



2014/15

AMSI Vacation Schools & Scholarships

Participation Strategy Implementation



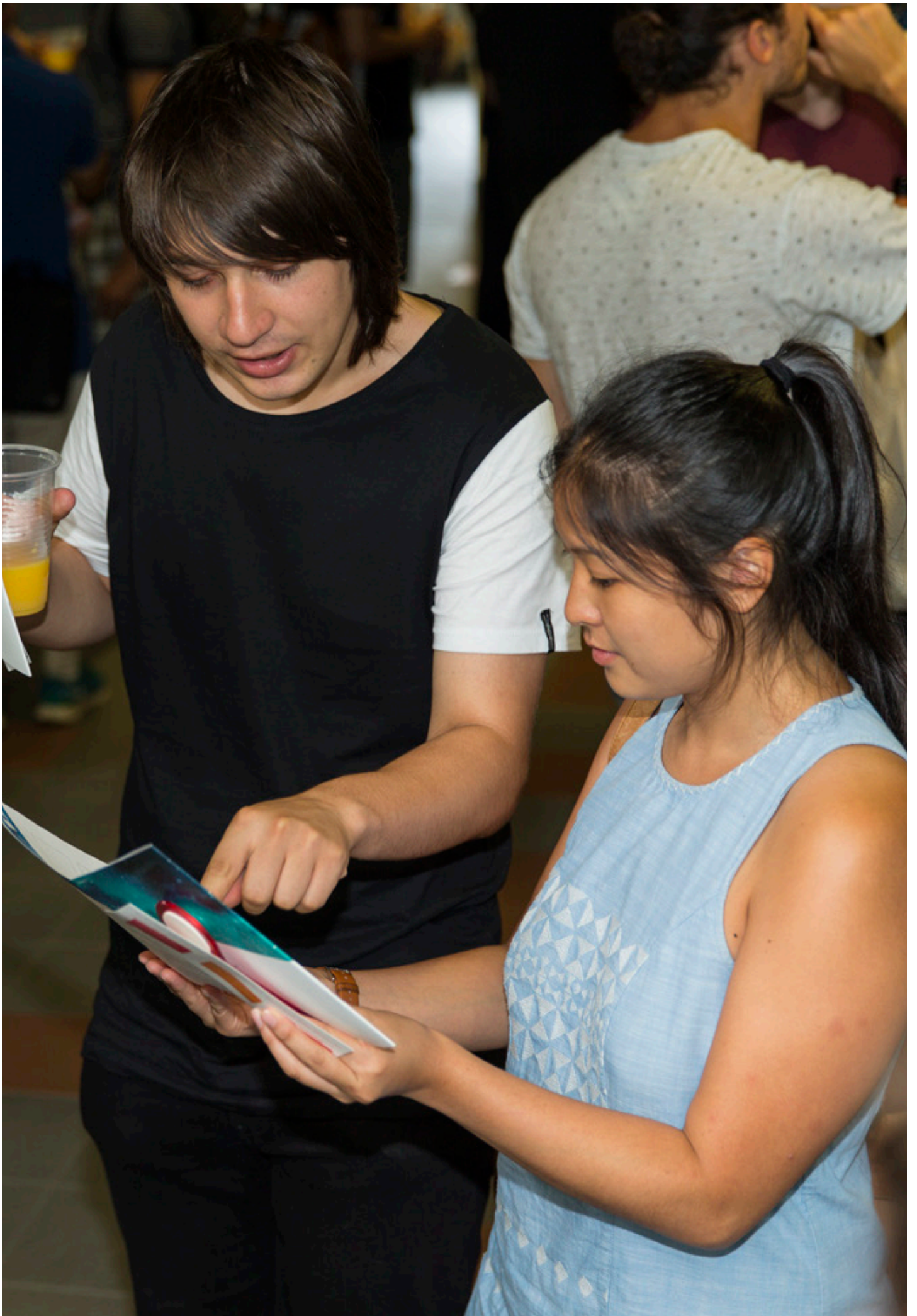
Australian Government
Department of Education and Training

AMSI Vacation Schools & Scholarships

Participation Strategy Implementation

2014/15

Introduction	3
Program Participation	4
Review of Benchmarking Data	6
Gender	9
Choose Maths	10
ATSI & Low SES	13
Outreach	14
Advocacy	17





Introduction

This document provides an update on the successful implementation of the AMSI Vacation Schools and Scholarships Participation Strategy in 2014/15. It should be read in conjunction with the 2012/13 AMSI Vacation Schools and Scholarships Participation Strategy and the 2013/14 AMSI Implementation Strategy.

AMSI has set the following program objectives

LONG-TERM PROGRAM OBJECTIVES

- Male and female participants will be approximately equal in number and of a high calibre.
- Significant increases in participation of high calibre persons of Aboriginal and Torres Strait Islander (ATSI) descent.
- By the year 2020 at least 20% of participants will be from low socio-economic status (SES) backgrounds.

SHORT-TERM PROGRAM OBJECTIVES

- Male and female participants should reflect the current cohort of enrolled mathematical sciences undergraduate and postgraduate students.
- Participants of Aboriginal and Torres Strait Islander descent should reflect the current cohort of enrolled mathematical sciences undergraduate and postgraduate students.
- Participants from low socio-economic status backgrounds should reflect the current cohort of enrolled mathematical sciences undergraduate and postgraduate students

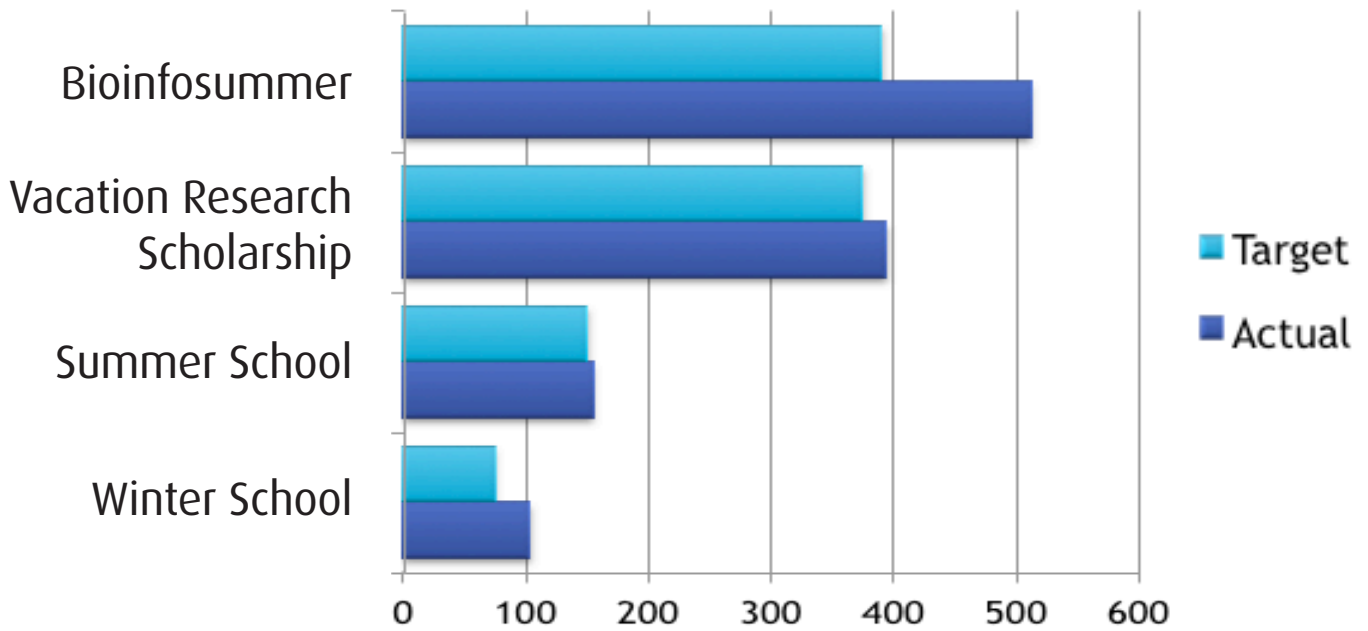


Figure 1: Target and actual participation in the Vacation Schools and Scholarships for the first three years of the Vacation Schools and Scholarships project

Participation grew or remained constant in BioInfoSummer, Winter School and the Vacation Research Scholarship program in the 2014/15 project period.

Participation in the Summer School was lower than projected. When the location was agreed we anticipated a larger number of students travelling from Sydney to Newcastle daily to attend the School; due to changes in the rail network this was not an attractive option. The loss of these Sydney students impacted both the overall attendance numbers and the number of female students attending as we were unable to significantly increase the budget for residential scholarships.

Enrolment numbers 2012-2014 (absolute figures)

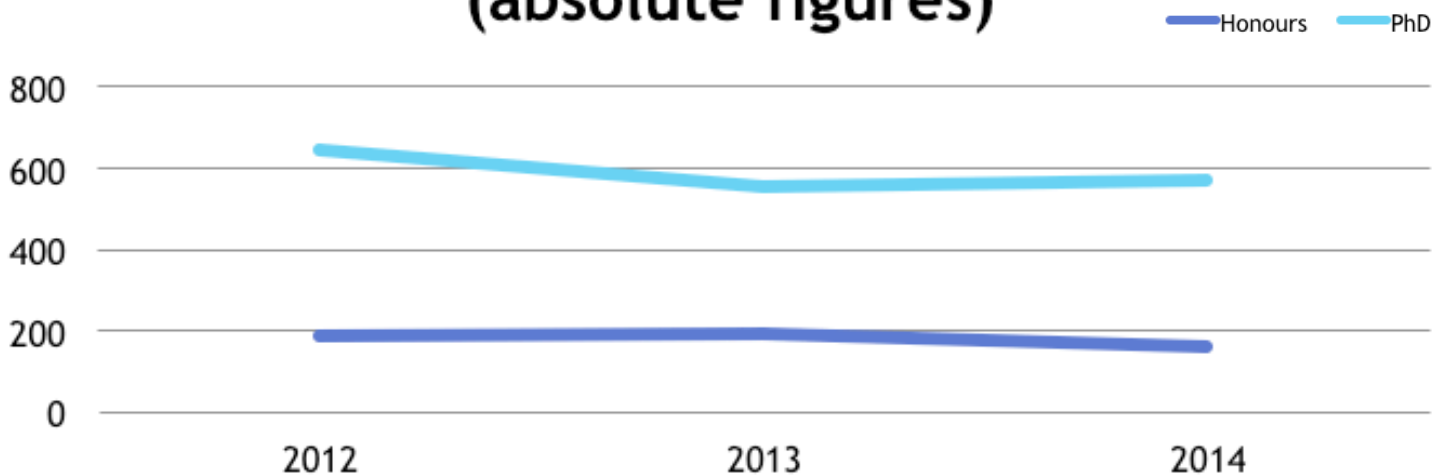


Figure 2: Number of students enrolled in Australian mathematical sciences honours and PhD programs in the period



BENCHMARKING

In Stage 1 of the project AMSI benchmarked female attendance at past Vacation Schools and Scholarships events and set female attendance targets based on 2001-2010 completion data* provided by the Department.

Since 2012 AMSI has prepared a Discipline Profile of the mathematical sciences in Australia, compiling longitudinal discipline data from various sources and the results of a survey of our Member departments.

The data presented in the Discipline Profile indicate that the 2001-2010 benchmarking data provide targets that are unrepresentative of the current cohort.

* Li, Z (2012). Domestic student Award Completions with qualifications in mathematical sciences by state.

Honours completions in the period 1980-2013 by gender

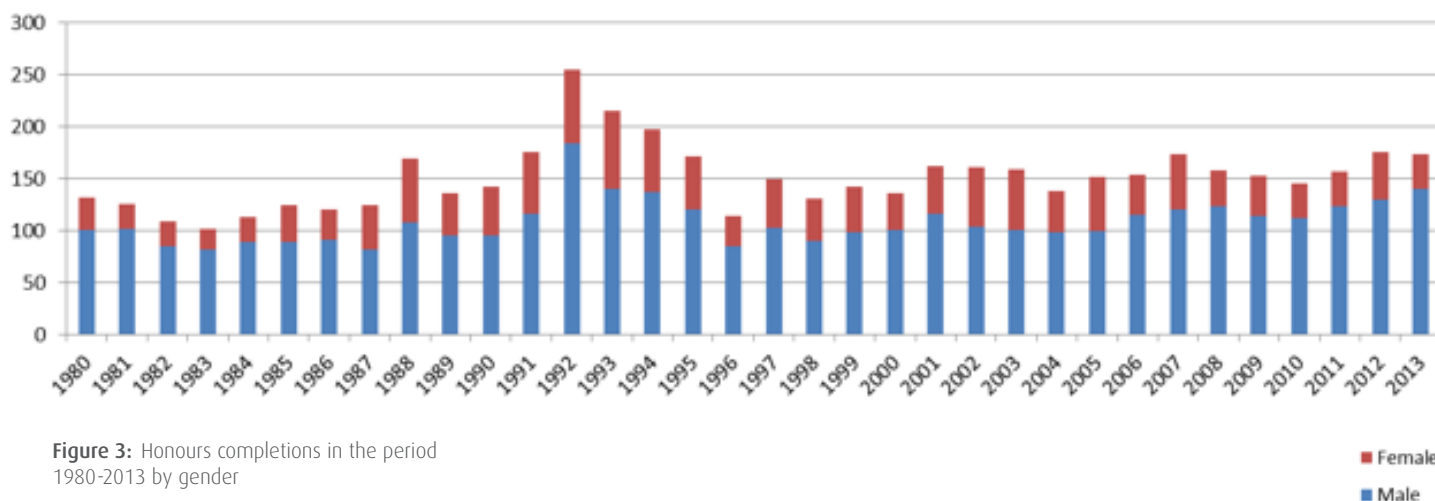


Figure 3: Honours completions in the period 1980-2013 by gender

■ Female
■ Male

HONOURS COMPLETIONS

Associate Professor Peter Johnston at Griffith University has, on behalf of the Australian Mathematical Society (AustMS), assembled longitudinal data on honours degree completions in Australia.

Despite spikes upwards and downwards, overall completions in mathematics and statistics have been fairly stable since 1980. After a slight rise in honours completions in the period 2010-2012, the number of completions fell slightly in 2013.

The proportion of females completing honours degrees had increased slightly since 1980 but has not been impressive in the last few years. In the 1980s the average proportion of females completing an honours degree was 26%, in the 1990s this increased to 31% and it has levelled out to 29% in the first decade of this century.

However, in the period 2010-2013 the proportion of female honours completions decreased to a disappointing 22%.

HONOURS ENROLMENTS

Honours enrolment data seems to indicate that attrition is a problem with a lower proportion of female students completing honours than are enrolled in honours programs in the mathematical sciences. This needs more investigation.

Honours enrolments in mathematical sciences degrees

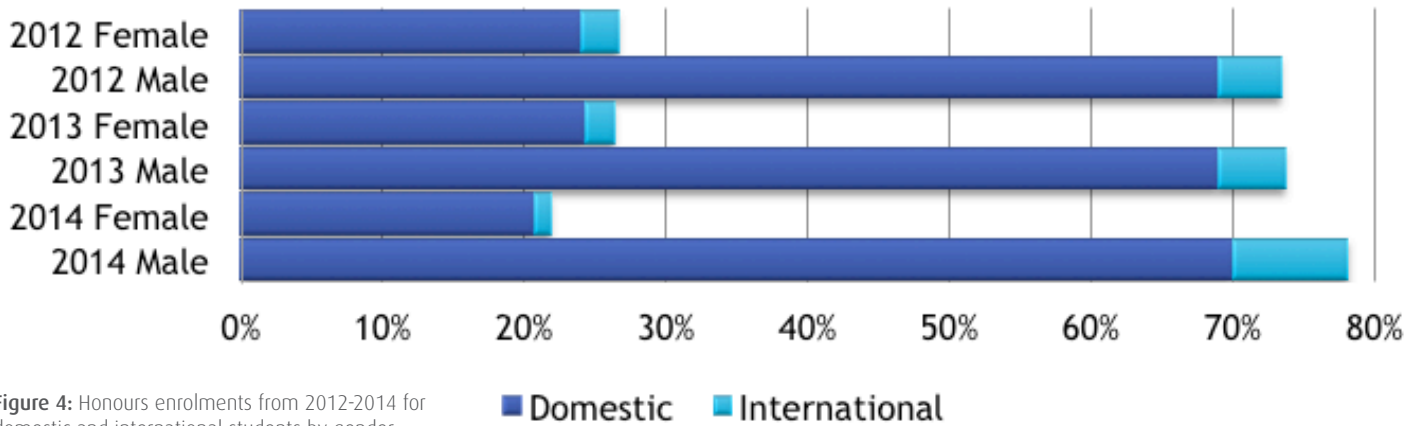


Figure 4: Honours enrolments from 2012-2014 for domestic and international students by gender

PHD COMPLETIONS

Over the past 30 years, the number of PhD completions has seen an increase. This is partly due to the increased number of females completing a PhD. In the 1980s, the average proportion of females completing a PhD in mathematics and statistics was only 12%; in the 1990s this rose to 23% and in the first decade of this century 29% of PhD graduates were female.

Between 2010-2013 the average female proportion rose to 36%. However, as is shown in Figure 6 this was due in large part to the contribution of international female students.

According to data reported to AMSI in its annual survey, PhD completions fell in 2012, and increased again in 2013. The number of completions is projected to fall again in 2014.

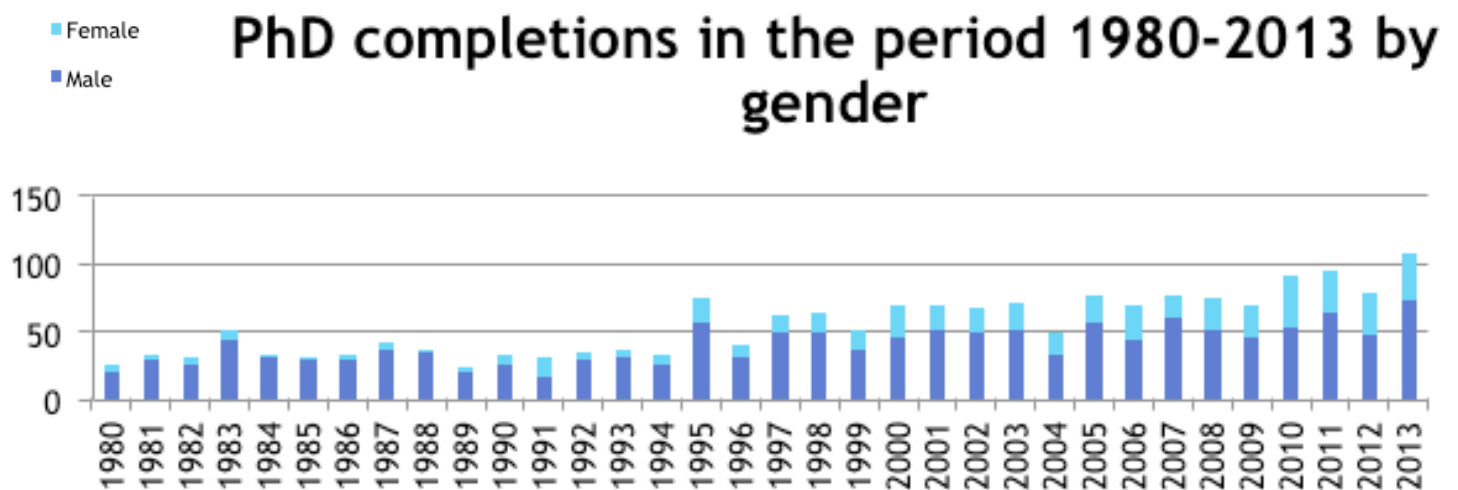


Figure 5: PhD completions in the period 1980-2013 by gender

PHD ENROLMENTS

PhD enrolment data from 2012-2014 indicates that only 15-17% of enrolments in mathematical sciences PhDs were domestic

PhD enrolments in mathematical sciences

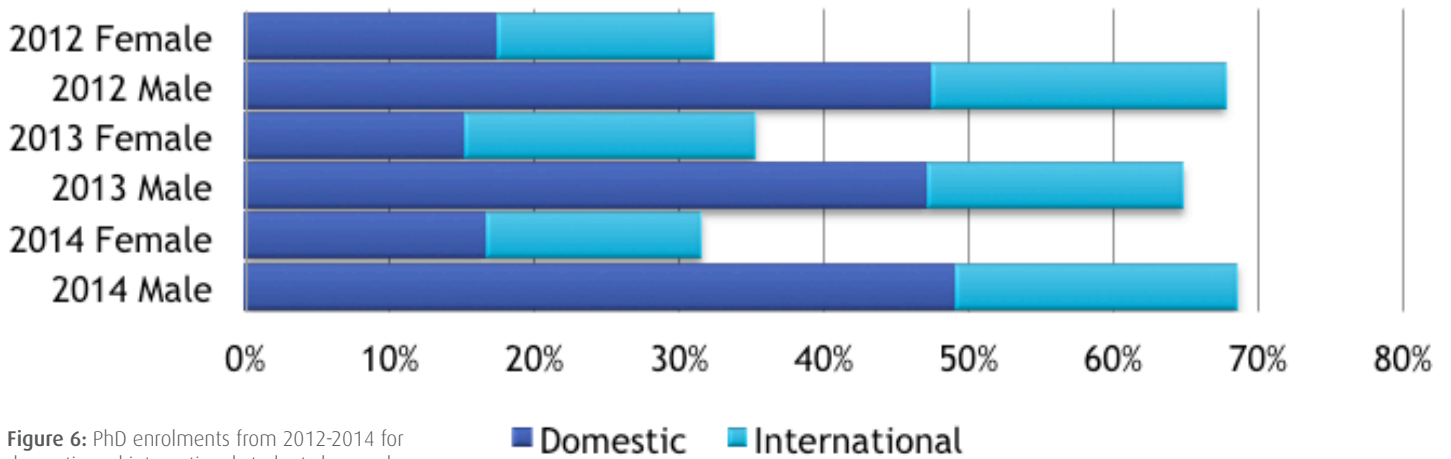


Figure 6: PhD enrolments from 2012-2014 for domestic and international students by gender

IMPACT ON PROGRAM

These findings affect the targets set for the short-term program objective that male and female participants should reflect the current cohort of enrolled mathematical sciences students and indicate that a review of the targets is necessary.

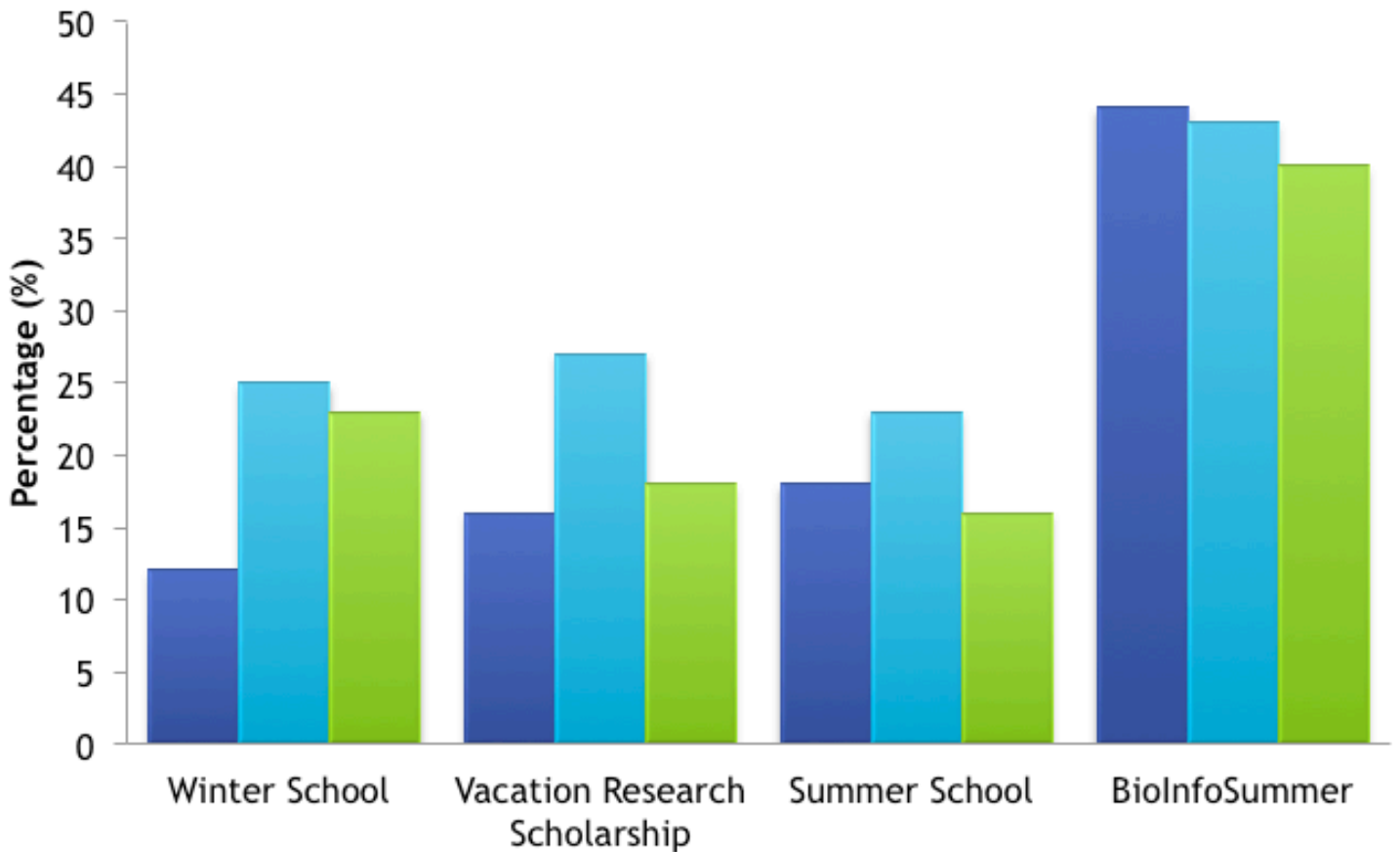


Figure 7: Female participation in the Vacation Schools and Scholarships project by program and financial year.

In 2014/15 female participation has remained consistent or declined slightly from the 2013/14 levels.

Female participation in the Summer School was particularly low this year. On reviewing the benchmarking participation data and the attendance at the school, it appears that this occurred in part due to the regional location of the school.

Due to the travel funding available and priority being given to honours students, less PhD students attended this year. The "Review of Benchmarking Data" section indicates that female participation/completion of mathematical sciences honours sits at 20-25%.

Another possible contributor is the program attendance rules, students can only participate in each program once with a full travel and accommodation scholarship. In 2013/14 a big push to encourage female students to participate increased participation numbers, but the proportion of female students enrolled in mathematical sciences programs did not increase this year leaving a smaller pool of female students to participate in the 2014/15 period. We are investigating the possibility of female scholarships to combat this.

We will address these issues in 2015/16 and are optimistic that we will increase female participation again next year.

Choose Maths

A partnership between BHP Billiton and AMSI to increase the representation of girls and women in the field of mathematics was launched on 28 April 2015. The program increases the impact and reach of AMSI's activities to address the pipeline issues from primary school, into secondary school and through to university and the workplace. Increasing awareness of the value of mathematics to careers and lifestyle, especially for women, is a program highlight. The program will have a high impact in the long-term on Australian student enrolments in undergraduate, honours and PhD mathematical sciences programs and will significantly increase participation in the AMSI Higher Education programs.

Choose Maths will work with students, parents and teachers over five years, through a program of professional development, awareness and reward, to turn around community attitude to participation in mathematics, especially for girls and young women.

The program will build self sustaining education communities where girls and young women share equally in the rewarding careers and rich life experiences that mathematics offers.

CHOOSE MATHS AIMS TO:

- Increase the engagement, enthusiasm and confidence in mathematics demonstrated by girls
- Enhance teacher knowledge and confidence in mathematics and assist teachers to implement strategies known to engage and inspire girls
- Grow the understanding of the importance of mathematics in the minds of the public
- Address the tightly held public perception of gender stereotypes with regard to mathematics



“Any increase in STEM participation is good news but an increase in female representation is especially valuable because of the undeniable benefits of diversity.”

Andrew Mackenzie,
BHP Billiton Chief Executive Officer



1. MATHEMATICS-READY TEACHER PROFESSIONAL DEVELOPMENT

AMSI will work on the ground in 120 Australian schools throughout the life of Choose Maths. The program will be based on AMSI's existing, highly successful cluster arrangement where a secondary school and its feeder primary schools are formed into a professional development group working with an AMSI Specialist to focus on enhancing content knowledge.

- Teacher support
- Professional development
- School visits
- Teacher resource portal

2. INSPIRING WOMEN IN MATHEMATICS NETWORK

A role-model network will be established to inspire school girls and young women to seek the opportunities mathematics offers.

- A community of high achieving women
- Young women connecting with women working in STEM through shadowing opportunities
- Scholarships to AMSI Summer and Winter Schools
- Career events at AMSI member universities
- Maths and biology initiative

3. AWARDS FOR EXCELLENCE IN TEACHING & LEARNING OF MATHEMATICS

Choose Maths will reward students, teachers and schools who are highly successful in motivating, inspiring and preparing students, particularly female students, through gender-sensitive teaching of mathematics.

- Annual teacher awards for successful mentoring of girls
- Student awards for outstanding communication of the value of mathematics

4. NATIONAL MATHEMATICS CAREER AWARENESS CAMPAIGN

A nation-wide awareness campaign to educate and excite the public with the knowledge of the importance of mathematics and an understanding that mathematics enhances career options and is a critical choice pathway to STEM.

- Posters
- Brochures
- Videos to illustrate practice
- Website
- Radio and print advertising
- Social media



EVENTS

The partnership with the Australian Mathematical Society Women in Mathematics Special Interest Group continues to strengthen.

Under the agreement, a Women in Mathematics event is embedded in the Vacation Schools programs. These events are open to both women and men, and raise awareness of issues faced by women in the mathematical sciences and create a national support network.

- Summer School Women in Maths Afternoon
- Winter School Women in Maths Networking Event
- Vacation Research Scholarships Big Day In Careers Panel with a segment on Women in Maths

We continue to work with the Women in Mathematics Group to identify and remove barriers to female speaker and student participation in AMSI events.

FEMALE ROLE MODELS

AMSI has continued to actively create female role models and the Choose Maths project will allow us to expand our work in this area through the Inspiring Women in Mathematics Network.

FIRST YEAR IN MATHS PROJECT

AMSI was involved in the FYi Maths project, which built academic networks, connections between tertiary and secondary mathematics education, and information and resources to improve retention of mathematical sciences students in the first year of university.

The first year of university is a pivotal experience in students' transition from high school to university, and is strongly influenced by their interactions with their teachers and other students, as well as the content and learning environment of the subjects they study.

In mathematics there is often also a significant gap between students' mathematics education at school and expectations of them at university. The role of the first-year subject and program coordinator in assisting students' transition from high school to university is an important part of the support structure that universities provide to ensure students succeed. As the numbers of mathematics graduates in Australia continues to decline, it is important that faculties maximise the opportunities to support first-year students and encourage their progress in the discipline.

Improving retention in the first year will help to increase female participation in the mathematical sciences.

Project website: www.fyimaths.org.au

The Choose Maths project significantly increases the reach of the AMSI Schools program to regional areas. While the target group is girls of primary and secondary school age and first year university students. It is inevitable that a program that enhances the mathematics experiences of girls also has positive impacts on all students in the schools in which we will operate.

Through the project we will be working in some of the same schools as the CSIRO-BHP Billiton Aboriginal and Torres Strait Islander science, technology, engineering and mathematics (STEM) project.

AMSI also continues to provide teacher professional development to regional and rural schools, through partnership in the Regional Universities Network pilot project, to overcome barriers hampering mathematics and science education in rural, regional and remote Australia. Funded under the Government's Australian Mathematics and Science Partnership Program (AMSPP). The professional development is addressing the needs of rural and regional mathematical teachers and students.

While AMSI programs have an impact on ATSI and low SES participation, to significantly increase ATSI and low SES participation in the mathematical sciences a well-funded coordinated national strategy is required.



PUBLIC EVENTS

A comprehensive program of outreach events ran throughout the 2014/15 period. The program included public lectures linked to AMSI Vacation Schools and Scholarships events to increase awareness of both the events and the role of the mathematical sciences.

Highlights included:

- Mathematics in Australia – the political & cultural environment: Dr. Thomas Barlow, Barlow Advisory. Drawing upon more than a decade spent analysing research and development trends in Australia, Dr. Barlow shared his personal observations about the importance of mathematics in all modern economies, Australia’s competitive standing in the field, and the nature of politics and policy development for the mathematical sciences.
- AMSI Lecture Tour: Professor Terry Speed from the Walter and Eliza Hall Institute of Medical Research and recipient of the Prime Minister’s Prize for Science. Professor Speed toured Australia from August to November 2014. During the tour he gave eight public lectures reaching almost all states and territories and exiting students and young researchers with his bioinformatics research
- The AMSI Winter School Public Lecture in conjunction with BrisScience: Professor Andrew White, School of Mathematics and Physics, The University of Queensland. Professor White led the audience through the progress and the pitfalls of quantum computing and cryptography in his talk Cracking the Quantum Code.

AMSI INTERACTIVE WEBSITES

The new AMSI website was launched at the end of 2014. The website allows AMSI to engage more effectively with our audience.

The site includes:

- A research blog – highlighting interesting research, showcasing Vacation Research Scholarship achievements, and announcing mathematical sciences achievements and awards (www.research.amsi.org.au/news)
- A schools level blog – highlighting interesting and accessible mathematical sciences stories that can be used in the classroom (www.calculate.org.au/category/look-what-we-found)
- Interviews – with mathematical scientists from research and industry
- Easy access to relevant resources

SOCIAL MEDIA

Social media allows us to reach a wider Australian and international audience. We have successfully implemented a social media strategy that has seen Facebook engagement and click-throughs to the AMSI Vacation Schools and Scholarships websites and AMSI website steadily increase.



Figure 8: Growth of Facebook Likes January 2014 - April 2015.



E-NEWS

Subscriber numbers to the monthly Research & Higher Education e-news are also growing steadily. The e-news advertises AMSI programs and events and includes links to quirky maths problems or topical stories. The e-news increases engagement with the mathematical sciences and the Vacation Schools and Scholarships program.

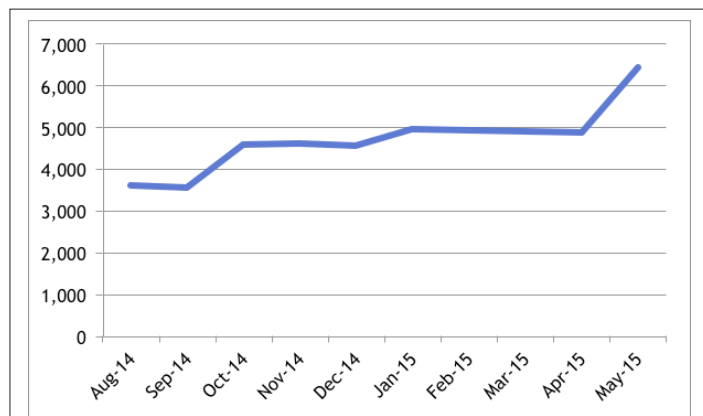


Figure 9: Growth of AMSI e-news subscribers from August 2014 - May 2015

E-news: www.research.amsi.org.au/news/e-news

HOT MATHS PARTNERSHIP

AMSI Vacation Research Scholarship blogs are reposted by the Cambridge University Press HOT MATHS blog with links back to the AMSI website and information about the program.

Blog: <https://blog.hotmaths.com.au/blog>

Opinion pieces are an effective way for us to promote the Vacation Schools and Scholarships program, Australian research and issues in the mathematical sciences. In 2014/15 we arranged quarterly opinion pieces linked to our programs:

- *Quantum linked computers challenge cyber security* - Tom Stace, University of Queensland
- *Big data is watching you* - Ron Sandland, AMSI Board
- *Humans vs microbes: game on!* - Dr David Lovell, CSIRO
- *Infection projections: how the spread of Ebola is calculated* - Dr Jonathan Keith, Monash University
- *Who said girls aren't interested in maths?* - Lily Serna, AMSI Board

CAREERS AWARENESS

Maths Ad(d)s

The 2014 Maths Ad(d)s was endorsed by The Hon. Christopher Pyne, MP Minister for Education. Circulated to all schools in Australia, the booklet features job ads for mathematicians and statisticians, student profiles from the AMSI Vacation Schools and Scholarships program and profiles of mathematicians and statisticians.

Careers Afternoon

The annual Careers Afternoon, embedded in the AMSI Summer School, gives students the opportunity to hear from mathematical sciences employers. This year employers included PwC, the Commonwealth Bank, Optiver and the Bureau of Meteorology.

Careers Panel

Careers panels were embedded in BioInfoSummer and the Vacation Research Scholarship mini-conference the *Big Day In*. Both panels were very popular with great audience engagement. Feedback requested more time for the audience question and answer sessions.

Maths Adds: Careers Powered by Maths

The new AMSI Careers website was launched in July 2014. The site provides students and parents with information about how mathematics and statistics lead to great career and learning paths.

All AMSI's careers resources are easily accessible (download or to order) from the site:

<http://careers.amsi.org.au>

DISCIPLINE PROFILE

The third edition of the Discipline Profile of the Mathematical Sciences was released in June. AMSI's 2014 publication highlights trends as they apply to school education, higher education, research and research training, and career prospects for graduates. Each year the discipline profile is accompanied by a Policy Document that identifies key priorities for government intervention and actions for peak bodies (commercial, educational, scientific and technological) to undertake.

POLICY RECOMMENDATIONS

Australia's international competitiveness, security, population health and climate stability requires the workforce to be mathematically literate. AMSI's Policy Document has been structured to address the challenges apparent from the 2014 profile data. AMSI recognised three distinct priorities:

- Train the unqualified teachers of school mathematics and secure the future supply of mathematics teachers.
- Reverse the decline in intermediate and advanced mathematics enrolments at Year 12.
- Increase the number of girls studying maths and women employed in the quantitative professions.

The release of the 2014 Discipline Profile and AMSI Policy Document generated significant media attention. The AMSI Director was interviewed for television, radio and newspaper.

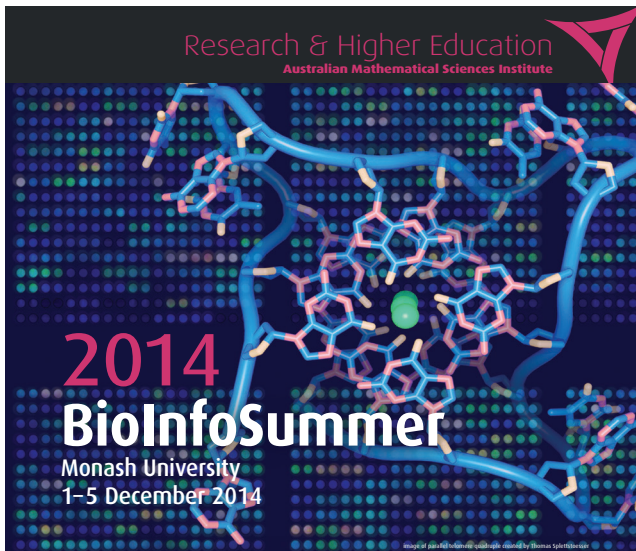
These documents can be downloaded here:

www.amsi.org.au/publications

“The Australian Mathematical Sciences Institute continues to support mathematical research, enhancing the experience of undergraduate and postgraduate students and mathematically preparing students entering tertiary education.

Ensuring that we have sufficient graduates in science, technology, engineering and mathematics is important for Australia in the development of globally competitive 21st century knowledge economies.”

The Hon. Christopher Pyne, MP Minister for Education



Research & Higher Education
Australian Mathematical Sciences Institute

2014 BioInfoSummer

Monash University
1-5 December 2014

Bioinformatics is an exciting, fast-moving area analysing and simulating the structures and processes of biological systems. BioInfoSummer introduces students, researchers and others working in related areas to the discipline.

The program features:

- Introduction to molecular biosciences and bioinformatics
- Next-generation DNA sequencing and sequence evolution
- High-throughput technology and omics data analysis
- Methods in bioinformatics
- Systems biology



Register now: www.amsi.org.au/BIS



Research
Australian Mathematical Sciences Institute

The 9th annual AMSI Winter School

Contemporary Aspects of Cryptography

7-18 July 2014
The University of Queensland

Seven reasons to attend:

- Hear** from eminent national and international lecturers
- Discover** contemporary cryptography and its modern applications
- Learn** mathematical tools and techniques used in research
- Uncover** the link with mathematics, computer science and electrical engineering
- Understand** key aspects of current cryptography research
- Build** collaborative networks with PhD students and early career researchers
- Expand** your skills in the mathematical sciences

Who should attend:

- Students, researchers and employees focusing on
 - cryptography,
 - related areas of mathematics, or
 - quantum science, computer science and electrical engineering

Lecturers include:



Full travel and accommodation scholarships available!



Apply today: www.amsi.org.au/WS



Higher Education
Australian Mathematical Sciences Institute

2014 AMSI Summer School in the Mathematical Sciences

6-31 January 2014, Australian National University

7 Reasons to Attend:

- **Learn** from Australia's leading mathematicians and statisticians
- **Choose** from a wide range of courses to suit your speciality
- **Gain** credit towards your degree
- **Meet** future employers at the Careers Afternoon
- **Build** your networks at dinners, BBQs and special events
- **Broaden** and deepen your knowledge base with advanced coursework
- **Discover** the latest subjects in your discipline

Subjects:

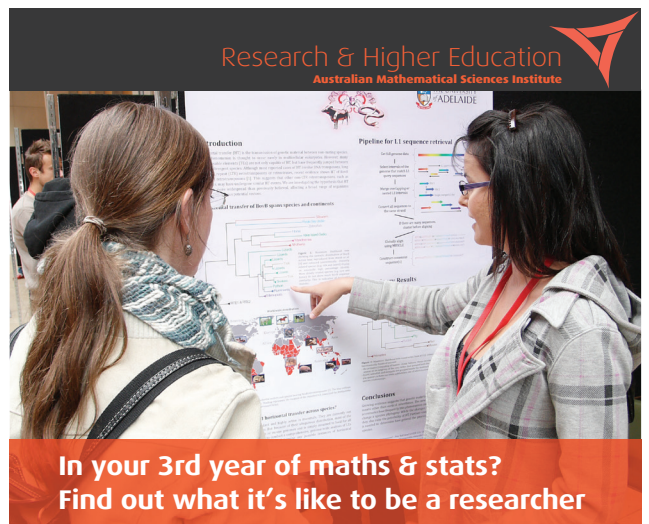
- Bioinformatics - Dr Conrad Burden
- Conformal Field Theory and String Theory - Prof. Peter Bouwknegt & Dr David Ridout
- Differential Geometry - Dr Ben Andrews & Dr Julie Clutterbuck
- Finite Element Method - Dr Bishnu Lamichhane
- High-Dimensional Data - Assoc. Prof. Inge Koch & Dr Samuel Mueller
- Hydrodynamic Stability - Prof. Sergey Suvlov
- K Theory - Dr Vigleik Angeltveit
- Statistical Inference - Prof. Alan Welsh and Assoc. Prof. Robert Clark



Full travel and accommodation scholarships available!



Apply today: www.amsi.org.au/SS



Research & Higher Education
Australian Mathematical Sciences Institute

In your 3rd year of maths & stats?
Find out what it's like to be a researcher

2014/15 AMSI Vacation Research Scholarships

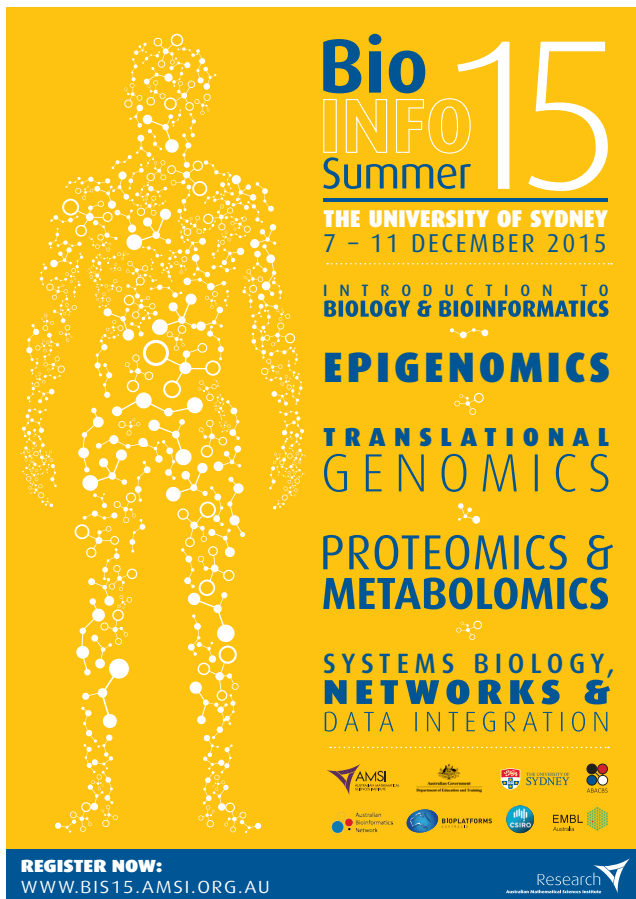
Get funding to complete a six-week summer research project under the guidance of a supervisor!

Scholarships:

- Australia wide
- \$450/week for six-weeks
- Present at CSIRO's Big Day In
- Fully funded travel and accommodation
- Open to intending honours and masters students



Apply today: www.amsi.org.au/VRS



BioINFO 15 Summer

THE UNIVERSITY OF SYDNEY
7 - 11 DECEMBER 2015





INTRODUCTION TO
BIOLOGY & BIOINFORMATICS





EPIGENOMICS

TRANSLATIONAL
GENOMICS

**PROTEOMICS &
METABOLOMICS**

SYSTEMS BIOLOGY,
**NETWORKS &
DATA INTEGRATION**

REGISTER NOW:
WWW.BIS15.AMSI.ORG.AU

Research
Australian Mathematical Sciences Institute



Research
Australian Mathematical Sciences Institute

Winter School 2015 on Algebra, Geometry & Physics

29 June - 10 July 2015
The University of Queensland

Introductory and advanced courses in:

Geometric Representation Theory
Assoc. Prof. Anthony Henderson, The University of Sydney
Dr Masoud Kamgarpour, The University of Queensland
Dr Tony Licata, The Australian National University

Moonshine Conjectures and Vertex Operator Algebras
Prof. Terry Gannon, University of Alberta
Dr Nora Ganter, The University of Melbourne
Prof. Geoffrey Mason, University of California, Santa Cruz

K-Theory and its Applications
Dr Vigleik Angelteit, The Australian National University
Dr Pedram Hekmati, The University of Adelaide

Moduli Spaces in Symplectic Geometry
Dr Joan Licata, The Australian National University
Dr Brett Parker, The Australian National University

Full travel grants available!

In collaboration with the 2015 ANU Mathematical Sciences Institute Special Year in Geometry & Physics











www.amsi.org.au/WS



AMSI 16 Summer School

IN THE MATHEMATICAL SCIENCES

RMIT University
4-29 January 2016

Research
Australian Mathematical Sciences Institute

STOCHASTIC MODELLING
Giang Nguyen, University of Adelaide

LINEAR CONTROL THEORY & STRUCTURED MARKOV CHAINS
Yoni Nazarathy, University of Queensland

CONIC PROGRAMMING
Yera Koschitzka, RMIT University

MODERN NUMERICAL METHODS FOR DIFFUSION EQUATIONS ON GENERIC GRIDS
Jerome Droniou, Monash University

DESIGN & ANALYSIS OF EXPERIMENTS
Stavros Georgiou, RMIT University

COMPLEX NETWORKS
Stephen Davis, RMIT University

CALCULUS OF VARIATIONS: THEORY & PRACTICE
John Dillerbeck, The Australian National University
& Anis Silas, Monash University

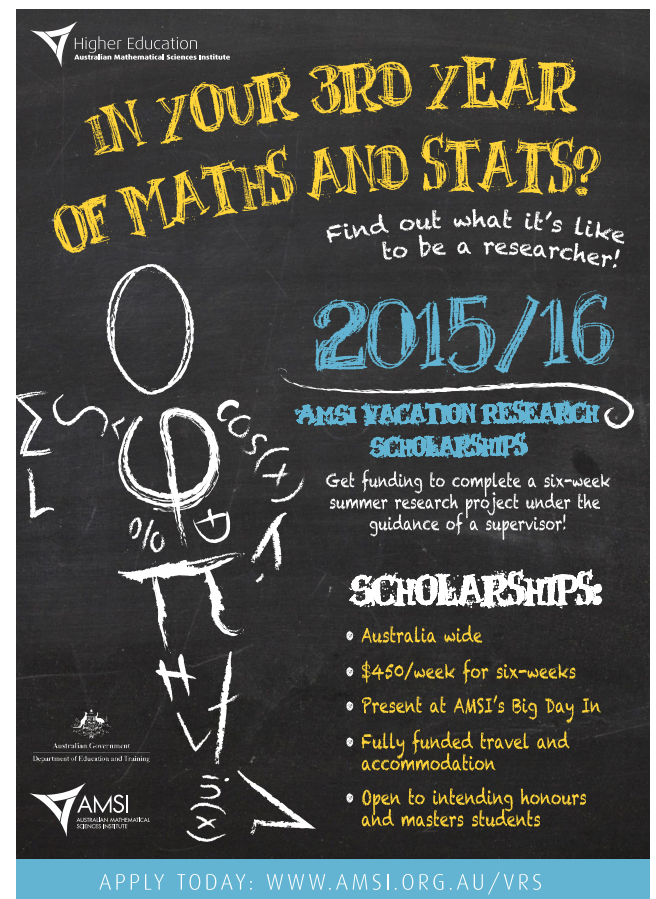
PROJECTIVE GEOMETRY
John Kambouris, The University of Western Australia








REGISTER TODAY: WWW.AMSI.ORG.AU/SS



Higher Education
Australian Mathematical Sciences Institute

IN YOUR 3RD YEAR OF MATHS AND STATS?

Find out what it's like to be a researcher!

2015/16

AMSI VACATION RESEARCH SCHOLARSHIPS

Get funding to complete a six-week summer research project under the guidance of a supervisor!

SCHOLARSHIPS:

- Australia wide
- \$450/week for six-weeks
- Present at AMSI's Big Day In
- Fully funded travel and accommodation
- Open to intending honours and masters students

Australian Government
Department of Education and Training

AMSI
AUSTRALIAN MATHEMATICAL SCIENCES INSTITUTE

APPLY TODAY: WWW.AMSI.ORG.AU/VRS

Australian Mathematical Sciences Institute

Simi Henderson
Research and Higher Education Manager
c/o University of Melbourne VIC 3010

simi@amsi.org.au
www.amsi.org.au

