

WORKSHOP REPORT

FYiMaths (First Year in Mathematics) New South Wales 2024 Meeting Report

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Abstract

This article provides a report of the recent First Year in Mathematics New South Wales (FYiMaths NSW) meeting held in Sydney, Australia, in December 2024. Nine talks were presented, with an overall theme of, *How should we teach and assess maths and stats to improve student outcomes?* An overview and background of FYiMaths is provided, followed by a summary of each of the nine talks presented at the recent FYiMaths meeting. Finally, a summary of the day is provided which includes emerging themes, key takeaways and lessons learned.

Keywords: FYiMaths, mathematics education, statistics education, student success, student outcomes.

1. Introduction

The First Year in Mathematics (FYiMaths, <https://fyimaths.weebly.com/>) network is a national collective of tertiary mathematics educators. Open and free to all, the network holds a two-day annual national conference. In addition, the FYiMaths New South Wales (NSW) group holds a one-day meeting each year.

For over a decade, FYiMaths has provided colleagues with opportunities to present their teaching and learning research, discuss successes and challenges, and share their experiences with colleagues from across the country.

The annual FYiMaths NSW meeting was held at Macquarie University as a hybrid event on 16 December, 2024, with the theme of, *How should we teach and assess maths and stats to improve student outcomes?* There were approximately 53 attendees in total, with 31 attending face-to-face and 22 attending online. Nine talks were presented throughout the day, each of which are summarised in Section 2, with recordings of the talks available at the FYiMaths YouTube channel at <https://www.youtube.com/playlist?list=PL-MI0q0vuCRU4BwRDIMrR3hlqg1wBvb6T>.

2. Talks

2.1. Conditional Reasoning in First-Year Mathematics Students (Lara Alcock: Plenary talk)

The day opened with a plenary talk by Lara Alcock from Loughborough University. Lara's talk explored the difference between mathematical, and everyday interpretation of conditional inference statements; that is, statements of the form "if A then B".

Throughout the talk, the audience was asked to engage in various tasks involving abstract inference statements, highlighting the difficulties in interpreting such statements, even for experienced practitioners.

The believability of true inferences was explored using comparative judgement (that is, where assessors are asked to compare solutions and decide which is better). Although truth and believability of the examples did not perfectly align, strong correlations were found between experts and students for those that did align.

The next result reported on included statements that were conditionals that had been classified as abstract, mathematical relatively believable or mathematical relatively unbelievable, and everyday causal relatively believable or everyday causal relatively unbelievable. Participants in the study were undergraduate mathematics students who had previously had some basic instruction in logic.

Results showed that students were better at accepting believability of mathematical inferences than everyday causal inferences and they accepted the truth of mathematical unbelievable inferences at about the same level as abstract inferences.

In general, students understood the difference between the truth of an inference and its converse, but were less reliable at identifying truth of "not A implies not B".

A small study on propositional inferences is underway, with earlier results showing that these are more challenging for students to comprehend.

2.2. Study on how maths and stats educators and students think that maths and stats should be taught and assessed - a progress update (Merryn Horrocks)

This talk reported on the progress of a study using structured interviews to capture educator and student perspectives on mathematics and statistics learning, teaching and assessment. 11 students (from Western Sydney University) and 33 educators (both Australian and International) had been interviewed to date, with more interviews planned. The study intends to apply a thematic analysis to the data.

Preliminary analyses found that students liked active learning activities, ongoing low-stakes assessments, and a variety of assessment types. There was great diversity in the educator views, but it was generally agreed that effective teaching and assessment modalities are dependent on the student cohort and the subject, and most were strongly in favour of active learning and peer-collaboration activities, and valued the development of mathematical/statistical communication skills in students. It is hoped that the formal data analysis will provide rich insights into methodologies and perspectives of educators actively involved in the teaching and learning of mathematics.

2.3. Smart Problem-Solving: From Strategies to AI Integration (Linda Banihashemi)

The speaker reported on a study design which has just received grant funding and which will be developed over the coming year. The project involves developing a module called Smart Problem Solving. Data show that many students have difficulty in using conventional problem-solving strategies. This, combined with low motivation levels, leads to overreliance on looking up the answers; in particular, students asking AI tools for solutions, rather than learning to develop their own solutions.

The project aims to develop an open access module that integrates conventional problem-solving strategies with AI tools to enhance numeracy and critical thinking skills. This will involve first teaching students problem-solving strategies and using them to solve specific problems, then exploring the use of AI to address the problems, and teaching students to critically evaluate the AI solutions, as well as how to validate their own solutions.

2.4. Improving pass rates in first-year statistics (Amanda Shaker)

This talk focussed on an intervention that was implemented within a large first-year statistics subject (module) with the aim of improving pass rates, with the impact on student anxiety and confidence also evaluated. The evidence-based intervention involved increasing the amount of early assessment within the subject, enabling students to progressively build their knowledge via low-stakes activities early in the teaching period, and assisting lecturers to identify at-risk students early in order to provide support.

Following the intervention, pass rates noticeably improved. General statistics anxiety did not significantly decrease as a result of the early assessment, however a significant decrease was seen in software-related anxiety. In terms of student perceptions, a significant and positive impact was observed, with students indicating that the early assessment had a positive impact on anxiety, confidence, learning, keeping up with the material, and motivation.

2.5. CARMA-MATRIX Maths Art Competition Awards 2024 (Judy-anne Osborn)

The speaker, CARMA Director, presented the 2024 award winners of the [CARMA/MATRIX Poster/Art Competition](#). Following an overview of the CARMA-MATRIX awards history, a presentation of the 2024 artwork entries was provided (e.g., Figure 1).

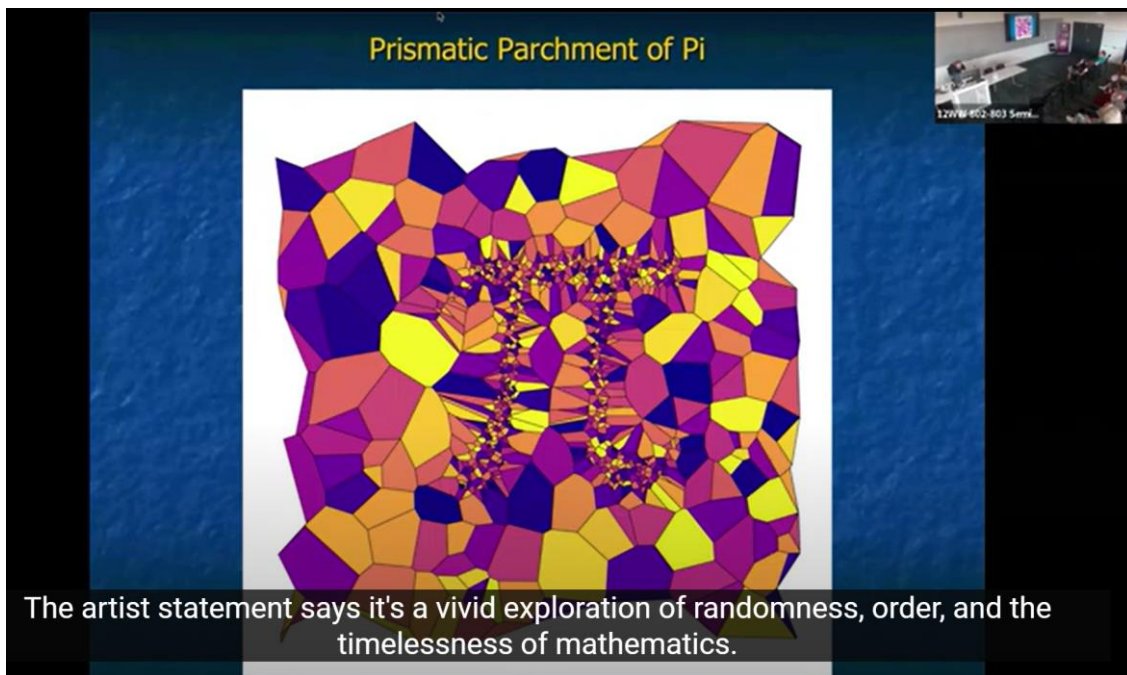


Figure 1. *Prismatic Parchment of Pi* by Jared Roberts.

The 2024 winners in both the Art and Outreach categories were announced as follows:

Art Prizes:

- 1st Prize: *Prismatic Parchment of Pi*, by Jared Roberts
- 2nd Prize: *Intergalactic moth*, by Awansika Nimuthumana and Anuradha Mahasinghe
- 3rd Prize: *Eratosthenes meets Ulam*, by Peter van der Kamp

Outreach Prizes:

- 1st Prize: *Wallpaper Groups*, by Ena Bahk-Pi
- 2nd Prize: *The Transition from Knots to Rational Numbers*, by Can Selek

2.6. Day-long mathematical modelling problems as outreach and assessment (Peter Bier)

This talk discussed a using a day-long project for senior secondary school students to promote and develop skills in mathematical modelling. Students worked in groups of 3-4 over 8 hours to solve an open-ended problem. Past problems have included “How many airships would be required to replace the Cook Strait Ferries?”, “If you had a million dollars, what percentage of the NZ population could you persuade to sign a petition you wanted championed?” and “What’s the largest payload that could be launched into orbit via slingshot?”. Students may use any public resources, including the Internet to help them develop their solution.

The aims of the day are to enthuse students and to get them to see the relevance of mathematics to real world problems. Much thought is put into choosing the questions, which need to be concise, open-ended with a low floor and a high ceiling, and currently unsolved. The questions are designed to encourage students to question their assumptions and to evaluate their solutions.

Around 1000 students from across New Zealand took part in the 2024 event. The speaker discussed some observations from the project, including the difficulty that students have in identifying the questions as maths problems (since they do not look like the maths problems they see in school), the stress they feel when the question does not provide all the data with which to solve the problem, and their euphoria when they finally submit their solution.

2.7. Discussion: Is student preparation declining? (Deborah King)

FYIMaths meetings endeavour to provide opportunities for the participants to discuss topics of general interest to the community. This provides valuable insights for colleagues on how their situation compares to other institutions and often leads to collaborative research initiatives across universities.

This session was intended to elicit perspectives on the current standard of student prior knowledge and if it has changed post-Covid.

Challenges noted by some participants included impacts of low attendance on student learning and lack of engagement with the material. Colleagues noted that students seemed to give low priority to university study and showed low levels of personal responsibility for their learning, but high dependence on staff to provide materials for them.

Some ideas that seem to be having a positive impact on students are live lecture streaming (rather than recorded lectures) and early assessment in subjects to provide feedback on progress.

The consensus view was that student prior knowledge continues to decrease but that this was not an evidence-based assessment.

2.8. Indigenising Statistical Learning through Project Work (Ayse Bilgin)

In this talk, the speaker discussed indigenisation of statistical learning through project work. In particular, [8 Aboriginal ways of learning](#) were presented, such as (4) Symbols and Images, and (7) Deconstruct/Reconstruct. The eight ways of learning were then mapped to essential elements of Work Integrated Learning in a statistical project context. For example, (4) Symbols and Images relates to the importance of data visualisation in statistics; (7) Deconstruct/Reconstruct relates to the importance of collaborating with clients when carrying out statistical consulting, especially where a roadblock has been hit. In this context, there may be additional information that the clients can provide, which can impact the data, story, and conclusions drawn. Utilising this framework, indigenisation of statistical learning was achieved, contributing to valuable career-ready skills development.

2.9. Effect of instant feedback on self-efficacy in a foundations mathematics course (Rosie Cameron)

The context of the research presented in this talk was a foundations mathematics course (module) at a New Zealand university. The student cohort was roughly 500 students and predominantly comprised of Engineering, Computer Science and Commerce students with diverse mathematical backgrounds. Pass rates were traditionally low and mathematics anxiety was present. In this course, students completed homework online in weekly quizzes using STACK (<https://stack-assessment.org/>). Upon answering a question, students could check their answer, receive feedback, and if desired, reattempt the question with a small penalty incorporated before moving on. Using focus groups, the effect of the instant feedback strategy was evaluated in terms of student self-efficacy and the results were presented.

Overall, the value of the quiz was made visible to students throughout the semester because they could see how the practice helped them to learn, and this was motivating for students. Some students also mentioned that the length of the quiz was challenging and found this to be de-motivating. Overall though, students found the quizzes to be motivating.

3. Concluding Remarks

The nine talks presented provided several key themes and takeaways related to the overall theme of *How should we teach and assess maths and stats to improve student outcomes?*

The most prominent emerging theme was provision of low-stakes assessments. In particular, the value of increasing the amount of low-stakes assessment early in the teaching period, and providing a mechanism for immediate feedback, was highlighted. These practices can lead to improved student outcomes, including student performance, student anxiety, confidence, and motivation, as well as student learning and keeping up with the material. Other benefits include the opportunity for students to progressively develop their knowledge and skills throughout a teaching period, and provision of a mechanism for lecturers to identify at-risk students early in a given teaching period in order to offer support.

Peer collaboration was another emerging theme, with evidence indicating that many educators value peer collaboration as an effective tool for student learning. The value of peer collaboration in conjunction with real-world problem solving was also discussed. Mathematical art was also presented as a real-world application of mathematics.

The importance of problem-solving skills was also discussed in the context of the emergence of Generative Artificial Intelligence (GenAI) technologies. In this context, it was suggested that while GenAI can and should be embraced as a learning tool, it is also important that students build their own problem-solving strategies, and learn to critically evaluate GenAI outputs.

Other topics covered included the use of active learning activities, and provision of a variety of assessment types, in order to improve student outcomes. The importance of understanding how students think and process logic was highlighted, and the value of indigenisation of statistical learning was demonstrated in terms of development of work-ready skills. Lecture streaming (rather than recorded lectures) was also raised as an important tool for student learning. The point was also made that which modes of teaching and assessment can largely depend on the student cohort and subject material.

Generally speaking, post-Covid challenges noticed by educators include low attendance, lack of student engagement with subject material, and increasingly complex student lives meaning that university study may be given lower priority. A general observation made was that prior mathematical background knowledge continues to decrease, although this observation was anecdotal rather than evidence-based.

The FYiMaths NSW meeting was a beneficial opportunity for mathematics and statistics educators to share experiences, discuss challenges, and share ideas with a view to improving outcomes for students. The next National FYiMaths meeting will be held mid-year in 2025, while the forthcoming FYiMaths NSW meeting will be held in December 2025. Details of future events will be published at the FYiMaths Events page (<https://fyimaths.weebly.com/events.html>).

References

Office for Teaching and Learning, 2015. First Year Coordinators in Mathematics. Available at: https://fyimaths.weebly.com/uploads/1/2/6/7/126775903/fyimaths_guide_web.pdf [Accessed 2 February 2024].

4. Acknowledgements

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