

WORKSHOP REPORT

FYiMaths (First Year in Mathematics) New South Wales December 2023

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Abstract

In this article, a summary is provided of the recent First Year In Mathematics (FYiMaths) New South Wales meeting held at the University of Wollongong, Australia, and online. The theme of the meeting was “Technology and Mathematics/Statistics” and the day comprised a total of 12 talks. We provide a brief background of FYiMaths, followed by a summary of the talks, and concluding remarks.

Keywords: FYiMaths, mathematics education, statistics education.

1. Introduction

The First Year in Mathematics (FYiMaths) group is an Australian group of academics, teachers and support staff with an interest in the teaching of mathematics at the undergraduate level. It began through a project funded by the Australian government to develop a handbook for coordinators of large first year mathematics subjects (Office for Teaching and Learning, 2015). Since then, the group has developed to become a community of practice for undergraduate mathematics and statistics education and the transition from secondary education.

FYiMaths NSW is the New South Wales branch of FYiMaths. The annual meeting of FYiMaths NSW was held as a hybrid event at the University of Wollongong and online on 13 December 2023, with about 50 people attending either in person or online. The theme of the meeting was “Technology and Mathematics/Statistics”, although the meeting also included talks from a wider range of topics.

The day comprised 12 talks (summaries below) and much lively discussion from all in attendance. Recordings of most of the talks can be found at the FYiMaths YouTube channel at <https://www.youtube.com/playlist?list=PL-MI0q0vuCRXOm38W2HvcjgeuYZ-cBxO>. A new innovation was introduced at this meeting, which was adapted from the CETL-MSOR lightning talks (e.g. CETL-MSOR, 2022). At the CETL-MSOR lightning talks, as a friendly incentive for speakers to remain within time limits, toy ducks were lined up, ready to be launched at a speaker with a toy projectile if their talk went over the specified time-limit. This light-hearted practice was adapted for the Australian context, whereby rather than toy ducks, it was the sacrifice of a number of toy koalas for speakers who exceeded their time limit. This proved to be a popular addition to the day.

2. Talks

2.1 Routes to First Year Mathematics (Ian Whiteway)

Where do the students who come to first year mathematics subjects come from and, more importantly, what do they know when they get here? The first speaker, a secondary teacher at a large private school, discussed the various routes that students could take at the end of their

secondary education including the Higher School Certificate (NSW education department exams), the International Baccalaureate, and the Cambridge A Levels, all of which are available to students in NSW. Similarities and differences in content and approach to learning were covered for the different levels of each qualification.

The ensuing discussion suggested that the information from this talk should be developed into a page on the FYiMaths website, and that it be expanded to include information about the larger groups of international students who study in Australia.

2.2 The Golden Gate Bridge is 1.479 km high and 2.15×10^6 m long, some thoughts on word problems in mathematics (Merryn Horrocks)

The answers quoted in the title of this talk were examples of answers given by students to questions in an engineering maths test. After dismissing the suggestion that such answers come from “stupid” students, the speaker discussed the difficulties inherent in word problems and outlined some strategies for overcoming them. This included unspoken assumptions in word problems and a model to teach students how to solve word problems.

2.3 When will I use this? Relating Mathematics to real life applications and its impact on student engagement and academic performance (Shatha Aziz)

This talk focussed on the concept of relevance in the context of a second-year linear algebra subject (module). The speaker began with a question that is commonly asked by students: *When will I use this?*, explaining that mathematics is often perceived as an abstract subject. For this reason, a case is made regarding the role of educators in connecting mathematics to the real world in order to positively impact student engagement.

As the speaker’s cohort was predominantly comprised of future teachers, she developed an activity that would be relevant to their profession. The activity was optional, and involved creating a group video presentation explaining a simple application of linear algebra, followed by a reflection on the benefit of the activity to students’ learning. Students could choose to explain one of four applications discussed in a research article provided by the speaker, or any other relevant application of their choosing. Student feedback on the activity was positive, with participating students commenting that they enjoyed the activity and that it was beneficial to their learning, helping them to appreciate the application of mathematics in the real world.

The speaker then facilitated a discussion on the activity, asking workshop participants for their ideas and insights. The discussion included acknowledgement of the benefit of implementing activities that provide concrete relevance, as was done by the speaker, as well as considerations around whether or not the activity should be mandatory and/or assessed.

2.4 CARMA/MATRIX poster/art competition awards (Judy-Anne Osborn)

The speaker, CARMA Director, discussed the [CARMA/MATRIX Poster/Art Competition](#) and announced the 2023 award winners. An overview of the CARMA-MATRIX awards history was provided. This was followed by a presentation of the 2023 artwork entries (e.g., Figure 1) and a description of their respective artist statements. Finally, the 2023 winners were announced as follows.

Art Prizes:

- 1st Prize: *Involution curve*, by Peter van der Kamp
- 2nd Prize: *Apollonian Sunset*, by Travis Stenborg
- 3rd Prize: *The beautiful patterns of Blaschke products*, by Juan Carlos Ponce Campuzano

Outreach Prizes:

- 1st Prize: *Turing Patterns*, by Travis Stenborg
- 2nd Prize: *Fractals, understanding the geometry of nature*, by Rahil Valani

All winners were congratulated, and workshop participants encouraged to consider submitting entries in 2024. Entries for the 2024 competition are now open on the [CARMA webpage](#).



Figure 1. *Recursion, Randomness and Nature* by Juan Carlos Ponce Campuzano. The image can be directly accessed at [this link](#).

2.5 Supporting self-efficacy beliefs through undergraduate tutorials (Sang Hyun Kim)

Given the fundamental nature of tutorials on student learning in mathematics, this talk summarised the results of a study comparing the effect of face-to-face tutorials with remote delivery in an undergraduate second-year service mathematics course at the University of Auckland. Effects compared included performance and self-efficacy. The study was a quasi-experimental design, with groups constructed such that students attending more than 50% of face-to-face tutorials were considered 'In-person students', and students attending less than 50% of face-to-face tutorials (i.e. completing their tutorial work online) were considered 'Online students'.

In terms of student performance, on average, the Online students' exam and final grade marks were higher than face-to-face students' marks, and this difference was significant in both cases. However,

in terms of self-efficacy, on average, there was a negative change in the Online group, compared with a positive change in the face-to-face group.

The speaker concluded by summarising some of the conclusions from the study so far, as well as describing possible future directions of the research. These include exploring possible reasons for the somewhat surprising results seen so far, and broadening the scope of the study.

2.6 Three online systems for organising teaching and learning resources (Jim Pettigrew/Laure Helme-Guizon)

In this talk, the speakers provided an overview of three online systems that have been developed for the organisation of teaching and learning resources.

The first system is a database website that allows for efficient management and easy look-up of previous exam questions (Figure 2). This system uses a MySQL database and a combination of PHP, JavaScript, CSS and HTML.

The second system contains an organised repository of responses to frequently asked student questions so that responses can be adapted and re-used as necessary. This system uses the Sphinx documentation-building tool.

The third system is a documentation website for comprehensive ‘how-to’ notes for the use of the Möbius online learning and assessment system. This system uses the Sphinx documentation-building tool.

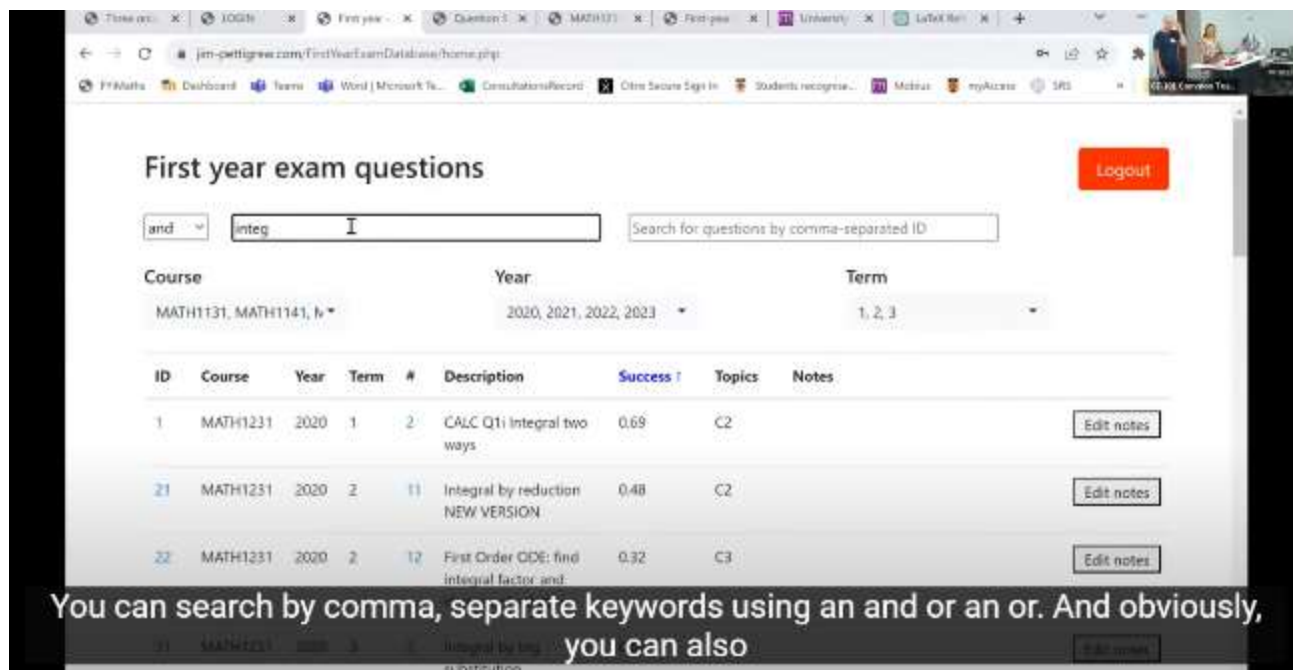


Figure 2. Database website that allows for efficient management of previous exam questions, including search functionality.

2.7 Maple use in first year exams (Jonathan Kress)

This talk describes the implementation of Maple, and other software, into large first-year exams. The speaker began by providing motivation for consideration of using Maple or other software in mathematics exams, including the availability and wide-use of sophisticated technology that is available in this day and age. The speaker then gave an overview of the use of Maple in first-year mathematics at the University of New South Wales beginning in the early 1990's.

The speaker explained that traditional exam delivery was disrupted due to the COVID-19 pandemic, and during that time, exams needed to be carried out as unsupervised, open-book assessments. This included the potential for students to use Maple during exams. For this reason, question design needed to be considered, with new questions focussing on understanding rather than calculation, and designed such that answers could not be obtained from an internet search or using a calculator.

Following this experience and with a return to invigilated exams, a decision was made to run the exams in computer labs with randomised questions, and thus, it was decided that the use of Maple would be allowed in exams. The speaker ended by reflecting on the types of mathematical skills students need in this day and age, which may now go beyond tasks that software and AI can perform.

2.8 Designing an introductory statistics subject for students with diverse educational backgrounds and chosen qualifications (Amanda Shaker/Rupert Kuveke)

In this talk, the speakers discussed the design of a large, first-year undergraduate statistics service subject at La Trobe University, which has been designed to cater for a diverse range of educational backgrounds and chosen qualifications. The subject is comprised of two parts: a core component containing foundational statistics concepts which all students complete, and a stream-specific component which contains differing content and assessment depending on students' chosen degree. Currently, the subject offers two streams: Science/Health, and Data Science, although additional streams can be added as need arises.

The speakers provided an overview of other design elements included in the subject, which include less emphasis on mathematical calculations and more emphasis on understanding and use of software, and various statistics anxiety considerations. After an initial evaluation, among other changes, a decision was made to use jamovi instead of R in the Science/Health stream, while Data Science students use R.

Over time and as a result of the iterative changes being made, both pass rates and overall student satisfaction have increased. A full paper on this project has been accepted for publication in *MSOR Connections* and appeared in a recent issue (Kuveke et al., 2024).

2.9 Users vs Developers (Usha Shridar)

The speaker in this talk used an analogy from computing of users vs developers to identify two groups of students of mathematics: the users who are essentially surface learners, and developers who want to understand concepts more deeply. Discussion within the talk focused on methods for accommodating these two groups within the traditional class structure.

2.10 A collaborative model for learning AI in the context of LANTITE content creation (George Papadopoulos)

The development of generative AI has caused consternation throughout academia due to many potentially negative outcomes which may arise from its use. This talk took an alternative view and discussed how AI has been used as a helper to write sample questions designed to help students to prepare for a compulsory literacy exam for pre-service teachers. The speaker had involvement with the beta development of Microsoft's Co-Pilot AI and used this in his role with a team of literacy educators to develop new questions from existing exemplars. Discussion centred around the possibilities that this approach offers for the development of questions in a mathematical context.

2.11 Technology challenges in AEI (Pranati Balijepalli/Visali Kadiyala/Radha Somanchi/Usha Shridar)

The speakers in this talk discussed the use of technology in a new subject, Arguments, Evidence and Intuition (AEI), which deals with data literacy and quantitative numeracy at a basic level. The talk included discussion around the issues created by the use of "big data", including data privacy, the use of language as technology and the use of Excel as a tool for generating statistics from data sets.

2.12 Higher Education Provider Amendment (Support for Students Policy) Guidelines - discussion (Don Shearman)

The Australian government has introduced new legislation which changes how students receiving government support for their studies are treated. Previously if a student failed more than four of their first eight subjects they would lose their government support. The new legislation moves the responsibility for students to pass their subjects more onto the tertiary institution by requiring them to assess a student's capability to succeed in their chosen program of study and to provide adequate academic and non-academic support to help students to succeed in their studies. This discussion session generated a lively discussion around the topic of how the new legislation will affect mathematics and statistics support in Australian universities with the consensus being that it will lead to improved services.

3. Concluding Remarks

The workshop included talks from a wide range of areas related to Higher Education mathematics and statistics in Australia and New Zealand. Topics discussed included pathways into first-year university maths, using maths word problems, student engagement and how students learn, e-assessment, and implications of forthcoming changes to government guidelines related to student support.

A recurring theme at the workshop was the diversity of academic backgrounds in service teaching of mathematics and statistics. This can lead to challenges with relevance, as students may not immediately see how these subjects apply to their chosen degree. Strategies discussed for addressing this included incorporating video assessments where students discuss real-life applications of mathematics in their discipline. Additionally, modularizing a statistics module to accommodate different disciplines was suggested for a large first-year statistics unit. The workshop also provided an update on various routes into first-year mathematics in the NSW context, acknowledging the role of FYiMaths in promoting awareness.

The meeting also discussed the new Support for Students Policy, emphasizing its implications for mathematics and statistics support services at universities. Another key topic was student engagement in a post-COVID world, comparing self-efficacy and performance between online and face-to-face cohorts.

The workshop highlighted several key lessons learned. One notable point was the use of mathematical software like Maple in mathematics exams, a practice adopted during the COVID-19 pandemic and recognized as beneficial. Another lesson stressed the importance of preparing students to tackle mathematical word problems, given the additional skills required for their solution.

Technology emerged as a recurring theme, with discussions on video assessments, software in exams, statistical software program comparisons in a first-year statistics unit, and systems developed for managing mathematics teaching resources. Another prominent theme was the interpretation of mathematics, encompassing mathematical word problems, real-world perspectives, and mathematical art.

The workshop was a welcome opportunity for attendees to share teaching ideas, connect, and collaborate. The FYiMaths NSW meeting is run annually in NSW towards the end of the calendar year. There is also a national FYiMaths meeting that is held annually in the middle of the year, with the next national meeting to be held in hybrid format in the middle of 2024.

4. References

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