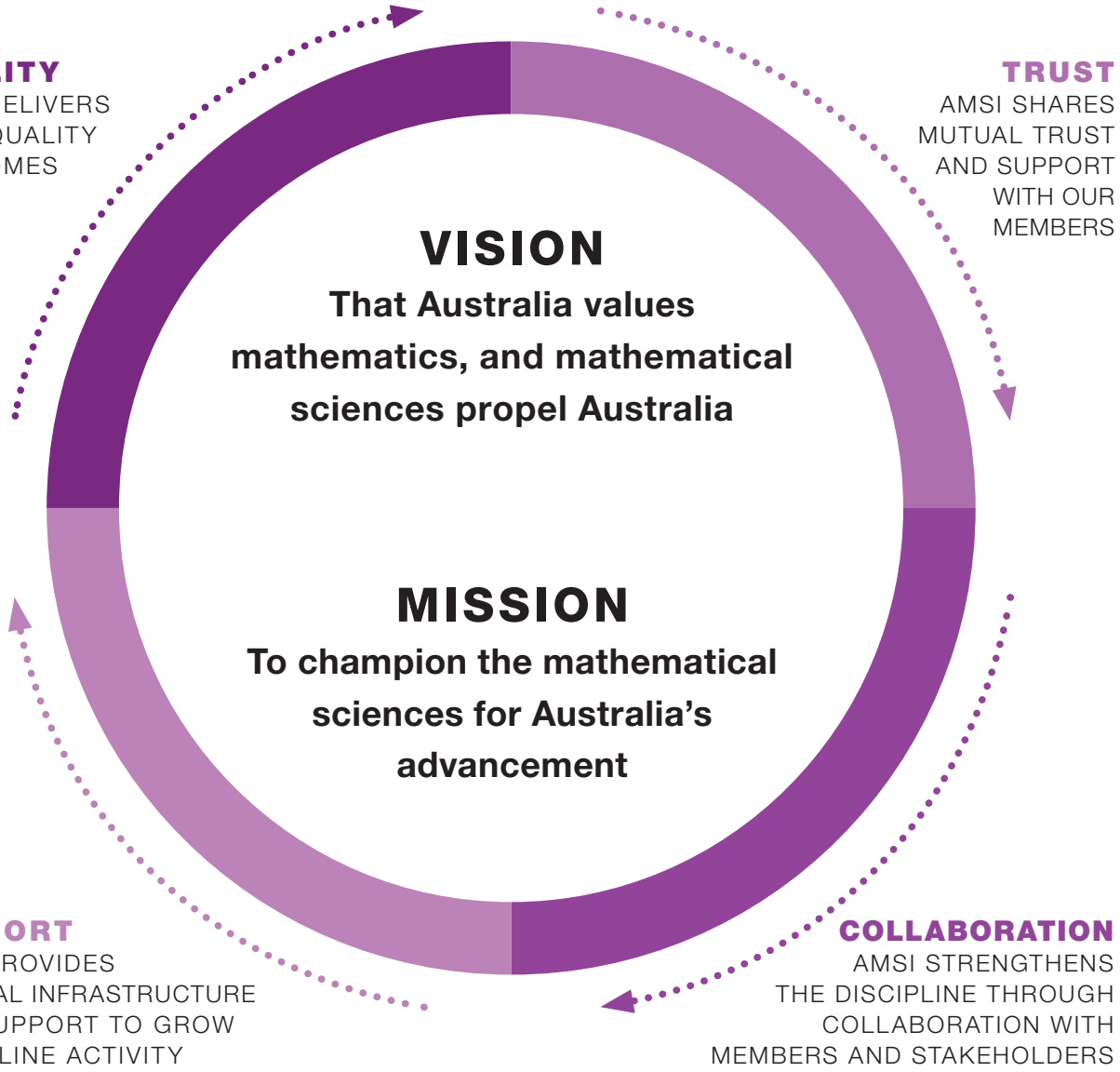
AMSI AUSTRALIAN MATHEMATICAL SCIENCES INSTITUTE

ANNUAL REPORT **2021**

Our Vision & Mission



Contents

AMSI Members

Full Members

La Trobe University
Monash University
QUT
RMIT University
Australian National University
The University of Melbourne
The University of Newcastle Australia
The University Of Queensland
The University of Sydney
The University of Western Australia
The University of Adelaide
UNSW Australia

Associate Members

Curtin University
Deakin University
ECU Edith Cowan University
Flinders University
Griffith University
James Cook University Australia
Macquarie University
Murdoch University
Swinburne University of Technology
University of New England
University of South Australia
University of Southern Queensland
University of Tasmania
UTS
University of Wollongong Australia
Victoria University Melbourne Australia
Western Sydney University

Government Agencies

Australian Bureau of Statistics
Australian Government Bureau of Meteorology
CSIRO
DST Group
Reserve Bank of Australia

Societies

ABACBS
ANZIAM
Aust MS
The Mathematical Association of Victoria
MERGA
NZMS
Statistical Society of Australia
The New Zealand Statistical Association

From the Chair

During 2021, we were witness again to changes in the external environment that AMSI operates in. This included the ongoing impacts of the COVID-19 pandemic, floods, earthquakes and general global uncertainty.

These events, and the uncertainty generated, continue to reinforce the importance of utilising the mathematical sciences to provide understanding and support decision making for the benefit of Australia's future.

During the past year, AMSI has shown incredible tenacity and resilience as it delivers on its mission to champion the mathematical sciences for Australia's advancement. To this aim, AMSI's Research & Higher Education programs delivered five flagship events and 16 sponsored workshops, while APR.Intern placed 197 PhD students into industry internships — creating significant value for universities, corporates and students across Australia. Collectively, these programs directly impacted nearly 2000 students of the mathematical sciences and other cognate disciplines.

Notably, APR.Intern is now being delivered under a new program model developed by AMSI following the conclusion of the Federal Government's *National Research Internships Program (NRIP*) grant, which allowed APR.Intern to expand nationally from 2017-2021.

We continue to see unprecedented demand from the corporate sector for high levels of rigour in analysing, predicting and gaining insights into what drives value. Ongoing collaboration between industry and the university sector will maximise the opportunities to commercialise scientific ideas, and AMSI is an enabler of this. I strongly believe that embedding mathematical competency into Australian organisations is fundamental to success and sustainability, and more than ever we see it is essential in our complex environment.

Many advantages exist in having the ability to use data scientifically and robustly for competitive advantage, to automate and apply artificial intelligence. All of these initiatives have mathematical sciences at their core, and the AMSI mission remains valid — to champion the mathematical sciences for Australia's benefit.

I highly commend the efforts of the AMSI Executive and staff in their ongoing dedication to serving AMSI and delivering its programs and initiatives. Your resilience, innovation and persistence help make AMSI outstanding, and it has been a pleasure to work with you all.

A big thank you goes out to the membership base of AMSI, which is integral to AMSI existing and remaining funded, and to our very loyal and dedicated alumni — we appreciate your ongoing support.

I have deeply appreciated the support and contributions from the AMSI Board during my time as Chair in the past years. This input has been invaluable for the strategic direction and governance of AMSI. A special commendation is owed to the dedicated Joint Venture Partner member representatives and those on our standing committees who take such an active interest in the success of AMSI and its programs.

I would like to acknowledge the University of Melbourne for providing ongoing support and expertise to AMSI as Lead Agent across many functions. AMSI is also grateful for funding awarded in prior years from the Federal Government, which has enabled significant investment into APR.Intern and AMSI's flagship events.

In reflecting on 10 years of serving on the AMSI Board and three years as Chair, what remains clear is the relevance of AMSI's mission. What remains constant is the overwhelming support and loyalty from the AMSI alumni, members, staff and sponsors,

which is integral to help AMSI deliver on its mission for the benefit of the mathematical sciences community in Australia.

I am very pleased that in July 2022, Dr Les Trudzik succeeds me as Chair of AMSI, and I look forward to seeing AMSI continuing to make impact as I remain a strong and avid supporter.

Adelle Howse
October 2022

From the Director

AMSI is a national voice for the mathematical sciences and delivers major programs across the mathematical sciences pipeline including schools, higher education, research and industry to increase the capacity of Australia's mathematical workforce, which is critical for our future technology-based economy. AMSI advocates to government, industry and the wider community, on behalf of its broad-based membership, in order to champion the mathematical sciences.

An important campaign in 2021 was advocacy relating to the Australian F-10 mathematics curriculum. In mid-2021, AMSI members expressed serious concerns relating to the consultation draft for the new curriculum. AMSI and the AustMS provided feedback, both to ACARA and the Federal Education Minister's office, regarding revisions to the curriculum. I believe the now approved new national F–10 mathematics curriculum is a significant improvement on the initial consultation draft and that our sustained advocacy was a very important part of this process.

During 2021, the challenges relating to school mathematics education in Australia appeared frequently in the national media. When interviewed on these matters, I highlighted AMSI member concerns relating to issues such as declining rates of participation in year 12 mathematics subjects and shortages of mathematics teachers, and suggested solutions to tackle the high rates of out-of-field mathematics teaching.

In 2021, AMSI welcomed two new associate members, the New Zealand Mathematical Society and the New Zealand Statistical Association. Many of the challenges and opportunities for the mathematical sciences are common to both Australia and New Zealand and it is extremely beneficial to work together with our NZ colleagues on these issues.

In 2021, three major externally funded AMSI programs concluded, all of which were highly successful and achieved remarkable results. The *Securing Australia's Mathematical Workforce (SAMW) 2016-2021* government grant supported 2700 participants and 23 national research and higher education events, over five years. The *National Research Internships Program (NRIP) 2017-2021*, again government funded, delivered 650 PhD industry internships with 41% female interns. Participants advanced their mathematical sciences skills, employability and national networks, and a third of PhD interns obtained employment as a result of the internship.

In 2021, the final report was also delivered to the BHP Foundation on the conclusion of ChooseMATHS 2015-2020 program. The ChooseMATHS program delivered outstanding results relating to mathematics and numeracy teacher professional development in schools, careers awareness, supporting female students and celebrating excellent teachers and students in mathematics.

During 2021, AMSI held its flagship Higher Education events in virtual and hybrid modes, due to the COVID-19 pandemic; these were Summer School (hosted by the University of Adelaide), Winter School (hosted by Queensland University of Technology), AMSIConnect, ACE Network Subjects and BioInfoSummer. All the events were extremely successful; both the Summer and Winter Schools had record attendances, with 190 and 110 enrolments, respectively. Thanks go to the AMSI Research and Higher Education team for transitioning these events to online.

During 2021, the APR.Intern program also enjoyed outstanding success, placing almost 200 PhD students into internships, across all disciplines. The first half of 2021 represented the last phase of the NRIP, while later in the year, the APR.Intern program transitioned to an independent program.

AMSI continues to work on sourcing new funding streams for its Schools, Research and Higher Education and APR.Intern programs, and on delivering excellent value to its members.

Professor Tim Marchant
October 2022

Introducing our Chief Operating Officer

2021 was a year of reorientation for AMSI, brought on by the global pandemic and the conclusion of three major and highly successful AMSI programs. The SAMW, NRIP and ChooseMaths programs were all capably brought in to land by the AMSI team, with all reports, reviews and acquittals accounted for and submitted to our funding partners.

The AMSI team had a dual and complex focus in 2021, some of which was on endings and some on new beginnings. In 2021, AMSI made a strategic decision to formally implement a philanthropy arm and we worked closely with consultants at Global Philanthropic to develop and implement a robust philanthropic strategy. At the end of 2021, the strategy was approved for implementation.

The Higher Education team delivered all programs and worked hard to pivot their broad array of offerings into hybrid mode so as not to disadvantage the students of mathematical sciences. We are thankful to all stakeholders for their cooperation and collaboration in these trying times for program delivery, which resulted in sustained participation rates and in some instances, record attendances.

The APR.Intern program had a highly productive and interesting year. It had to walk and chew gum at the same time, both bringing the NRIP government grant to a conclusion and successfully standing up a new ongoing model. The program had a record-breaking year delivering 197 internships and cementing its place as an expert facilitator of university-industry research collaboration, translation and commercialisation.

The AMSI Schools program continued to deliver the unique MathsTalk podcast in 2021, which stands alone as the only maths podcast for teachers in Australia and a very popular resource for teacher professional development and support. The Calculate and Schools websites also continued to be an ever-popular global resource for maths education tools and the AMSI maths textbooks sales continued in their ever-steady state.

AMSI advocacy continued in 2021, with an emphasis on supporting submissions to government and potential philanthropic partners, as well in the report writing for the closing of programs. Advocacy and finance were rolled together this year and the combination of maths ecosystem overview, writing skills and financial insight has worked extremely well.

The AMSI functions of marketing and design continued to offer their strong, dedicated and professional support to the various activities and initiatives for the year. I like to say ‘all roads lead to marketing and design’, and they really do. Everything that AMSI does or implements requires marketing, PR, communications and a close eye on branding.

From the governing bodies to the day-to-day operations, AMSI has demonstrated that it is flexible, resilient, nimble and cooperative – all attributes that have contributed to a productive, professional and positive culture in 2021, for which I am very grateful.

Lisa Farrar
October 2022

Major Achievements 2017–2021

- **$21.4M** in government funding and **$11.4M** in philanthropic funding generated by **$6.4M** in member subscriptions
- **2,766** participants at **27** AMSI flagship events
- **5,599** participants at **82** AMSI-sponsored scientific workshops
- **576** travel grants awarded to students
- **313** international mathematicians sponsored to speak at workshops
- **690** PhD students placed into industry internships, generating **$3,795,000** in research funding for universities, nationally
- A vibrant and influential school mathematics program including **1,719** school visit days at **120** schools across Australia
- **3,284** attendees at **383** professional development days for teachers
- **15,000** downloads of the AMSI Schools MathsTalk Podcast for teachers
- Publication of AMSI's flagship report, **State of Mathematical Sciences**, conveying key issues affecting the role and stature of mathematics in Australia
- Publication of additional reports; **2** Occasional Papers, **2** Gender Reports and **5** Survey Data Reports including data on Year 12 mathematics participation
- **Consistent advocacy** to government on the vital role of the mathematical sciences for Australia's advancement


AMSI
AUSTRALIAN MATHEMATICAL SCIENCES INSTITUTE
FIRE HYDRANT

Policy & Advocacy

The central voice for Australia's mathematical sciences, AMSI actively enters the national debate to advocate for critical reform across the mathematics pipeline spanning school-based and higher education, research, training and funding to industry collaboration and innovation to increase capacity and engagement.

Dr Maaike Wienk
Finance, Advocacy & Policy Manager
maaike.wienk@amsi.org.au

AMSI.ORG.AU

Strategy & Policy

In its policy document, *Mathematical Sciences: Foundation for Australia's Future — Policy Priorities realising AMSI's long-term strategic goals,* AMSI proposes immediate action in three areas of priority in line with AMSI's long-term strategic goals for the mathematical sciences in Australia:

- Equity and diversity
- Mathematical education
- Industry engagement in university teaching and research

These priority areas inform AMSI's current advocacy for the mathematical sciences and add to its ongoing programs to support mathematical research and education in schools and at universities.

AMSI'S LONG-TERM GOALS FOR THE MATHEMATICAL SCIENCES IN AUSTRALIA:

Australia **recognises and enjoys the benefits** of mathematical sciences

Australia **recognises the necessity for diversity** in the mathematical sciences workforce

Australia has **balanced supply and demand** for the Australian mathematical sciences workforce

Australia values mathematical sciences **research and its contributions**

The overall participation in high-level mathematical sciences at schools and universities **meets Australia's needs**

Policy Document: amsi.org.au/foundation-for-australias-future

2021 Policy Submissions

AMSI represents the mathematical sciences through submission of responses to national issues, papers and reviews.

The Mathematics Consultation Curriculum F–10 - Response to the ACARA Australian Curriculum Review Consultation, July 2021

In early 2021, the Australian Curriculum, Assessment and Reporting Authority (ACARA) presented a revision of the Australian school curriculum, including for Foundation to Year 10 mathematics. Following consultation with representatives of the member organisations, AMSI proposed for the introduction of the new Foundation to Year 10 mathematics curriculum to be delayed. While supportive of a review of the Australian F-10 mathematics curriculum, as part of a comprehensive strategy to address some of the challenges facing school mathematics and its teaching, AMSI pointed to a number of significant flaws in the design of the new curriculum.

Following the submission, AMSI continued to work constructively with ACARA to assist with a thorough review and revision of the revised mathematics curriculum. In April 2022, the State and Federal Education Ministers endorsed the new curriculum.

Submission: amsi.org.au/wp-content/uploads/2021/07/amsi_response_acara-_final_july2021.pdf

Growing Industry Internships for Research PhD Students through the Research Training Program - Implementation, August 2021

In this submission, AMSI provided comment on the implementation of new funding for universities to facilitate industry internships for PhD students under the new Research Training Program (RTP). Under this program, universities receive funding to facilitate PhD internships in industry in the first 18 months of candidature, for 60 full-time equivalent days (approximately three months).

Based on extensive experience with the APR.Intern program and comprehensive user feedback from participants, AMSI made the following recommendations for the implementation of the new RTP funding to ensure PhD internships best meet the needs of universities, industry and PhD students:

- No restrictions on the timing of internships to allow industry, interns and universities to facilitate internships at a time that is optimal for all parties involved
- Internships are offered in a single block of time, so that focus can be achieved, and the industry research project can be completed in a defined period
- To take the three-month RTP guideline strictly as a minimum only and allow the duration of the internship to be guided by the needs of the parties involved and the requirements of the internship project

Submission: amsi.org.au/wp-content/uploads/2021/08/rtp_submission_amsi_final.pdf

Panel Discussions

In 2021, AMSI introduced panel discussions at all AMSI member meetings, which take place twice a year, to engage with topics affecting the mathematical sciences, to inform members of current developments, to foster collaboration among universities and other organisations with an interest in promoting the mathematical sciences, and to elicit input and feedback into AMSI's advocacy and policy program.

Throughout the year, two panel discussions were organised:

February 2021: Out-of-Field Teaching

Speaker: Professor Merrilyn Goos, University of the Sunshine Coast

Panel Members:

- Professor Kim Beswick, University of New South Wales
- Dr Jill Brown, Deakin University
- Associate Professor Linda Hobbs, Deakin University

Members received a presentation from Professor Goos on the retraining of secondary school teachers in mathematics in Ireland. In order to address the decline in mathematics literacy among students, as well as the increase in secondary teachers who taught mathematics without a mathematics teaching qualification, the government agreed to pay tuition fees and kept a registry of qualified mathematics teachers. Teachers from low socio-economic areas were given priority. The number of enrolments was determined by the level of government funding. Blended learning options (online and face-to-face) were offered to encourage teacher participation across the country.

Positive outcomes included an increase in teachers' confidence and knowledge of mathematics, improvement of teaching techniques and classroom practices, reduction in out-of-field teaching of mathematics, introduction of nationally consistent standards through a university accredited course, and long-term sustainability for the program.

Panel Discussions – *continued*

July 2021: Challenges & Opportunities in Mathematics Education in Australia

Speakers:

- Professor Catherine Attard, Western Sydney University, Mathematics Education Research Group of Australasia (MERGA)
- Professor Joseph Grotowski, University of Queensland
- Associate Professor Linda Galligan, USQ
- Dr Giuseppina Dall'Armi-Stoks, Defence Science and Technology Group

The speakers discussed the following current themes:

1 Maths Teacher Education

There are not enough mathematically qualified teachers in Australian secondary schools and the initial teacher's education is facing a number of challenges. Pedagogical content knowledge is a critical element of effective teaching, and it is essential to ensure that this, as well as ample mathematical content knowledge are provided in the institutions to diminish the disconnect between theory and practice.

The COVID-19 environment has amplified the existing challenges around the practicum, including difficulties in finding appropriate placements in schools. Continued professional learning is indispensable for teachers of mathematics at all stages during their careers to develop the appropriate depth of pedagogical content knowledge in new teachers and upskill the existing working force.

2 Jobs Ready Graduates Package Reforms

This package, which was implemented at the start of 2021, resulted in a 59% decrease in HECS fees for Commonwealth supported students enrolled in mathematical sciences courses. Moreover, the total per student funding (i.e. combined HECS and government contribution) will decrease by 15%, once the changes are phased in by 2024.

This presents potential funding challenges but also potential opportunities for students, who will pay much less for their studies. The question remains open whether this will lead to additional numbers of students undertaking mathematics degrees or lead to further reductions in mathematical sciences staff capacity (or both).

3 Data Science

In the last few years, student and employer interest in the discipline of Data Science (DS) has grown significantly, which is reflected by establishment of new degrees and majors at Australian universities and increased employer demand for these graduates. The growth in DS presents opportunities to introduce mathematics and statistics to more students and promote their benefit in developing critical and analytical thinking and problem-solving. It is important for the mathematical sciences to work together with computer science and the social sciences. In collaboration with the Statistical Society of Australia (SSA) AMSI has initiated a review on the state of Data Science in Australia, to be published in 2023.

4 COVID-19 & Online Teaching

COVID-19 and lockdowns have required universities to be able to deliver their mathematics teaching fully online. It is likely that mathematics teaching will not return to purely face to face, but that hybrid and online modes of learning will continue. Many challenges exist for disciplines such as mathematics which have traditionally used in-person exam-based assessments; these include online assessment integrity and plagiarism.

5 Challenges in Regional, Rural & Remote Australia

Universities in regional and remote areas of Australia face additional challenges compared to metropolitan universities. Students tend to be older and from low SES backgrounds. Some of the challenges include keeping mathematics and statistics majors viable, and to provide effective teaching and support to low SES students. Teaching mathematics and statistics is needed in various degrees such as engineering and business, so the challenges lie around knowing how to embed quantitative skills required in degree programs.

6 Training Mathematical Science Graduates for Industry

Employment growth in the fields of data analytics, financial services, cyber security, artificial intelligence, machine learning and defence industries has created many employment opportunities for mathematical sciences graduates. The government encourages industries to work with academia in order to increase the number of maths and STEM graduates and ensure that there is a diverse workforce. One important example of industry-university engagement is the DST Group, which engages with universities through a large variety of programs such as the Defence Graduate Program, Summer Vacation Placement Program, Industry Experience Placement Program, and Graduate Industry Placement program.

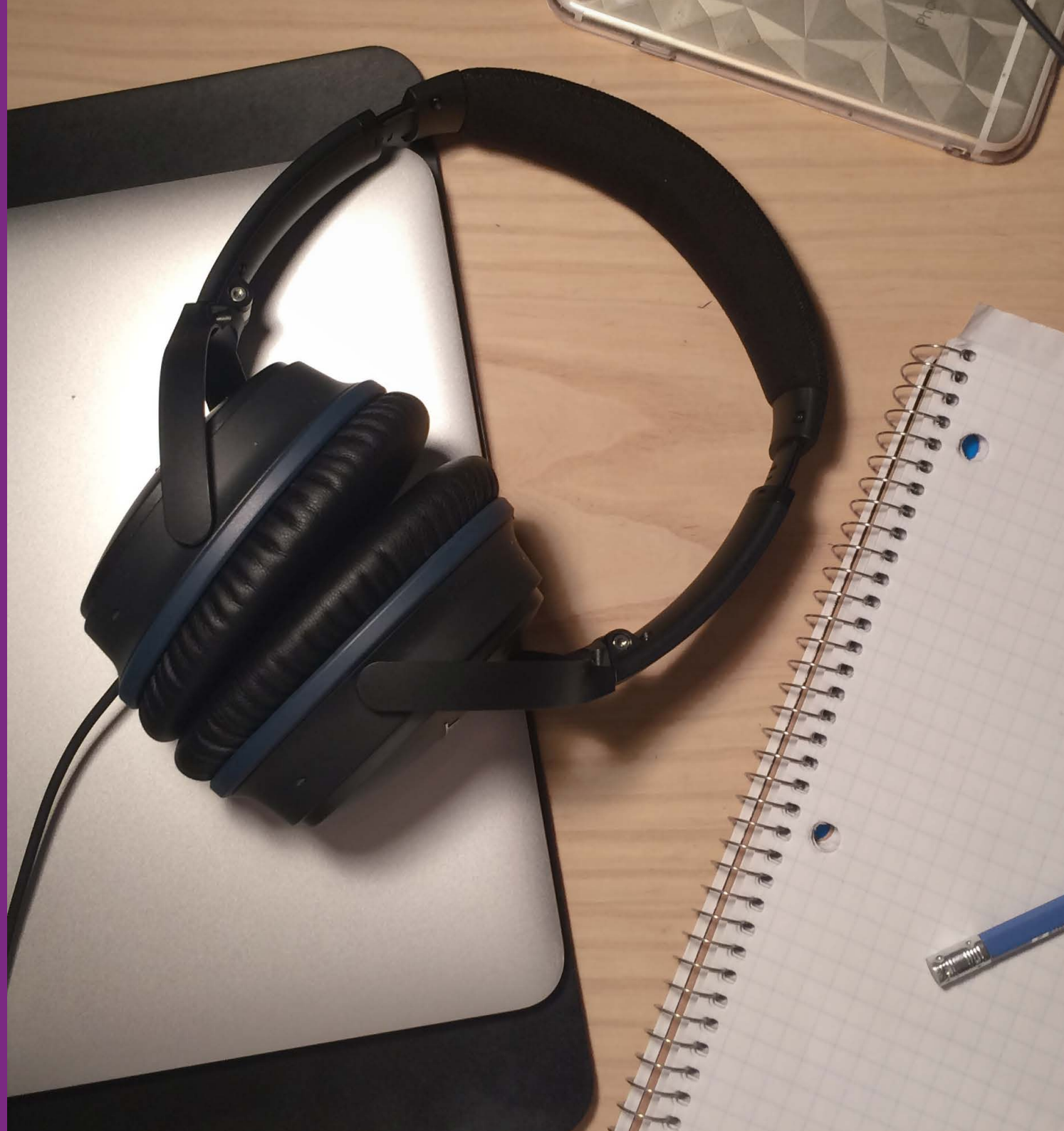
Schools

The AMSI Schools program delivers a range of initiatives that support and strengthen mathematics teaching in schools, including resources for teachers, students and parents, and professional development programs.

The work of the AMSI Schools team has gone a long way to transform the conversation regarding the teaching and learning of mathematics. Students and teachers are now more competently and confidently navigating the world of mathematics, based on knowledge of what benefits the study of mathematics can bring to their lives.

Leanne McMahon
Schools Outreach Officer
leanne@amsi.org.au

SCHOOLS.AMSI.ORG.AU



Finalising ChooseMATHS

The completion of AMSI's highly successful ChooseMATHS project saw the delivery of the ChooseMATHS final report to the BHP Foundation in 2021. This report tells the story of a project that resulted in thousands of school visits across Australia, reaching tens of thousands of teachers and students, two highly engaging maths careers campaigns, a women in mathematics mentoring network, four inspiring awards ceremonies that distributed hundreds of student and teacher awards, and a new maths podcast with well over 15,000 downloads—and counting. The report details the achievements in each of the four main ChooseMATHS project components and the ChooseMATHS research component, which underpinned the project. It also examines the challenges and learnings that will inform AMSI's future projects. While KPIs were based around the number of visits, the value of the ChooseMATHS Outreach component transcends these numbers, as evidenced by the feedback from participating schools and the program evaluation.

In addition to the Outreach activities in schools, ChooseMATHS Outreach Officers delivered many keynote and session presentations at teacher conferences organised by state-based and national maths teacher associations. It was concluded that the ChooseMATHS project had a significant impact on mathematics education across Australia and provided important knowledge and insight for further programs to BHP, AMSI and the mathematics education community.

Outreach

In June 2021, AMSI was able to resume attendance at face-to-face conferences, with Leanne McMahon presenting at the MASA State conference in Adelaide. The respect that the maths education community have for the ChooseMATHS Outreach Officers was clear, with former AMSI staff Helen Booth and Cassandra Lowry entrancing the audience with their keynote address on maths anxiety, and Nadia Abdelal, Jacinta Blencowe and Leanne McMahon receiving excellent feedback on their sessions that encompassed podcasting, data analysis, maths games and more.

The need for the AMSI Outreach program was highlighted by many teachers in AMSI's interactions, and requests for assistance were plentiful. To this end, the whole of AMSI is seeking further funding opportunities to continue to expand on the foundation built by ChooseMATHS.

Consulting

An area in which AMSI has had a vital role to play is in the development and consultation of the new curriculum by ACARA. AMSI is in the unique position of being an organisation that not only advocates for the mathematical sciences, but has expertise in the teaching of these.

AMSI's understanding of mathematics in schools was vital to the preparation of the AMSI response to the ACARA draft curriculum and highlights the importance of the maintenance of a strong connection to school mathematics educators as a part of the pipeline. The Federal Education Minister has communicated his reliance on AMSI through various releases and AMSI's work with Joint Venture Partners and ACARA has ensured that the curriculum delivered meets the highest of standards, mathematically and educationally.

AMSI had a representative at the Out of Field Teaching Summit in October 2021, where the Institute advocated strenuously for action to train out-of-field mathematics teachers and address the problem identified in AMSI's paper, 'Crunching the Numbers in Out of Field Teaching.'

Teacher Professional Learning

AMSI Schools continues to engage with many stakeholders to ensure that the AMSI brand is well recognised in all Australian primary and secondary schools. Teacher professional learning courses have been submitted to the NSW Education Standards Authority (NESA) for accreditation—a rigorous process that involves matching AMSI's professional learning offerings to the Australian Professional standards for teachers. AMSI's activities must also meet the principles of professional learning, something the Schools division has always taken very seriously. When accreditation is finalised, AMSI will begin to offer its professional learning activities nationally.

MathsTalk Podcast

The MathsTalk podcast by AMSI Schools continues to go from strength to strength, with over 15,000 downloads.

MathsTalk stands alone as the only podcast dedicated to the teaching and learning of mathematics in Australia, and it has extended AMSI's Outreach program beyond participating schools to the wider education community in Australia and even overseas.

In addition, AMSI's access to a network of well-known experts in mathematics education has made the MathsTalk podcast a go-to for maths educators. With an initial 31 episodes over two years, the podcast has already built a dedicated following with enormous potential to grow. Nine episodes were released in 2021.

2021 PODCAST EPISODES

JAN	2021 Re-Release: Starting the Year—What Classrooms Needs
MAR	Conceptual Understanding: Primary to Secondary
	Re-release: The Equals Sign
	Conceptual Understanding Part 2
MAY	Re-release: Fluency in Mathematics
JUL	Re-release: Multiplication Matters Part 1
	Interventions in Maths
AUG	Changes to the Australian Curriculum—Maths
NOV	Tutoring in Mathematics

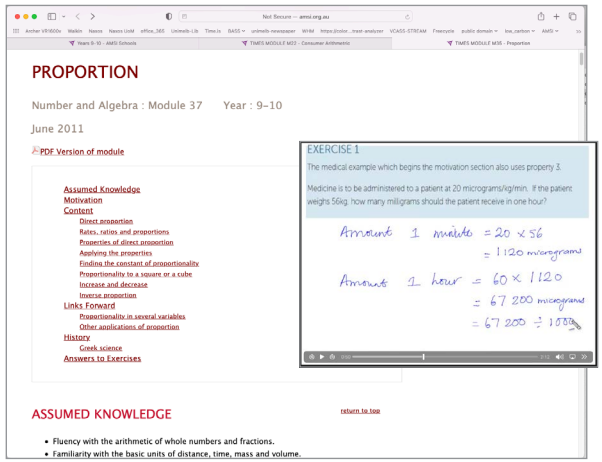
Above: *MathsTalk Host, AMSI's Leanne McMahon*

Teacher Resources

AMSI Schools has continued to develop a sizeable collection of teacher resources and modules with support from various funding partners. These resources continue to support teachers from Foundation to Year 12 with free mathematics materials.

The AMSI Schools and Calculate websites also host The Improving Mathematics Education in Schools (TIMES), funded by the Australian Government, and Supporting Australian Mathematics (SAM, funded by Education Services Australia) curriculum resource modules.

Nationally and internationally popular, AMSI's teacher resources continue to be the most visited part of any AMSI website.

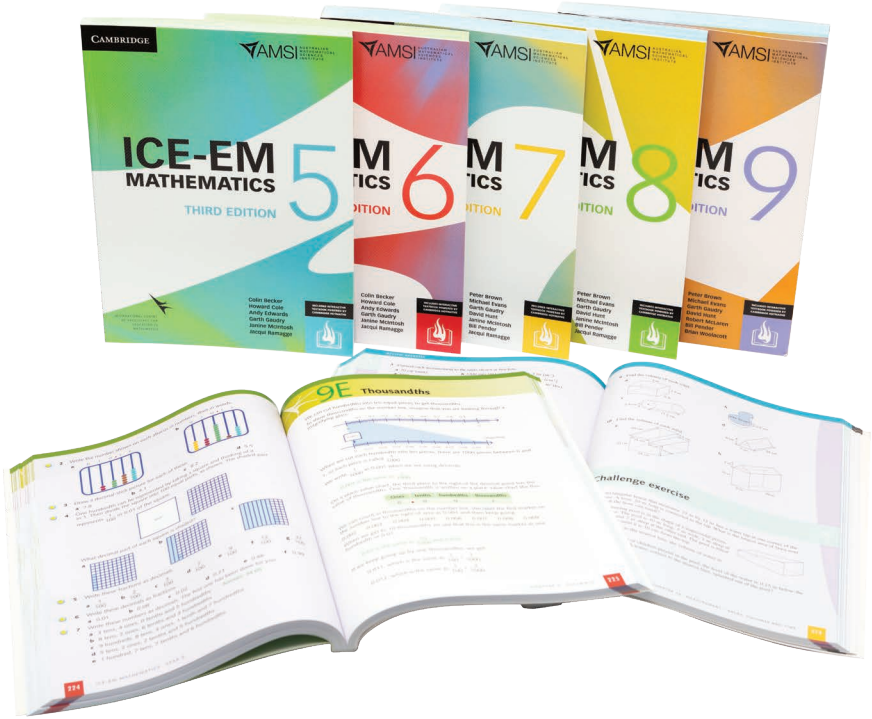


ICE-EM Mathematics

The ICE-EM Mathematics textbooks series was first self-published by AMSI in 2006. Together with AMSI Schools teacher professional development, the textbooks have become a well-regarded source of classroom support in the industry and a vital source of income for AMSI. Now published by Cambridge University Press, the textbooks include a large online component and sales of the Third Edition continue to do well.

The ICE-EM Mathematics series develops a clear understanding of mathematical ideas and concepts for students with a range of abilities, needs and levels of interest.

With the updating of the Australian curriculum, a fourth edition is in the pipeline and the newly enhanced online component provided further incentive to make the change.



Research & Higher Education

AMSI's Research & Higher Education programs play a critical role in delivering national research training schools and scholarships, careers events, industry-focused symposia, advanced online subjects, support for visiting lecturers and researchers, and an internationally recognised scientific research workshop program.

The flagship events provide students with a world-class introductory research experience, which supports their progression to research studies or the technology workforce, while the workshop program nurtures collaboration and knowledge sharing critical to mathematical discovery.

Angela Coughlin
National Program Manager — Research & Higher Education
angela.coughlin@amsi.org.au

RHED.AMSI.ORG.AU

2021 Overview

AMSI's flagship Research & Higher Education events and sponsored workshops empower students and researchers to grow and develop their mathematical skills, and continued to demonstrate their relevance and importance in the Australian mathematical sciences landscape in 2021.

Through exposure to cutting-edge methodologies and access to world-class lecturers and researchers, these programs provide the opportunity to deepen knowledge, engage in cross-disciplinary research, forge new networks and drive industry innovation.

The ongoing impacts of the global pandemic saw the continuation of events successfully transitioning to virtual and hybrid formats. The introduction of state-based event hubs in 2021 allowed participants to attend some in-person events when COVID-19 rules allowed, and the flexibility to continue with the program virtually in the event of a lockdown.

AMSI's long-term funding partnership with the Department of Education concluded on a high, with remarkable results achieved in delivering the *Securing Australia's Mathematical Workforce (SAMW) 2016-2021* project. 23 national flagship events were held in six states and territories with 2,679 total participants including 1,905 domestic participants. The events connected students, early-career researchers and academics with 57 industry organisations and 352 national and international experts.

Starting at second-year undergraduate level right through to PhD students and early-career researchers, participants advanced their mathematical sciences skills, employability and national networks through this extensive program of research training schools, scholarships, and industry-research symposia.

Providing a Platform for World-Class Talent

World-class experts delivered a mix of virtual and in-person presentations, public lectures, specialised courses and workshops to educate our current and future student pipeline and workforce. Academic guests at the flagship events came from a variety of institutions around the world including the Genome Institute of Singapore, Harvard T.H. Chan School of Public Health (USA), Institute for Integrative Systems Biology, Spanish National Research Council (Spain), NextRNA Therapeutics (USA), Salk Institute for Biological Studies (USA), The University of Otago (NZ) and the University of Utah (USA).

Supporting Diversity & Inclusion

For Australia to reach its full potential, our future mathematical workforce needs to be more diverse. AMSI Travel Grants and Registration Scholarships address financial and social barriers to participation of currently under-represented groups, including female, First Nations, and regional, rural, and remote students at AMSI events. Hybrid participation options further increase the accessibility of AMSI flagship events to those unable to travel. In 2021, 122 students including 34 women received registration scholarships to participate in the flagship programs and activities. The scholarships were awarded on a competitive basis by the respective event committees.

AMSI diversity in STEM events held as part of the flagship event programs covered a variety of topics including engagements and inclusion, LGBTQI+ issues, mental health, industry mentors, advocates, role models, the advantages of embracing different perspectives in the workplace and ways to create a more inclusive community.

KEY STATS

654 AMSI flagship event participants

31% of flagship event participants were female

122 students received AMSI Registration Scholarships

16 sponsored workshops held in 2021

More than **1,100** workshop participants

Approx. **30%** of workshop participants were female

76 international workshop speakers

Careers

Each of our 2021 flagship events featured several program extras that provided participants with the opportunity to expand their professional networks, connect with the wider mathematical sciences community and foster student-industry engagement. Well-attended Careers sessions held at Summer School, Winter School and BioInfoSummer linked students with employers of mathematical science graduates to give students a clearer idea of what lies beyond their degree. At AMSI-Connect, the conference held for Vacation Research Scholarship students, talks about life as a post-graduate student and as a researcher were included in the program, as well as a careers presentation and Q&A session by AMSI Director Tim Marchant.

Outreach

The embedded outreach programs, popular among event participants, host university staff and the public, continues to foster community engagement with the mathematical sciences. Accessible cutting-edge research is shared across a range of outreach initiatives such as public lectures, panel discussions, blog posts and speaker and student profiles.

2021 also saw the return of the AMSI international lecturer program: the AMSI-ANZIAM public lecture, featuring Dr Cecile Viboud from the Fogarty International Centre, National Institutes of Health (February) and the AMSI-SSA lecture featuring Professor Renate Meyer from The University of Auckland (July).

Further value is gained by making recordings of our public lectures available on the AMSI YouTube (www.youtube.com/c/AustralianMathematicalSciencesInstitute) and social media channels.

AMSI Flagship Events

These events were well-attended, with 654 participants across all 2021 flagship events, demonstrating the demand for cutting-edge content in Australia to further enrich their studies.

AMSI Summer School 2021

11 January – 5 February, The University of Adelaide
SS.AMSI.ORG.AU

Now in its 19th year, AMSI Summer School has become one of the most important annual calendar events in Australia for honours and postgraduate students in the mathematical sciences and cognate disciplines. In 2021, Summer School was held virtually for the first time, attracting 191 students, early career researchers and academics from 21 universities—a record number of participants! Under the supervision of 10 national mathematical sciences research leaders from six Australian universities, students participated in eight intensive courses. From very topical and in-demand subjects such as the modelling of infectious diseases and deep learning, to cutting edge pure mathematics and theoretical physics courses such as algebraic topology and string theory. Delivered online over the four weeks, the subjects incorporated a combination of live streamed lectures, instructional course videos, tutorials, and practice sessions.

Social events and study days held in state-based hubs complemented the online academic program, providing opportunities for participants to meet and socialise in-person. The Careers Day was a highlight of the program and included talks from the Australian Institute of Machine Learning, Australian Space Agency, Optiver, DST Group, CSL, Australian Signals Directorate, CSIRO's Data 61, the University of Queensland, and the University of Adelaide. Public lecturer Professor Kerry Mengersen from Queensland University of Technology drew 200 viewers for her talk on deriving insights from new data sources such as virtual reality, thermal imaging, satellites, and crowdsourcing.

AMSI Vacation Research Scholarships 2020–21

December 2020 – February 2021
VRS.AMSI.ORG.AU

Scholarships were awarded to 50 undergraduate students from 22 member universities—the broadest participation to date—to support them to complete a six-week research project during their 2020-21 summer break. Working alongside some of the nation's leading academics and researchers, students got to experience life as a researcher while developing analytical, critical-thinking and science-communication skills.

At the end of summer, the students presented their results and networked with fellow Scholars at the national AMSIConnect student conference, held virtually for the first time over three days in February. They completed the experience by writing blog posts and research reports outlining their findings.

Winter School 2021

12 – 23 July, Queensland University of Technology
WS.AMSI.ORG.AU

In its 15th year, AMSI Winter School has become an integral part of the events calendar for PhD and postgraduate students, as well as early-career researchers in the mathematical sciences and cognate disciplines. The program introduces participants to cutting-edge research and methodologies by drawing upon the knowledge of national and international lecturers at the forefront of their fields. 2021 saw the return of the program after the pandemic forced the cancellation of the 2020 event. The theme was Statistical Data Science and this two-week program featured modules on Bayesian statistics, advanced Markov Chain Monte Carlo methods, likelihood-free inference, modern neural networks, and dimension reduction for high dimensional data.

Hosted virtually by the Queensland University of Technology with event hubs in Brisbane, Melbourne, and Perth for intervals when COVID-19 restrictions were relaxed, the school attracted a record breaking 109 participants from 24 universities, including a student from Beihang University (China) and industry representatives from the Australian Bureau of Statistics, Boeing Research and Technology, Bureau of Meteorology, CSIRO's Data 61, Department of Defence: Defence Aviation Authority and Geoscience Australia.

Interspersed between classes were a variety of virtual activities including a public lecture by Professor Renate Meyer on the new discoveries made in astronomy facilitated with Bayesian methods, a Celebration of Maths event that illuminated the diverse pathways in mathematical careers, high-quality participant talks and social events for participants to become better acquainted with each and build their national networks.

AMSI BioInfoSummer 2021

29 November – 2 December, Curtin University, James Cook University, The University of Adelaide, The University of Melbourne, UNSW Sydney
BIS.AMSI.ORG.AU

Focused on building Australia's bioinformatics and mathematical/computational biology research capability, AMSI BioInfoSummer explores new and cutting-edge developments and provides training to upskill participants in the latest techniques. The program features global topic expert speakers alongside Australia's leading researchers.

170 students, researchers, and professionals from 43 universities, research institutes and industry organisations participated in the 2021 hybrid event—either virtually or from one of the in-person event hubs in Adelaide, Melbourne, Perth, and Townsville. The conference major themes were High Performance Computing for Bioinformatics, Computational Methods in Human Genomic Health, Metagenomics and Long Reads.

Sessions included hands-on introductory workshops tailored to various discipline backgrounds and specialist lectures by local and international experts. Participants received bioinformatic specific careers advice from academic and industry researchers from WEHI, CSL, University of Utah and UNSW during an interactive afternoon panel. Melanie Farrier from the Department of Defence ran a STEM engagement and inclusion session and WEHI's Aaron Jex delivered a topical public lecture on Advanced technologies underpinning Victoria's COVID-19 wastewater monitoring program.

AMSI ACE Network Honours & Masters Courses 2021

RHED.AMSI.ORG.AU/ACE

The AMSI ACE Network allows honours and masters students to undertake a broader range of specialised mathematical sciences subjects than just those on offer at their home university. This provides access to leading academics outside their current institution and facilitates more honours and masters completions in the mathematical sciences.

The AMSI ACE Network facilitates national collaboration within the Australian mathematical sciences community that supports students studying at smaller universities, particularly those in regional, rural, and remote Australia. In 2021, 19 ACE subjects were delivered online over two semesters to 134 students from 25 AMSI member universities.

Semester 1 Subjects

- Advanced Data Analysis
- Asymptotic and Perturbation Methods for Ordinary and PDEs
- Convex Optimisation
- Elliptic PDEs from an Elementary Viewpoint
- Functional Analysis
- Mathematical Modelling in Ecology
- Networks and High-Dimensional Inference
- Statistical Consulting

Semester 2 Subjects

- Abstract Algebra
- Advanced Numerical Analysis
- Categorical Data Analysis
- Computational Thinking with Python
- Distribution Theory
- Nonlinear PDEs
- Introduction to PDEs
- Lagrangian and Hamiltonian Dynamics
- Mathematical Epidemiology
- Optimisation for Deep Learning
- Topological Groups

AMSI Sponsored Scientific Workshop Program 2021

AMSI.ORG.AU/SCIENTIFIC-WORKSHOPS
RHED.AMSI.ORG.AU/WORKSHOP-FUNDING

AMSI supports collaborations between national and international researchers to strengthen Australia's research capabilities by funding scientific workshops and conferences. Each successful funding application must be proven to be of national benefit. Diversity is a core value of the program and organisers are required to actively encourage the participation of women and early career researchers.

In this second year of restricted meetings during the pandemic, organisers and participants adapted well to remote participation through online video communications. A particularly pleasing aspect was the high number of overseas online participants. While funding usually covers the travel and accommodation expenses of international keynote speakers, the model was adapted under these special circumstances to support digital platforms, keynote recordings and post event publication. Incentive research support payments were also offered to organisers of online events.

After a successful first year in 2020, the MATRIX-AMSI PhD Student Research Collaboration scheme was renewed for 2021. This partnership with MATRIX supports Australian based PhD students to organise symposia and engage in ongoing post event collaboration.

AMSI supported 16 workshops in 2021 covering a variety of topics:

MATRIX-AMSI PhD Student Symposium: Spatial and Temporal Statistics
17–19 February, University of Wollongong (Online)
Attendees: 63

Practical Applications of Network Science 2021
22–23 February, RMIT University and Victoria University (Online)
Attendees: 78

MATRIX-AMSI PhD Student Symposium: (GT)^2: Graduate Talks in Geometry and Topology
2 March – 22 June, University of Sydney (Online)

Mathematical and Statistical Challenges in Modelling Cellular Systems in Biology
11 May, University of Melbourne (Online)
Attendees: 113

MATRIX-AMSI PhD Student Symposium: Dynamical Systems in Topology and Triangulated Categories
7 June – 2 July, Australian National University (Online)
Attendees: 23

MATRIX-AMSI PhD Student Symposium: Categories and Companions
8–12 June, Macquarie University, UNSW Sydney and University of Sydney (Online)
Attendees: 83

PDE Models in Mathematical Biology
24 June, Queensland University of Technology (Online)
Attendees: 90

The Mathematics of Conformal Field Theory II
5–9 July, Australian National University (Online)
Attendees: 96

MATRIX-AMSI PhD Student Symposium: Data-Driven Modelling in Mathematical Biology
28 June – 9 July, Queensland University of Technology (Online)
Attendees: 49

CATS 2021 Computational & Algorithmic Topology, Sydney
19–23 July, The University of Sydney (Online)
Attendees: 41

Early Career & Student Statisticians Conference 2021
26 July – 1 August, Statistical Society of Australia (Online)
Attendees: 93

Indigenising University Mathematics
20–21 September, CARMA, University of Newcastle (Online)
Attendees: 120

Number Theory Down Under 9 (NTDU9)
27–30 September, The University of Sydney (Online)
Attendees: 78

Mathematics of Sea Ice and Ice Sheets 2021
9–12 November, University of Southern Queensland
Attendees: 47

Knot Days Virtual Summer School
15-19 November, Australian National University (Online)
Attendees: 25

Workshop on the Intersections of Computation and Optimisations
22–25 November, RMIT, UNSW Sydney and ANU (Online)
Attendees: 104

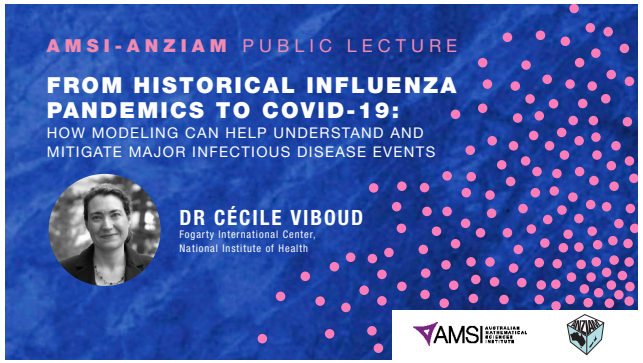
AMSI Lecturers

RHED.AMSI.ORG.AU/PUBLIC-LECTURE

Each year, AMSI partners with the Australian and New Zealand Industrial and Applied Mathematics (ANZIAM) group, the Australian Mathematical Society (AustMS) or the Statistical Society of Australia (SSA) to sponsor an eminent international researcher in the mathematical sciences to undertake a national lecture tour. The funding allows the researcher—whose area of expertise alternates between applied and industrial mathematics and statistics—to visit a broad set of Australian universities and give research presentations at each.

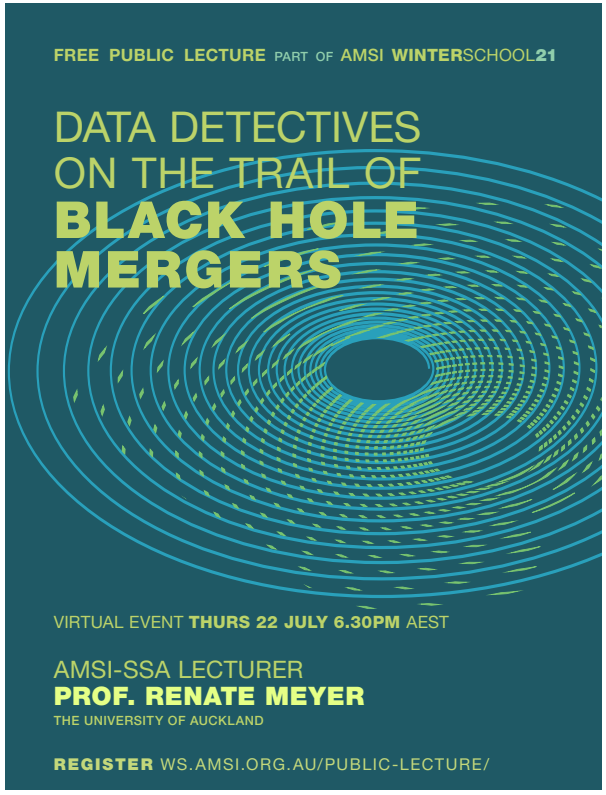
AMSI-ANZIAM Lecturer

Dr Cecile Viboud from the Fogarty International Centre, National Institutes of Health, delivered the 2021 AMSI-ANZIAM Lecture on how mathematical modelling can help scientists and policy makers understand and mitigate major infectious disease events, using examples from historical influenza pandemics and COVID-19. Due to pandemic related travel restrictions a national lecture tour could not be conducted so instead Dr Viboud presented a virtual public lecture on the International Day of Women and Girls in Science (11 February) which was chaired by Professor James McCaw from the University of Melbourne.



AMSI-SSA Lecturer

Professor Renate Meyer from The University of Auckland delivered the 2021 AMSI-SSA Lecture: *Data Detectives on the Trail of Black Hole Mergers*. Due to pandemic related travel restrictions a national lecture tour could not be conducted so instead Professor Meyer delivered a virtual public lecture in conjunction with the AMSI Winter School on 22 July which discussed the role data science plays in helping astrophysicists uncover the mysteries and history of the universe as we know it.



AMSI thanks the following people for their leadership in 2021: Summer School Director Associate Professor Thomas Leistner (The University of Adelaide), Winter School Director Professor Chris Drovandi (Queensland University of Technology), BioInfoSummer organising committee Dr Jimmy Breen (The University of Adelaide), Dr Vicky Perreau (The University of Melbourne), Dr Fatemeh Vafaee (UNSW), Dr Ira Cooke & Associate Professor Matt Field (James Cook University) and Associate Professor Nicola Armstrong (Curtin University), ACE Network Directors Dr Judy-anne Osborn (University of Newcastle) and Associate Professor Stephen Davis (RMIT University), Research Committee Chair Professor Stephen Tillman (The University of Sydney) and Research Committee Deputy Chair Emeritus Professor Phil Broadbridge (La Trobe University). We also acknowledge the contributions of our committee members, of the speakers and lecturers, and Vacation Research Scholarship supervisors and support staff. We are grateful for their generosity in giving their time to ensure the success of these events.

SPONSORS

ARC Centre of Excellence for Mathematical & Statistical Frontiers (ACEMS), Australian BioCommons, Australian Mathematical Society (AustMS), Australian and New Zealand Industrial and Applied Mathematics (ANZIAM), Biostatistics Collaboration of Australia, Curtin University, James Cook University, Optiver, Queensland University of Technology, Queensland University of Technology Centre for Data Science, QCIF, Statistical Society of Australia (SSA), University of Adelaide, University of Melbourne, UNSW Sydney.

Research Collaboration — Parks Victoria

Partnership Update

Parks Victoria is responsible for managing a diverse estate that covers more than 4.1 million hectares (about 18 per cent of Victoria), including national parks, urban parks, wilderness areas, 75 per cent of Victoria's wetlands and 70 per cent of Victoria's coastline.

In 2010, AMSI established a collaborative research partnership with Parks Victoria to provide statistical support for their environmental monitoring, evaluation and reporting activities.

This partnership, enabled through Parks Victoria's Research Partners Panel, embedded AMSI statistician Kally Yuen within Parks Victoria's Environmental Research Partnerships and Programs Unit of the Environment and Science Division, actively supporting research and monitoring activities to help improve park management.

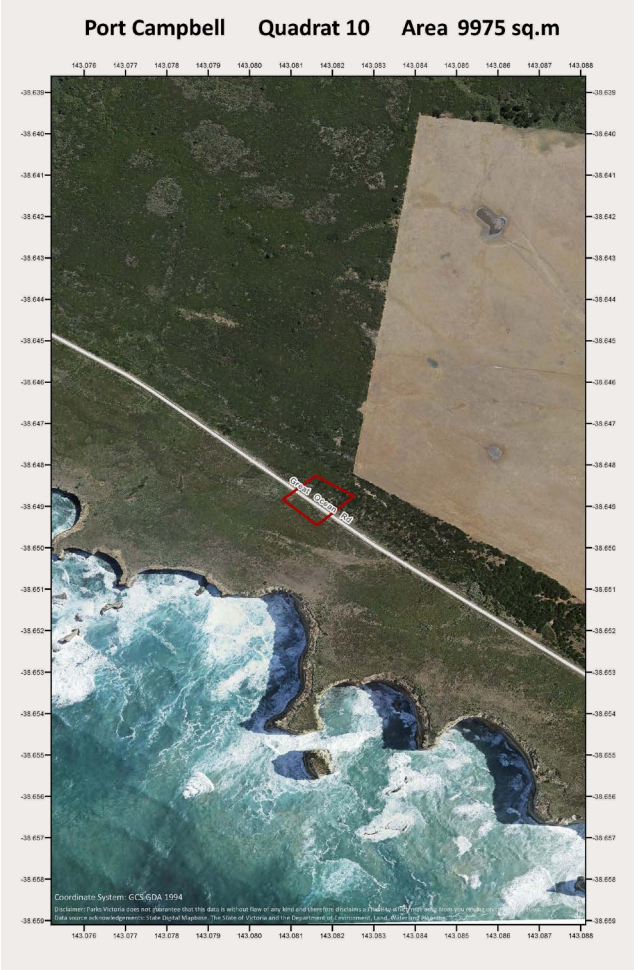
The research collaboration continued into 2021. The following are the key projects that Kally has actively supported throughout the year.

Otway Eden Pest Plant Mapping & Monitoring Program

The Otway Eden program was established in 2004 to protect the biodiversity of the Otway Ranges National Park. This program aims to control the well-established weed species and prevent new weeds from establishing.

In 2011-2012, a weed survey was carried out in five designated biodiversity asset areas within the Park. These areas were again surveyed in 2019-2021. Kally analysed the data sets. Consequently, a detailed written report of the results was generated in collaboration with Dr Marie Keatley, Plant Community Ecologist, Parks Victoria. The results provided the 2019-2021 weed status in each of the survey areas and how it has changed over time. Kally and Marie also gave an online presentation of the results to the Otway Weeds Program Working Group in December 2021.

Very positive feedback was received from the Group, and the results are being used to inform management and contribute to ongoing discussions around weed threat management and costs.

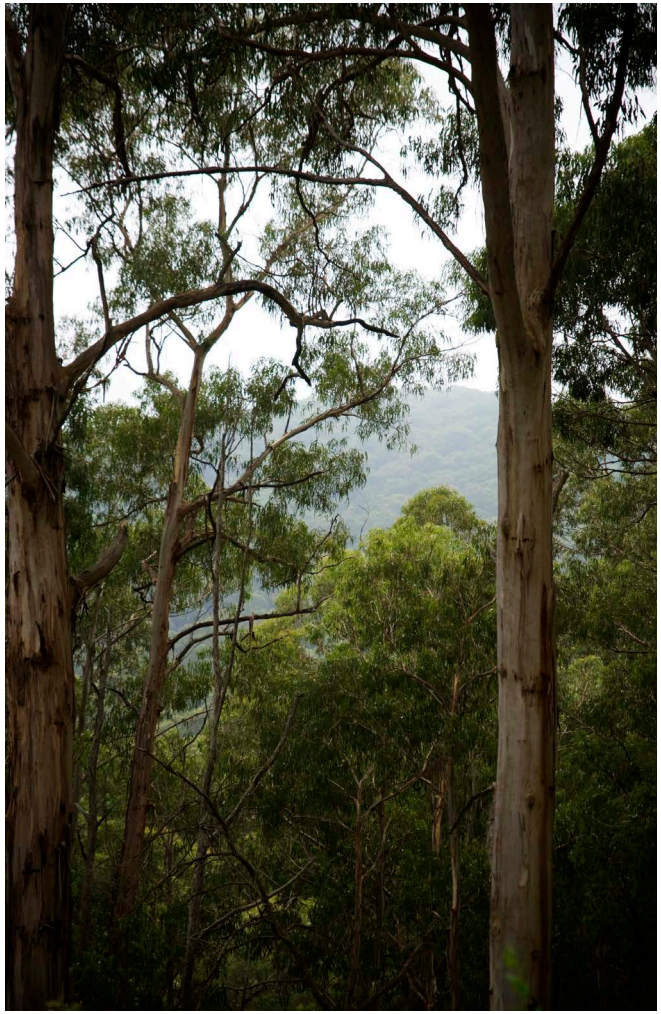


Above: *A survey site (indicated by red border) conducted in Port Campbell for the Otway-Eden Pest Plant and Monitoring Program. (photo source: Parks Victoria)*

Web Application Interface for Dandenong Ranges Weed Monitoring Program

Commencing in 2002, weed surveys have been conducted periodically in four management areas of the Dandenong Ranges National Park (DRNP) – Doongalla, Ferntree Gully, Olinda and Sherbrooke. A total of four weed surveys have been carried out over the years. To enable Park managers to retrieve the enormous amount of data efficiently, a web application interface (app) was developed by Kally to interrogate the amount and locations of weeds in each area at different times. Kally gave a demonstration of the app to Parks Victoria staff in May 2021.

Since then, the app has been used by DRNP staff to locate their weeds of interest, consequently allowing them to implement their weed control in an effective manner. This app can be readily adapted for use by other parks in their weed monitoring.



Right: *Mature gum trees in the Dandenong Ranges National Park. Environmental management work has been conducted over the years to protect native species, both flora and fauna, in the Park. (photo source: Parks Victoria)*

Technical Advice Provided for Park Health Check Program

The Park Health Check monitoring program is one of the tools the Environmental Research Partnerships and Programs team in Park Victoria oversees. This tool assesses the ecological health and management needs of a park. Kally provided advice on the establishment of thresholds for condition categories. Then working with Parks Victoria staff determined how the results can be summarised and presented.

Park Health Check monitoring was used to support Parks Victoria's successful application to the International Union for Conservation of Nature (IUCN) for inclusion of Warby-Ovens National Park in their Green List of Protected and Conserved Areas. For the application to be successful, the park needed to demonstrate successful conservation outcomes. The IUCN Expert Assessment Group for the Green List (EAGL) which assessed the application acknowledged the excellent work done by staff to develop appropriate thresholds and performance indicators (acknowledgement extracted from EAGL Evaluation Summary in https://iucngreenlist.org/sites/warby-ovens-national-park/). The Park is the first site in Victoria to be admitted to the Green List and is currently only one of four Australian sites admitted to the List.

Above: *The iconic Xanthorrhoea glauca subsp. angustifolia, Grey Grass-trees, found in Warby-Ovens National Park. They are critically endangered in Victoria. (photo source: Parks Victoria)*

APR.Intern

AMSI's industry engagement arm, Australian Postgraduate Research Intern (APR.Intern), is the only national PhD internship program spanning all sectors and disciplines.

The program connects postgraduate research students with industry through short-term placements, empowering students to thrive in a practical environment. For businesses, APR.Intern is a platform to access Australia's brightest emerging research talent and unlock new frontiers of innovation.

Lisa Farrar
National Program Manager — APR.Intern
lisa.farrar@aprintern.org.au

APRINTERN.ORG.AU

PhD Graduate, Dr Leila Alhagh, from the University of Melbourne, completed an internship at the State Library of Victoria in 2021, where she applied her expertise to help catalogue fragile Southeast Asian Islamic manuscripts. Leila is pictured third from the right, with the State Library Team, her Academic Mentor, Professor Robyn Sloggett (fourth from left), APR.Intern Business Development Manager Justin Mabbutt (far left) and some of the manuscripts.

2021 Overview

In 2017, AMSI received $19.1M of Federal Government funding to deliver a four-year program that scaled PhD internships to a national level. The Government grant period (2017-2021) has now been successfully completed, with a total of 648 PhD student internships with 326 industry partners facilitated nationally.

Following the completion of the grant period in 2021, APR.Intern underwent an extensive review, including consultation, surveys and analysis with our stakeholders. Strong demand was shown for the continuation of a national internship program. A revised, sustainable business model was developed and established in late 2021, to continue working with universities and industry to facilitate internships for as many PhD students as possible.

The new APR.Intern model provides AMSI university members with access to unlimited free mathematical sciences internships and a number of non-mathematical sciences internships, with a small facilitation fee applied following exhaustion of free non-mathematical sciences internships. The model also offers an annual subscription alternative for universities placing a high volume of interns.

Demand for industry internships remained strong during the final year of the Government grant period. The program had its biggest month ever in February 2021, with 61 internships executed — almost double the previous record of 33 internships in 2020. The pipeline of internship projects and interns never looked healthier, thanks in part to the 90% rebate made available for industry following a variation to the Government contract in October 2020, and the program ended up delivering a total of 197 internships in 2021 — the highest number of internships delivered in a single year.

In 2021, interns were placed in a total of 140 businesses across 20 industry sectors. Of these, 126 (64%) were businesses that were completely new to the program, representing ongoing expansion into our addressable market.

The majority of interns were placed in small to medium enterprises (69 interns), followed by government agencies and research institutes (43), start-ups (37), and large corporates (31), demonstrating the value of PhD expertise across a range of organisation types.

KEY STATS 2021*

197 interns placed from **20** disciplines across **35** Australian universities

140 industry partners across **20** industry sectors

43% female participation rate

36% of internships undertaken by females in STEM

147 (75%) of interns placed were domestic students

APR.Intern continued to provide industry experience for students across all higher education institutions. In 2021, interns from 35 universities across Australia participated in the program. Standout universities were the University of Sydney (17 interns), University of New South Wales (14), University of South Australia (14), and Queensland University of Technology (13).

Female participation remained high during 2021 at 43%, as did the regional student participation rate at 13%. The female STEM participation rate was 36%. Domestic students represented 75% of all interns in 2021.

Student demand for internships continued throughout 2021, and a total of 643 internship applications were submitted by students from 35 Australian universities, including 129 applications in January alone.

APR.Intern continued to offer subsidised internships for industry partners in 2021 through its partnerships with industry bodies, which provide rebate vouchers for organisations in the defence, manufacturing and MedTech and pharmaceutical sectors. In addition to the Government rebate, 95 subsidy vouchers were delivered to industry through our partnerships, with a total value of $698,400.

APR.Intern received an award for Professional Excellence and Innovation from the University of Melbourne and was named a finalist in the Australian Defence Industry Awards for Graduate Program of the Year.

2021 Highlights

37 start-up industry partners including Cortical Labs, Metakosmos and Cingulan Space

69 SME industry partners including Biointellect, Inventia Life Science Operations and One Harvest

31 large corporate industry partners including Airservices Australia, Toyota Motor Corporation Australia, Tibra Capital and Lockheed Martin Australia

43 government agency and research institution industry partners including Office of the Chief Scientist QLD, Department of Agriculture, Water and the Environment, Cancer Australia, Peter MacCallum Cancer Institute and South Australian Research and Development Institute

Participant Satisfaction Survey Results (2017-2021)

Overall program satisfaction of **99%** (1365 respondents)

Intern satisfaction of **99%** (560 respondents)

Industry partner satisfaction of **99%** (416 respondents)

Internship project outcomes implemented by **75%** of industry partners (416 respondents)

61% of industry partners intended to continue collaborating with the university after the internship (416 respondents)

88% of interns reported that the internship was very important or important in preparing them for future employment (560 respondents)

68% of job ready interns employed in non-academic positions following internship, **29%** in academia (560 respondents)

Strategic Partnerships

Ongoing relationships are critical for APR.Intern's sustainability and have enabled the program to become embedded not only within universities, but also within organisations that require highly skilled PhD researchers as part of their workforce.

APR.Intern's strategic partnerships continue to be highly valued and fruitful. The subsidy vouchers are particularly important for start-ups and SMEs, which benefit greatly from research innovation and, according to survey results, are the largest employers of interns post-internship.

Strategic focus remains on a program that unlocks talent and innovation as a cornerstone of Australia's research translation and innovation landscape.

Case Study: PhD Intern Accelerates Biomedical R&D

When biomedical start-up, Haemograph, identified an opportunity to develop new life-saving technology that automated blood clot measurements, the team engaged a PhD student intern to accelerate R&D.

Martina Di Venere from Deakin University was the perfect match, specialised in biomedical engineering and fluidics. Over 6-months, she managed in-depth literature reviews, analysis, design and development of initial methods and prototypes—all under remote internship arrangements, utilising Zoom and conference calls.

'The internship was a great opportunity to learn new skills and experience the differences between industry and academic research environments. I gained new technical and soft skills, and learned the inner workings of a start-up.'

Haemograph CTO and Martina's Industry Supervisor, Dr Alex Lubansky, believes Martina's contributions will greatly advance the company's product.

Above: Martina Di Venere

"Martina provided useful insights on the project and even assisted in the supervision of two master projects aligned with her topic. Her contribution, and the APR.Intern program, were highly appreciated," said Dr Lubansky.

Following the internship's success, Martina was offered full-time employment as a Haemograph Research Engineer.

Marketing & Media

As Australia's national voice for the mathematical sciences, AMSI engages with a broad target audience including primary and secondary school students, teachers, parents, university students, AMSI members, government and industry. In 2021, AMSI continued to maintain its position as an authority on the state of the mathematical sciences in Australia, supporting policy engagement, advocacy and AMSI program activities.

Jo Piltz
Marketing & Communications Coordinator
media@amsi.org.au

AMSI.ORG.AU

Strategy & Brand

As three significant grant periods came to completion in 2021, Marketing and Communications played a key role throughout the year to ensure strong stakeholder engagement was delivered and that AMSI's value and vision were clearly conveyed.

To achieve this, activity throughout the year included a review of AMSI's vast range of websites, resources and collateral across all program areas, the development of new collateral to support AMSI Directorate and Business Development, promotion of the mathematical sciences in mass media, positioning of AMSI as the national peak body for the mathematical sciences, and continued marketing support for each of AMSI's program areas.

The team also delivered an updated version of AMSI's popular MathsADDS Careers Guide publication, which was shared digitally with AMSI members for distribution to prospective undergraduate students at open days, events and within student marketing.

AMSI's APR.Intern program required a particular marketing focus throughout 2021, as it transitioned into a new version of the program, requiring ongoing stakeholder communication including EDMs, website updates, partnership documents, case studies, and the development of new program collateral.

Social Media

AMSI's social media audiences continued to grow across all platforms, with particularly large growth on LinkedIn. This platform was largely untapped prior to 2021 and is now an important stakeholder engagement tool, enjoying a considerably high engagement rate of 4.23% compared to an average of 3% on similar organisations profiles.

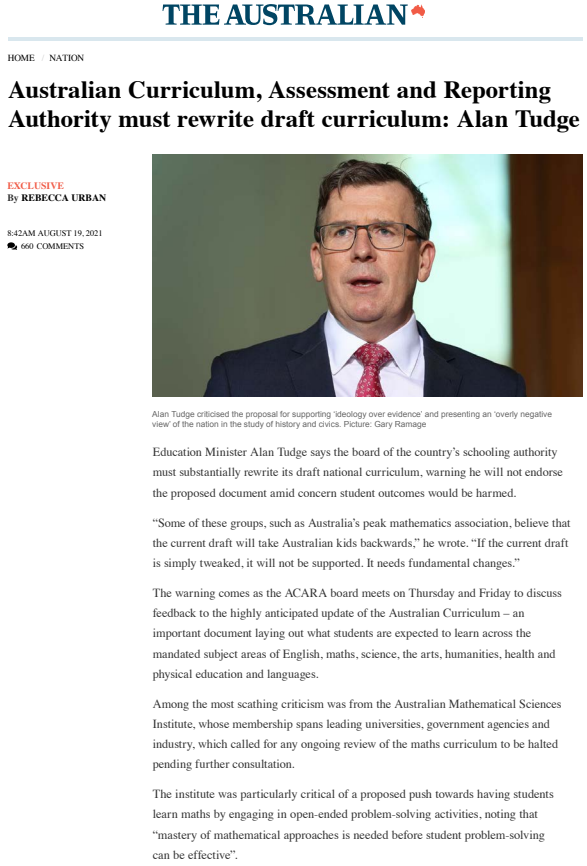
@Discover AMSI **2600** followers
@APRInternau **692** followers

/australian-mathematical-sciences-institute **1290** followers
/aprintern **1600** followers

AMSI in the Media

A selection of media exposure from January–December 2021:

'1 in 4 Australian year 8s have teachers unqualified in maths—this hits disadvantaged schools even harder'
Sue Thomson, Deputy CEO (Research) at the Australian Council for Educational Research, referenced AMSI data in an opinion piece for *The Conversation* on 25 May 2021.
263,333 daily readership
$21,000 equivalent exposure in advertising terms



THE AUSTRALIAN

HOME / NATION

Australian Curriculum, Assessment and Reporting Authority must rewrite draft curriculum: Alan Tudge

EXCLUSIVE
By **REBECCA URBAN**

8:42AM AUGUST 19, 2021
660 COMMENTS

Alan Tudge criticised the proposal for supporting 'ideology over evidence' and presenting an 'overly negative view' of the nation in the study of history and civics. Picture: Gary Ramage

Education Minister Alan Tudge says the board of the country's schooling authority must substantially rewrite its draft national curriculum, warning he will not endorse the proposed document amid concern student outcomes would be harmed.

"Some of these groups, such as Australia's peak mathematics association, believe that the current draft will take Australian kids backwards," he wrote. "If the current draft is simply tweaked, it will not be supported. It needs fundamental changes."

The warning comes as the ACARA board meets on Thursday and Friday to discuss feedback to the highly anticipated update of the Australian Curriculum – an important document laying out what students are expected to learn across the mandated subject areas of English, maths, science, the arts, humanities, health and physical education and languages.

Among the most scathing criticism was from the Australian Mathematical Sciences Institute, whose membership spans leading universities, government agencies and industry, which called for any ongoing review of the maths curriculum to be halted pending further consultation.

The institute was particularly critical of a proposed push towards having students learn maths by engaging in open-ended problem-solving activities, noting that "mastery of mathematical approaches is needed before student problem-solving can be effective".

'Worrying STEM teacher shortage with pressure felt in rural and remote schools'
Antonia O'Flaherty quoted AMSI Director, Professor Tim Marchant, in a report for *ABC Online* on 16 June 2021.
336,333 daily readership
Equivalent exposure in advertising terms not available due to ABC's ad policy

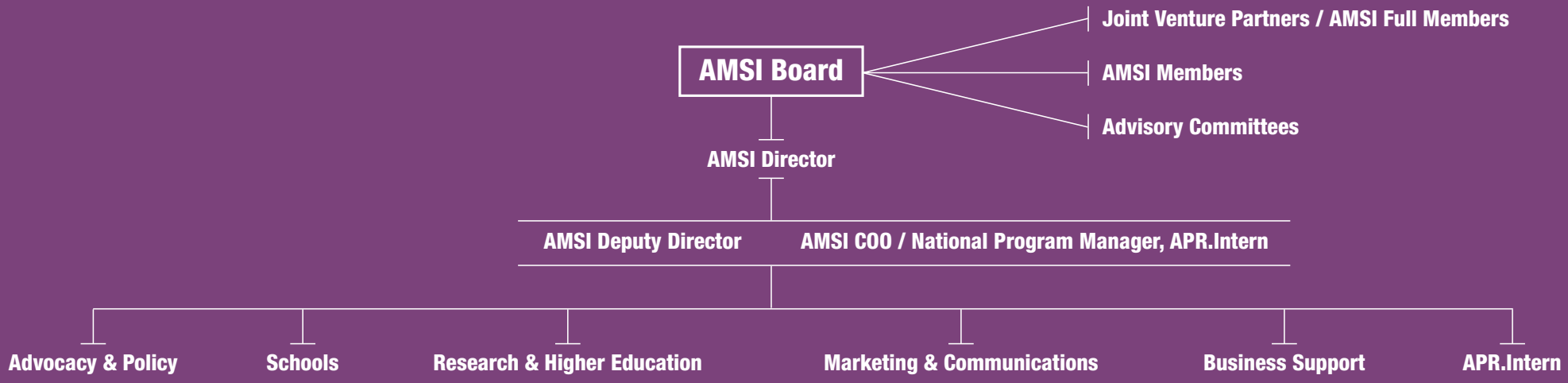
'Schools struggle as maths, science teachers in short supply'
Suzan Delibasic quoted AMSI Director, Professor Tim Marchant, in the *Herald Sun* on 24 June 2021.
144,933 daily readership
$34,752 equivalent exposure in advertising terms

'Australia falling behind on passion and performance in maths'
Rebecca Zhu quoted AMSI Director, Professor Tim Marchant, in *The Epoch Times* on 19 August 2021.
833,333 daily readership
$7,077 equivalent exposure in advertising terms

'Australian Curriculum, Assessment and Reporting Authority must rewrite draft curriculum: Alan Tudge'
Rebecca Urban quoted AMSI's response to the ACARA curriculum review in *The Australian* on 19 August 2021.
176,666 daily readership
$41,040 equivalent exposure in advertising terms

Governance

Effective Organisation Structure



AMSI's Organisational Structure

AMSI is an unincorporated collaborative joint venture of Australia's universities and other bodies related to the mathematical sciences.

In 2002, six universities signed a Joint Venture Agreement (JVA) to become the first full members of AMSI. As of 2021, AMSI's full membership totalled 12 universities, including all of the Group of Eight. The University of Melbourne acts as AMSI's lead agent in the JVA. Beyond the full membership, our extended membership is made up of an additional 17 universities, five government agencies and eight mathematical and statistical learned societies.

AMSI continues to make a significant contribution to the mathematical sciences in Australia. Our initiatives and programs are important parts of an overall strategy to enhance the standing and health of mathematics and statistics across the community.

The Institute is critically dependent upon the support of its membership. Without this support—both financial and via active participation in AMSI's enterprise—it would not be possible to provide the many services that are of direct benefit to the mathematical sciences.

AMSI's full members meet at least four times annually, and all AMSI members meet twice per year. This ensures that AMSI's programs are kept fresh and responsive to its membership.

Management of AMSI

The JVA makes the AMSI Board responsible for the overall direction of the Institute, formulation of policies and oversight of the management the Institute. Management of the Institute and its activities is the responsibility of the Executive (listed on page 35). External advice is provided by five high-profile advisory committees.

AMSI's four portfolio areas are:

- Research & Higher Education
- Advocacy
- Industry engagement
- Schools education

Activities are detailed in the annual Business Plan and Budget document, authorised annually by the full members and the Board.

AMSI Board Composition

The Board comprises:

- An independent chair appointed by the full members
- The Institute Director
- The Institute Deputy Director appointed by the full members
- One person representing the lead agent—University of Melbourne
- Two full member representatives appointed by mutual agreement of full members
- Two associate member representatives appointed by mutual agreement of associate members
- Up to five independent persons with relevant affiliations beyond the Institute's membership

Board representatives for the full members and associate members serve two-year terms.

We actively seek participation of women and under-represented groups in AMSI, for diversity across all levels promotes the greatest outcomes for all.

Board Meetings

In 2021, scheduled Board meetings were held on the following dates:

Date	Location
Thu 18 February	Video conference
Thu 15 July	Video conference
Thu 23 September	Video conference
Thu 11 November	Video conference

ATTENDANCE:

Dr Adelle Howse (4/4)
Anne Baly (4/4)
Dr Sue Barrell (4/4)
Professor Tim Marchant (4/4) from February 2021
Mr Joe Forbes (4/4)
Associate Professor Linda Galligan (4/4)
Professor Graeme Hocking (2/2)) until July 2021
Dr Bishnu Lamichhane (2/2) until July 2021
Professor Moira O'Bryan (3/4)
Professor Robyn Owens (4/4)
Dr Andrew Peele (4/4)
Professor Mat Simpson (1/1) until February 2021
Professor Stephan Tillmann (4/4) from February 2021
Professor Peter Taylor (2/2) until July 2021
Associate Professor Sanjeeva Balasuriya (2/3) from July 2021
Associate Professor Bronwyn Hajek (3/3) from July 2021
Professor Inge Koch (3/3) from July 2021

Committees & Stakeholders

Board Members

Dr Adelle Howse *Chair*
Professor Tim Marchant *AMSI Director* – from February 2021
Professor Mat Simpson *AMSI Deputy Director* (Queensland University of Technology) – until February 2021
Professor Stephan Tillmann *AMSI Deputy Director* (University of Sydney)
Professor Moira O'Bryan *Lead Agent Representative* (University of Melbourne) – from February 2021
Dr Bishnu Lamichhane *AMSI Full Member Representative* (University of Newcastle) – until July 2021
Professor Peter Taylor *AMSI Full Member Representative* (University of Melbourne) – until July 2021
Associate Professor Linda Galligan *AMSI Associate Member Representative* (University of Southern Queensland)
Professor Graeme Hocking *AMSI Associate Member Representative* (Murdoch University) – until July 2021
Professor Robyn Owens *External member* (University of Western Australia)
Dr Andrew Peele *External member* (ANSTO)
Anne Baly *External member* (Nous Group)
Dr Sue Barrell *External member* (Science and Technology Australia)
Mr Joe Forbes *External member* (Biarri Commercial Mathematics)
Assoc. Prof. Sanjeeva Balasuriya *AMSI Associate Member Representative* (University of Adelaide) – from July 2021
Assoc. Prof. Bronwyn Hajek *AMSI Associate Member Representative* (University of South Australia) – from July 2021
Professor Inge Koch *AMSI Full Member Representative* (University of Western Australia) – from July 2021

Board Observers

The President of the Australian Mathematical Society, the President of the Statistical Society of Australia, and the Chair of the National Committee for the Mathematical Sciences (NCMS) are also invited onto the Board as observers.

Professor Alan Welsh Chair, National Committee for the Mathematical Sciences
Associate Professor Jessica Kasza President, Statistical Society of Australia
Professor Ole Warnaar Australian Mathematical Society

AMSI Research & Higher Education Committee

Professor Stephan Tillmann *Chair*
Emeritus Professor Phil Broadbridge *Deputy Chair*
Professor Tim Marchant *AMSI Director*
Angela Coughlin *AMSI RHED National Program Manager*
Associate Professor Stephen Davis *ACE Network Director*
Professor Scott Sisson *University of New South Wales*
Professor Mary Myerscough *University of Sydney*
Associate Professor John Bamberg *University of Western Australia*
Dr Ramiro Lafuente *University of Queensland*
Professor Lesley Ward, *University of South Australia*
Professor Aidan Sims *University of Wollongong*
Professor Ezra Getzler *Northwestern University*
Professor Terry Tao *UCLA / Clay Mathematics Institute*
Professor Yasuhide Fukumoto *Kyushu University*
Professor Linda Cummings *New Jersey Institute of Technology*

AMSI Advisory Panel

Professor Bruce Henry *University of New South Wales*
Associate Professor Gary Glonek *University of Adelaide*
Emeritus Professor Geoff Prince *La Trobe University / AMSI Director 2009-18*
Professor Tim Brown *AMSI Director 2019-20*
Emeritus Professor Cheryl Praeger *University of Western Australia*
Professor Jacqui Ramagge *University of Durham / University of Sydney*
Dr Ron Sandland *AMSI Chair 2011-19*
Professor Hugh Possingham *Chief Scientist Queensland*
Professor Kate Smith-Miles *University of Melbourne*
Professor Doreen Thomas *University of Melbourne*
Jan Thomas *AMSI Honorary / AMSI Executive Officer 2002-11*
Dr Michael Evans *AMSI Schools Programs Manager 2004-13 / AMSI Honorary*
Professor Catherine Attard *University of Western Sydney / MERGA President*
Professor Mike Clapper *Australian Mathematics Trust*
Associate Professor Mary Coupland *University of Technology Sydney*
Professor Gilah Leder *Monash University / La Trobe University*
Dr Mark Lawrence *Mark Lawrence Group / AMSI Board 2012-19*
Dr Eileen Doyle *AMSI Board 2010-18 / FAICD*
Dr Milica Ng *CSL*

Our Staff

Director's Profile

Professor Tim Marchant—Director, AMSI

Professor Timothy Marchant is Director of the Australian Mathematical Sciences Institute (AMSI) at the University of Melbourne and an Honorary Professor of Applied Mathematics at the University of Wollongong (UOW).

During his career at UOW, Professor Marchant was Head of the School of Mathematics and Applied Statistics 2007–2009 and Dean of Research 2009–2020.

Professor Marchant gained a PhD in Applied Mathematics from the University of Adelaide in 1988 and has published 100 research papers. He has also successfully supervised 20 Masters/PhD students on various topics in Applied Mathematics.

Professor Marchant's research areas include nonlinear optics, nonlinear waves and combustion theory. Professor Marchant is a Fellow and Past President of the Australian Mathematical Society.

He is a past member of the Endeavour Awards selection panel and a current member of the National Colombo Plan selection panel. He is also an editorial board member of the Applied Mathematical Modelling Journal.

Professor Marchant is a member of the Illawarra Bridge Club and speaks intermediate Mandarin.

Executive

Professor Tim Marchant Director, AMSI
Lisa Farrar National Program Manager, APR.Intern, Acting Co-Chief Operating Officer, AMSI (January-July 2021), Chief Operating Officer, AMSI (from July 2021)
Angela Coughlin National Program Manager, Research & Higher Education
Maaike Wienk Acting Co-Chief Operating Officer, AMSI (January-June 2021), Finance, Advocacy and Policy Manager, AMSI (from July 2021)

Honorary Staff

Dr Michael Evans Senior Consultant
Jan Thomas OAM Research Fellow

Non-Executive

Jenny Wang Finance Officer (until April 2021)
Simran Marwaha Finance Officer (from May-September 2021)
Darla Trejo Finance & Admin Officer
Elena Panfilova Executive Assistant to the Director (from March 2021)

Marketing & Communications

Jo Piltz Marketing & Communications Coordinator
Michael Shaw Art Director & Multimedia Manager

Schools

Leanne McMahon Schools Outreach Officer

Research & Higher Education

Angela Coughlin National Program Manager
Anna Muscara Project Coordinator
Francesca Hoban Ryan Administrative Assistant

Parks Victoria *(Detached Staff)*

Dr Kally Yuen Statistician

APR.Intern

Lisa Farrar National Program Manager
Glen Sheldon Deputy Program Manager
Margo Brown Senior Program Coordinator
Mark Ovens Business Development Officer
David Beecham Business Development Officer (until October 2021)
Justin Mabbutt Business Development Officer
Michael Valentine Business Development Officer
Jo Piltz Marketing & Communications Coordinator
Alex Mullany Project Coordinator (until July 2021)
Stacey Hansen Project Coordinator (from July 2021)
Zak Blayney CRM and Project Officer
Sophie Kennedy Program Officer & Executive Assistant to the National Program Manager
Alyssa Weirman Business Development Officer (until May 2021)
Michaela Murphy Business Development Officer (until March 2021)
Tracey McClurg Business Development Officer (until May 2021

Financials

AMSI's financial records are managed and administered by AMSI Finance staff in accordance with the accounting policies and financial systems of the University of Melbourne.

All financial statements are reconciled to the University of Melbourne's integrated financial system to ensure compliance with relevant policies and to confirm the amount of cash reserves held by the University of Melbourne on behalf of AMSI at the end of each financial year. The University of Melbourne undertakes to provide audited financial statements for all contractually funded activities when required by the relevant funding body.

AMSI's financial performance in 2021 resulted in an expected operational deficit in line with the conclusion of the NRIP program, with the payment of a large number of industry vouchers using the balance of Commonwealth funding provided to AMSI over the 2017-2021 NRIP project period.

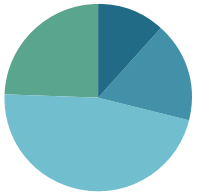
AMSI's revenue for the year ended 31 December 2021 comprised:

Membership income	$ 1,681,603
Commonwealth grant income	$ 3,247,202
Trading revenue	$ 1,191,705
Other income (other project income, sponsorships & interest)	$ 816,782
Total Income	**$ 6,937,292**

AMSI's expenditure for the year ended 31 December 2021 comprised:

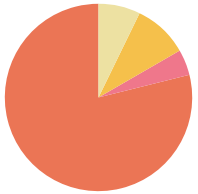
Directorate - including Governance and Outreach	$ 681,880
Research & Higher Education	$ 881,716
Schools Program including ChooseMATHS	$ 412,624
APR.Intern	$ 7,352,779
Total Expenses	**$ 9,328,999**

Institute Income



- Membership income
- Commonwealth grant income
- Trading revenue
- Other income (other project income, sponsorships & interest)

Institute Expenditure

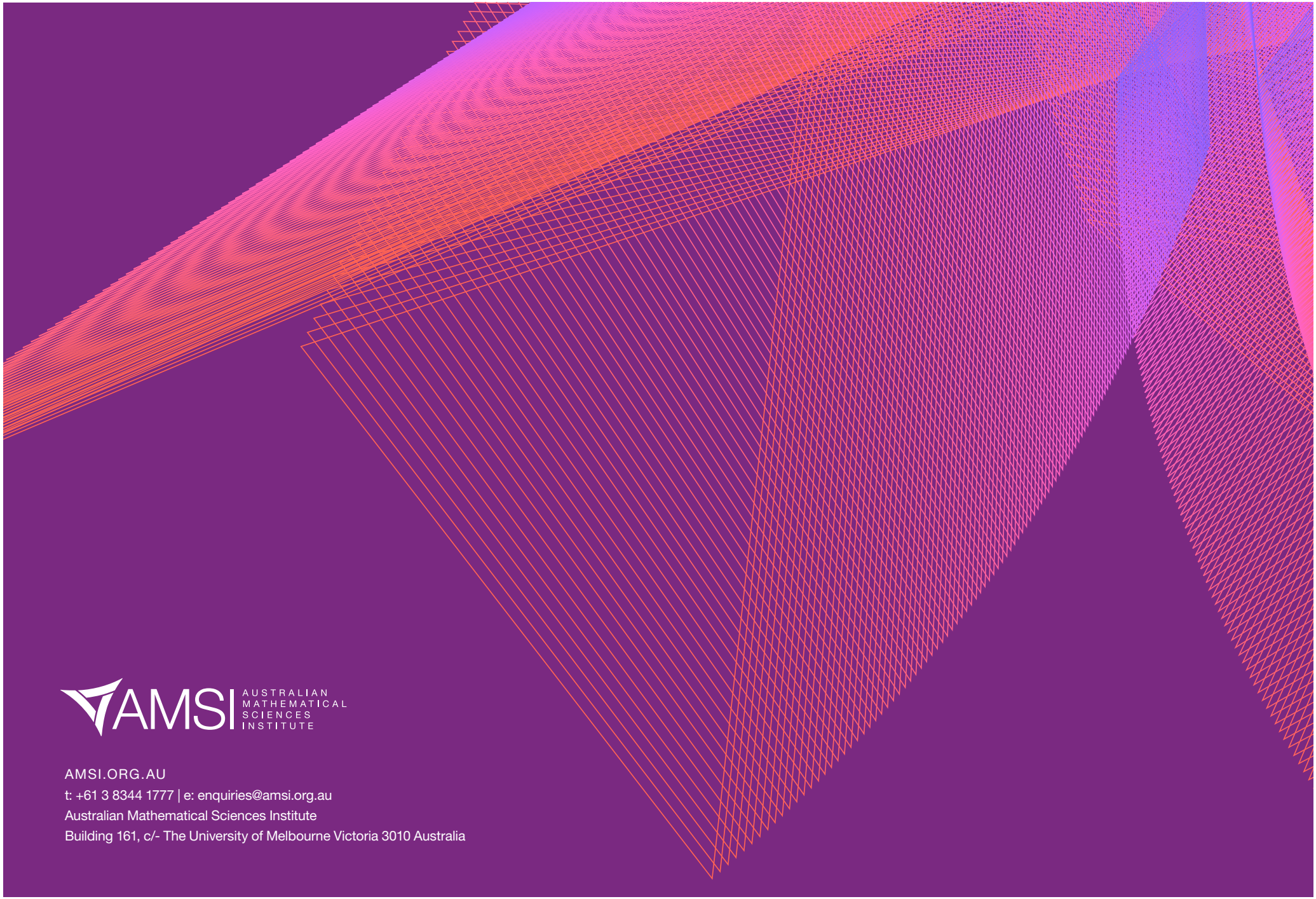


- APR.Intern
- Schools Program including ChooseMATHS
- Research and Higher Education
- Core Business - Including Governance & Outreach

Statement of Financial Position		As at 31 December 2021	As at 31 December 2020
ASSETS		$	$
Funds on Hand:		2,162,971	4,554,679
	Net Assets	2,162,971	4,554,679
EQUITY			
Retained income brought forward after prior period adjustments		4,554,679	3,082,310
Total Operating Result (income less expenses)		(2,391,708)	1,472,370
	Net Equity	2,162,971	4,554,679

Tim Marchant
AMSI Director

Maaike Wienk
AMSI Financial, Policy and Advocacy Manager



AMSI.ORG.AU
t: +61 3 8344 1777 | e: enquiries@amsi.org.au
Australian Mathematical Sciences Institute
Building 161, c/- The University of Melbourne Victoria 3010 Australia