we, as a community/society, need to address this misconception".

Science and Technology Australia, which represents more than 70,000 Australian scientists and technologists through its 50+ member organisations, recently issued a statement https://scienceandtechnologyaustralia.org.au/stem-leaders-forge-path-to-stronger-australian-science-and-technology/ addressing the issue of STEM skills and calling for science to be a priority platform for the major parties' campaigns in the next federal election. This was signed on behalf of the Australian Mathematical Society by president Kate Smith-Miles. Kate reports on this and other meetings in her column, in particular the *Women in Optimisation* panel discussion at the AMSI Optimise conference which took place in June.

AMSI is a major contributor to mathematics conferences around Australia. This time, their regular column is written by Simon Clarke, who reports on the 2018 Summer School. This annual four-week residential school enables honours and postgraduate students to "come together, take advanced courses, meet and socialise with their contemporaries and be exposed to mathematical sciences beyond

the confines of their institutions". This year it attracted 168 participants. Likewise, in the occasional column from ANZAMP, Jon Kress reports on their most recent and their next conference. Jan de Gier gives a comprehensive list of upcoming programs at MATRIX in his report. Other upcoming conferences which may interest members are listed in the News section, along with updates and items of interest from departments around the country.

In the Talking Teaching column, Birgit Loch discusses at length the worrying issue of contract cheating. On a more positive note, Heather Lonsdale reports in detail on three mathematicians who won Australian Awards for University Teaching.

Asperger's Syndrome may be more common in Mathematics Departments than in the general community. Peter Donovan presents an interesting account of this condition.

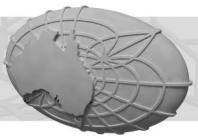
We include an obituary of Tom Horner, who gave many years of service to the University of Wollongong.

Last but not least, let us mention Peter Higgins' ever interesting Puzzle Corner.

We hope that you find some entertaining and thought provoking reading in this issue.

David Yost, Centre for Informatics and Applied Optimisation, Federation University Australia, Ballarat, VIC 3353. Email: d.yost@federation.edu.au

David Yost is a graduate of the University of Melbourne, the Australian National University and the University of Edinburgh. He has lived in eight countries and ten cities, returning to Australia in 2003, where he has now completed 15 years at Federation University Australia and its predecessor institution, the University of Ballarat, including a three-year period as Deputy Head of School. While most of his research is in functional analysis, he has lately been interested in convex geometry.



President's Column

Kate Smith-Miles*

It's been a busy couple of months involving quite a few trips to Canberra to represent the Society at various multi-society meetings. I was lucky to be the winner of a random draw to fund my travel expenses to attend the Science Technology Australia (STA) Forum for CEOs and Presidents of their member societies. I'd like to thank STA, not only for their financial support, but for hosting a very interesting day of discussions about how STA can better support their member societies, and how we can all work together to add power to a collective voice to raise the profile of the needs of our sector as we approach a federal election. A joint communique was issued that day that I was pleased to sign on behalf of the Australian Mathematical Society. It urges political candidates to address the following issues in the lead up to the next election: a whole-of-government plan for science and technology; a strategy to equip the future Australian workforce with STEM skills; strong investment in both basic and applied research; creating policy informed by the best available evidence. The full communique can be read at https://scienceandtechnologyaustralia.org.au/stem-leaders-forge-path-to-stronger-australian-science-and-technology/. Other recent Canberra trips included a meeting of the Australian Academy of Sciences National Committee for the Mathematical Sciences, where I presented the AustMS response for how we will contribute to the implementation of the Decadal Plan for the Mathematical Sciences, in partnership with other groups such as AMSI, AAMT, SSAI, etc. We are also at the early stages of exploring how best AustMS can partner with other societies and organisations to strengthen our collective operations research capability, coordinated by Defence agencies. So a recurring theme at the moment is exploring how our society interacts with other like-minded groups to deliver something greater than the sum of our parts. I believe these are important outcomes to pursue.

Speaking of operations research, I was fortunate to participate in *AMSI Optimise* this week at the University of Melbourne. As I type, I have just returned to my office from moderating a wonderful panel discussion on *Women in Optimisation*. I'd like to devote the remainder of this column to share with you what was so remarkable about this discussion, rather than recounting more details of trips to Canberra on society business! The panel comprised three generations of women who have worked in optimisation: Alison Harcourt (University of Melbourne); Maria Antónia Carravilla (University of Porto); and Marie-Ève Rancourt (HEC Montréal). We discussed their career journeys with an emphasis on why they chose to work in optimisation, how their path to success was supported, what barriers they encountered, and how support structures have made a difference or might have made a difference if they had been in place. It was fascinating to hear about

*Email: President@austms.org.au

their unique journeys, but also to discover the commonality of their quest to use their mathematical talents to create social impacts.

While each of the panellists had remarkable stories, I would like to draw special attention to Alison Harcourt (née Doig). Hers is an amazing story that has not received the recognition and celebration that it deserves. Recent media attention stemming from the AMSI Optimise event highlighting her remarkable career is a good first step! (see https://www.theaustralian.com.au/higher-education/maths-pioneer-alison-harcourt-sees-progress-for-women/news-story/331d4be5bbe9827760464419eb30510d).

Alison is a pioneer in the field of operations research, having co-authored the seminal paper:

Land, A.H. and Doig, A.G. (1960). An automatic method of solving discrete programming problems. *Econometrica* **28,** 497–520.

This ground-breaking paper is well known to researchers in operations research since it proposed a method for solving integer programming problems which later became known as the "branch-and-bound" method. It underpins much of modern day optimisation software packages that provide efficient solutions to challenging combinatorial optimisation problems ranging from logistics and transportation, to scheduling, telecommunications, and even cancer radiotherapy treatment planning. This seminal paper has almost 3000 Google Scholar citations! Most people are not aware that it was authored by two women since their first names are never identified on the paper[1].

Alison co-authored the paper while working in London as a research assistant to Ailsa Land at the London School of Economics. She was offered the position based on the quality of her University of Melbourne Masters thesis on integer linear programming in the mid-1950s. Alison never enrolled in a PhD, had career interruptions for child-raising and, by the mid-1960s, returned to the University of Melbourne to take up a position as a Senior Lecturer in Statistics. She found it difficult to continue her integer programming research having been away from the field for a while, lacking nearby collaborators who understood the emerging field, and without opportunities to spend time visiting those at the forefront of the field overseas. Meanwhile, her talents were in high demand as a statistical collaborator, and she went on to have an amazing career as a statistician. Alison's statistical analyses have had profound impacts influencing government policy. Just a couple of examples of this include the first attempts to estimate poverty in Australia (informing the Royal Commission of Inquiry into Poverty); and statistical analysis of bias that lead to an amendment of the Commonwealth Electoral Act in 1984 which introduced a "double randomisation" method for allocating positions of

[1]I note that all of the other papers in that issue were authored by men, and all listed their first names, except for the Indian econometrician A.L. Nagar. This "JK Rowling" phenomena is still quite common today, no doubt due to concerns about unconscious bias that experimental studies have unfortunately confirmed to exist. See an interesting discussion at https://blogs.scientificamerican.com/unofficial-prognosis/study-shows-gender-bias-in-science-is-real-heres-why-it-matters/.

Left to right: Panellists Marie-Ève Rancourt, Maria Antónia Carravilla, and Alison Harcourt, with Kate Smith-Miles (moderator)

political parties on ballot papers (still used today). She was also foundation secretary of the Victorian branch of the Statistical Society of Australia (1963–1967), and has written several books and journal articles. She formally retired in 1994 but continues to share her passion for teaching as a sessional tutor in mathematics and statistics at The University of Melbourne at the age of eighty-eight!

I wonder how many of Alison's current and former students realise what a pioneer she is? At the time I was learning about the branch-and-bound method as a University of Melbourne undergraduate mathematics student around 1990, Alison was working in the Statistics Department. I am embarrassed to say that I had no idea that the famous Land and Doig (1960) paper was co-authored by someone in the building and that both were women! I wonder what a difference that would have made to me and the few female students I studied with. Having access to such an amazing female role model could possibly have offered inspiration and support that was unfortunately rather scarce at the time.

I'd like to think that things are getting easier for women starting their careers in this generation, and I hope this is true. In Alison's generation there was little by way of support for women whose careers were interrupted, and certainly no consideration of the phrase "relative to opportunity". I consider myself very fortunate that my career trajectory was not too disrupted by child-rearing—thanks to the luxury of having family nearby to assist with childcare, and a supportive husband who allowed his career to take a back seat to help with child-rearing responsibilities. While I took a break from attending international conferences for about five years, I have been able to return to the international

research scene over the last decade with this family support. But this minimal impact on my career trajectory has been my good fortune, not because of a system that was working to make sure that I could reach my potential. These days there are many more systemic efforts to level the playing field and support women more effectively to minimise the impact of career interruptions: the ARC's Relative to Opportunity guidelines for research performance assessment; various mentoring schemes specifically for women; more publicity for women as role models (via the AMSI CHOOSEMATHS program, STAs Superstars of STEM, ARC Georgina Sweet Awards to name just a few examples); and grants such as the AustMS Anne Penfold Street Awards to enable those with carer responsibilities to attend conferences more easily. I hope these strategies are making a difference, so that there will be many more women whose pioneering work we will celebrate in years to come. In the meantime, please join me in acknowledging the remarkable achievements of Alison Harcourt (née Doig).

Kate Smith-Miles is a Georgina Sweet Australian Laureate Fellow, and Professor of Applied Mathematics at The University of Melbourne. She is also a Chief Investigator in the ARC Centre of Excellence in Mathematical and Statistical Frontiers (ACEMS). She was previously Head of the School of Mathematical Sciences at Monash from 2009—2014, and Head of Engineering and IT at Deakin from 2006–2009. Kate is a member of the ARC College of Experts, Chair of the Advisory Board for the AMSI CHOOSEMATHS program, serves on the MATRIX Advisory Board, and is a member of the Federal Government's Knowledge Nation 100 group. She is a Fellow of the Australian Mathematical Society, and Fellow of Engineers Australia. She was awarded the Australian Mathematical Society Medal in 2010 and the EO Tuck Medal from ANZIAM in 2017.

Recognising excellence in university mathematics teaching and learning

Heather Lonsdale*

This article is the first in a series, organised by the AustMS Standing Committee on Mathematics Education, and seeks to recognise contributions to teaching and learning. In particular this article will highlight the work of three mathematicians who were recipients of 2017 AAUT Citations for Outstanding Contributions to Student Learning: Poh Hillock, Deborah Jackson, and Stephen Woodcock.

Introduction

There are a variety of different avenues for teaching staff to seek recognition of their excellence in teaching. Most universities have internal awards at a range of levels, whether university-wide or specific to a faculty or school, and these can provide a chance to achieve recognition of teaching excellence and to further disseminate good practice.

At a national level, the Australian Awards for University Teaching (AAUT) consists of five different award programs [2]. Among these are the Citations for Outstanding Contributions to Student Learning, which are awarded to those who have made a significant contribution to the quality of student learning in a specific area of responsibility over a sustained period. In 2017, three of these citations were awarded in the area of mathematics, and this article will profile each of these recipients.

Poh Hillock, University of Queensland

Citation for Poh Hillock: For a mathematics support program that improves student success by building confidence and fostering hard work and perseverance through participation in a community of practice.

Dr Poh Hillock teaches MATH1051 Calculus & Linear Algebra I, a first-year course that has a yearly enrolment exceeding 1500 students and services more than 45 programs at The University of Queensland. The course has a failure rate of about 20–30% each semester, including many multiple repeaters.

*WA representative on the AustMS Standing Committee on Mathematics Education.
Email: heather.lonsdale@curtin.edu.au

One of the first projects that Poh was involved in, when she joined UQ in 2012, was a study which documented student errors in an examination. This study led to the development and implementation of the Support Learning Tutorial (SLT), a voluntary weekly tutorial program aimed at students who were at risk of failing MATH1051. By providing targeted, timely and sustained support within a community of practice, the SLT has helped many students overcome learning deficits, improve maths skills and attain high levels of achievement.

Poh's excellent work has been reflected in the increased pass rates, in particular for repeating students, for attendees at the SLT. In addition to the AAUT citation, Poh's work with SLT students has also been recognised with a UQ Faculty of Science Teaching Excellence Award (2014), and a UQ Citation for Outstanding Contribution to Student Learning Award (2016). Further details of the support programme can be found in one of Poh's papers [4], and Poh can be contacted at p.hillock@uq.edu.au.

Deborah Jackson, La Trobe University

Citation for Deborah Jackson: For excellence in the development, teaching and leadership of an innovative Maths Skills Program that addresses diverse student needs in Science, Health and Engineering disciplines.

Dr Deborah Jackson, from La Trobe University, College of Science, Health and Engineering, and the Department of Mathematics and Statistics, has created and delivered the Maths Skills Program. This program offers cross-disciplinary mathematics support for a diverse range of subjects.

Since its pilot in 2010, the program now supports more than 30 subjects each year over six campuses. Maths Skills consists of a set of programs, each designed for a particular discipline and tailored to suit it. Participating disciplines include Chemistry, Biology, Physics, Statistics, Biochemistry and Biotechnology, Nursing, Engineering, Exercise and Sports Biomechanics, Statistics for Psychology, and various mathematics subjects. The program helps students improve their maths confidence, self-assessment, self-regulation and motivation. The Maths Skills program is integrated into the subject which it is supporting and provides students with choices about their learning modes.

Deborah has disseminated her work widely, giving talks in the mathematics education session of AustMS meetings, at First Year in Mathematics network meetings, and at the Australian Conference on Science and Mathematics Education, as well as through published papers ([5], [6]). For more information about the Maths Skills program, please contact Dr Deborah Jackson, d.jackson@latrobe.edu.au.

Stephen Woodcock, University of Technology Sydney

Citation for Stephen Woodcock: For development of curricula and resources to foster enquiry-oriented and research-inspired thinking in the applied mathematical sciences.

Dr Stephen Woodcock has developed a range of resources and classes designed to reduce students' reliance on rote learning, beginning in their first semester and scaffolded over a sequence of several subjects in a mathematics major. Having noticed students entering undergraduate study with an over-reliance on "pattern learning", Stephen saw this as an important element of the transition process to university.

Stephen developed problem-based materials and introduced modelling workshops that emphasise the importance of estimation and sense-checking of results. These are aimed to encourage students to make reasoned estimates, and to support those estimates with justification, rather than feeling that their ability is limited to memorising formula, and hence equip them to approach unfamiliar problems.

This program for undergraduate students was recognised by an internal UTS Teaching and Learning Citation in 2015. A discussion of the innovative approach and an evaluation of its impact on student learning was published in the ANZIAM Journal in 2016 [8]. Stephen has also been very engaged in outreach activities, producing plain language explanations of everyday applications of mathematical concepts ([9], [7]). Stephen can be contacted at Stephen.Woodcock@uts.edu.au to discuss his work further.

Award Opportunities

Aspiring teaching award recipients are strongly encouraged to pursue internal award schemes through their universities, and to build towards national awards where possible. Note that the Australian Awards for University Teaching awards will be led by Universities Australia from 2018 onwards [3]. No details are yet available on the process for applying for these awards, which may change under new governance and funding arrangements.

This year the Australian Mathematical Society has launched its Annual Teaching Excellence Awards [1], to be presented at the Annual Meeting for the first time in 2018. There will be two awards, with one reserved for early career academics, and these will provide an opportunity to recognise excellence in teaching in the particular context of mathematics. Further details are available on the AustMS website at http://www.austms.org.au/Teaching+Awards.

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