



MERGA 41

Mathematics Education Research Group of Australasia

1 - 5 July 2018 Massey University Albany, Auckland, New Zealand

Mathematics Teachers' Day

Saturday 30th June 2018
Massey University Albany, North Shore
9am - 3pm

Keynote Speaker



Assoc Prof Marcy Wood
University of Arizona, USA

Workshops

3 x sets of workshops with

- a mathematics education focus upon primary & secondary material
- NZ, Australian & international presenters
- all aimed at teachers

Arrival tea/coffee, morning tea & lunch provided

Registration type	Fee
Saturday Teacher	\$120.00

To Register click on 'Registration' on the Conference website:

<http://www.eenz.com/merga41/>

To view the Workshop Sessions go to the website click on 'Programme' then on 'Sat. Teachers' Day'. You can choose your workshops when registering.

TIMETABLE

All in the Sir Neil Waters Lecture Theatre Block	
8:30am	Registration / Tea & Coffee
9:15am	Keynote Address
10:30am	Workshop One
11:30am	Morning Tea
12:00pm	Workshop Two
1:00pm	Lunch
2:00pm	Workshop Three
3:00pm	Day concludes

REGISTRATION

- To view workshop options click on 'Programme' then in on 'Sat. Teachers' Day' in the drop down menu.
- You can choose your three workshops when registering. There will be limitations on the workshop sizes so "first in, first served"
- There will be no refunds offered. If you are unable to attend please send someone in your place.
- Confirmation of workshops will be sent by email.
- Unless personally notified to the contrary all persons enrolling for the seminar will be allocated three workshops and booked for lunch and morning tea.

KEYNOTE ADDRESS



Making waves and opening spaces: Helping each student engage in rigorous mathematics

In spite of our efforts to support more students in finding success in mathematics, students (and people) are still sorted into those who can do math and those who can't. If we want to end this ranking, we need to make waves, rethinking what it means to be smart in math and opening spaces for each student to show their mathematical capabilities. This talk will explore how ideas from Complex Instruction, and particularly the notion of status, can help us make sense of societies' beliefs about mathematics and can help us reshape our own classrooms to better support each student.

Marcy Wood is an Associate Professor at University of Arizona, USA. Her research interests arise from her experiences as a third and fourth grade teacher in Albuquerque, NM. She was curious about the mathematical learning of elementary students, and specifically students who have not yet been successful in mathematics classrooms. Her current research uses the tools of discourse and identity to examine mathematical learning (or not) and to assist teachers in supporting the mathematical learning of their students. She also draws upon sociocultural theories, and cognitive theories, and conceptual metaphors as structures for understanding mathematical learning. Dr Wood's teaching and research interests have led her to develop expertise in Complex Instruction (CI), a model for teaching developed by Elizabeth Cohen and Rachel Lotan at Stanford University. CI is a theoretical and practical framework for helping all students succeed in engaging rigorous mathematics. She works with preservice and inservice teachers to make sense of the theory and implement the tools of CI.

Workshop Session One – 10:30am -11:30am

ID	Presentation Title	Presenter/s
1.	Maths that made me go “wow”: Stories from classrooms across NSW K-6	Michelle Tregoning
2.	Using students’ photographs to design culturally responsive tasks	Libby Cunningham
3.	Formative assessment in Senior Secondary Maths	Heather Ernst
4.	Algebraic reasoning: It’s about noticing structure	Lorraine Day
5.	Engaging young students in mathematics through coding	Jodie Miller
6.	Modifying typical problems to enhance learning experiences	Ban Heng Choy Daya (Jaguthsing Dindyal)

1. Maths that made me go “wow”: Stories from classrooms across NSW K-6

Wow (interjection): an exclamation of surprise, wonder. Wow (verb): to gain an enthusiastic response.

Currently, over 100 school teams in New South Wales schools are participating in an extended professional learning project called ‘Building Numeracy Leadership (BNL)’. Drawing upon a range of research around substantive engagement, positive learning environments, growth mindset, formative assessment, mathematical proficiencies, rich tasks and current research, BNL strives to empower all our learners to think, act, and become mathematicians.

In this workshop participants will have the opportunity to explore learning experiences, tasks and assessment tools used in NSW public schools to redefine mathematics as a science of thinking and reasoning...a science that is useful, meaningful and a science that can also be full of surprises!

Michelle Tregoning is a primary school teacher in New South Wales. She currently works for the NSW Department of Education, leading numeracy for Early Action for Success (EaFS), an initiative designed to enrich the mathematics learning of students. In her role, Michelle supports numerous schools in remote, regional and metropolitan areas of NSW, working with students, teachers and leaders in their quest to think and work like mathematicians.

2. Using students' photographs to design culturally responsive tasks

This workshop will focus on the findings of a New Zealand based study working with Pasifika students and their families to develop culturally responsive tasks to engage students in mathematics. Following parent and student workshops, students were given cameras to document any mathematics that they use outside of school with links to their culture. We were able to build on the students' and their families' funds of knowledge to design mathematics tasks for their teachers to use in the classroom. In this workshop, I will explain to you in more detail about my study and what I did with the teachers, students and their families. I will share highlights of using photos to develop students' awareness of the mathematics they use in their everyday lives. I will describe the process of photo elicitation and building on students' funds of knowledge as a classroom resource. You will have the chance to design your own problems based on various photographs and be able to take home examples of tasks that were used throughout the research project.

Libby Cunningham is currently completing her Masters project: "Developing culturally responsive tasks to engage Pasifika students in mathematics." She is a primary school teacher who has completed ALIM and MST and has been the team leader of mathematics.

3. Formative assessment in Senior Secondary Mathematics

This session describes and demonstrates formative assessment strategies used in senior secondary mathematics. It will help you and your students identify their mathematical strengths and weakness before the formal assessment. The students' focus changes from finishing the work, to understanding the mathematical concepts. These methods involve little preparation, increase students' engagement and increase overall test results. Examples include; mini-white boards and matching cards with a range of closed and open-ended questions.

Heather Ernst has taught mathematics at government regional secondary schools in Victoria for 25 years, most recently in the senior secondary school. She completed her Masters at the University of Melbourne with an action research project where the maths department trialled and evaluated formative assessment strategies. She is now lecturing in Mathematics Education at Federation University Australia.

4. Algebraic reasoning: It's about noticing structure

Most curriculums now develop Number and Algebra together "as each enriches the study of the other" (ACARA, 2017). This represents a paradigm shift from emphasising number in the primary years and algebra in the secondary years. This made the transition from arithmetic to algebra difficult for many students, as it was a big jump from calculating numerical answers to representing relationships. Concentrating on the underlying structure of mathematics and forcing students to notice that structure will enhance the analysis of relationships, understanding the nature of variables and constants, generalisation and reasoning algebraically - all of the things necessary to be a successful student of algebra. Suitable for teachers in upper primary and lower secondary.

Lorraine Day is a Senior Lecturer at the University of Notre Dame Australia where she works primarily with Primary pre-service teachers in mathematics education. Her research interests are in mathematical reasoning, especially in the area of algebraic reasoning. She is a Life Member and former President of the Mathematical Association of Western Australia.

5. Engaging young students in mathematics through coding

Engaging young learners in STEM practices such as robotics and coding gives students the opportunity to use new and emerging technologies to solve problems while extending their own knowledge and understanding of mathematics. This session will draw on a research project that has been conducted with Year 2 and Year 4 students as they engage in robotics and coding to learn mathematics concepts. Participants will have the opportunity to work with coding programs and trial tasks that were undertaken as part of the research. This workshop will be suitable for teachers of primary students.

Dr Jodie Miller is a Senior Lecturer in School of Education at the University of Queensland. Her work primarily focuses on improving mathematics teaching and learning, especially for students most at risk of marginalisation (e.g., Indigenous students; learners who have English as an additional language, and students from low socio-economic backgrounds). In addition, Jodie also researches the role of mathematics in STEM contexts, such as robotics and coding. Her research is conducted in classroom settings, which means she is in touch with the opportunities and challenges practicing and pre-service teachers encounter in their day to day work.

6. Modifying typical problems to enhance learning experiences

A common way to think about enhancing learning experiences is to design a so-called **rich task** for students. However, such tasks are challenging to source, to design, modify, and implement. What else can teachers use to enhance the learning experiences of students? One possible way is to use **typical problems**, which are standard examination questions or textbook-type problems, frequently used in classrooms for developing procedural skills. Despite their omnipresence, the affordances of typical problems to develop conceptual understanding are largely untapped. By considering the mathematical potential of typical problems, teachers can begin to think about new ways of using such problems to provide more opportunities for students to engage with mathematically-rich learning experiences on a day-to-day basis. In this workshop, we will explore the potential of using such typical problems, examine some principles of task design, and apply these principles to select, modify, and use typical problems to develop conceptual understanding, besides procedural fluency.

Ban Heng Choy, a recipient of the NIE Overseas Graduate Scholarship in 2011, is currently an Assistant Professor in Mathematics Education at the National Institute of Education in Singapore. He holds a PhD in Mathematics Education from the University of Auckland, New Zealand. Specialising in mathematics teacher noticing, Ban Heng is currently leading two research projects on teacher noticing, and has worked with international researchers in this field. Drawing from his research, Ban Heng has conducted many professional development workshops for teachers, both in Singapore and overseas, to hone their craft.

Daya (Jaguthsing Dindyal) completed his PhD at Illinois State University in USA. He is currently an Associate Professor in the Mathematics and Mathematics Education Academic Group at the National Institute of Education in Singapore. He has prior experience in teaching mathematics at the secondary level and teaches mathematics education courses to both primary and secondary preservice and in-service teachers. His interest areas include teacher education, the teaching and learning of algebra and geometry, mathematical tasks, problem solving, and teacher noticing.

Workshop Session Two – 12:00pm -1:00pm

ID	Presentation Title	Presenter
7.	Fostering mathematical curiosity in classrooms	Jill Cheeseman
8.	“Tell us a story and let’s sing a song”: Using story-telling and singing as powerful mathematics pedagogies	Robin Averill
9.	Playing maths games and maintaining positive maths identities	Lisa Darragh
10.	Targeted teaching	Di Siemon
11.	How can primary teachers influence innovative and impactful financial literacy teaching and learning?	Carly Sawatzki
12.	Modelling open ended scenarios: Students knowing how and when to apply mathematics	Vince Geiger

7. Fostering Mathematical Curiosity in Classrooms

Observing young children as they weighed objects and posed challenges for themselves offered insights into the ways in which classroom teachers can foster mathematical curiosity. As a result of our research we have three suggestions for classroom teachers of mathematics: offer children challenging tasks and interesting mathematical tools; listen carefully to be aware of the learning potential children bring to the task; and encourage curiosity by showing a real interest in children’s investigations. This workshop will explore how teachers can build on these ideas in their classrooms.

Jill Cheeseman is a Lecturer in Education at Monash University, Melbourne, Australia. Jill comes from a background of primary teaching and throughout her career in mathematics education has maintained a deep interest in the work of classroom teachers. Jill’s current research focus is on ways that teachers challenge young children to probe their mathematical understanding by fostering mathematical inquiry.

8. “Tell us a story and let’s sing a song” Using story-telling and singing as powerful mathematics pedagogies

Storytelling and singing are traditional, powerful teaching and learning tools enjoyed by people of many cultures. In this interactive workshop we will explore why these tools are effective for learning and how they can enliven mathematics lessons, motivate students, and assist understanding, remembering and achievement. We will explore links to two models for promoting culturally responsive teaching, Tātaiako and he whare tapa whā. The workshop will mainly focus on curriculum levels 3-6.

Robin Averill is passionate about all students being able to enjoy mathematics learning and achieve. Her research interests and teaching resources focus on culturally responsive teaching strategies. An experienced teacher and teacher educator, Robin is Associate Professor at Victoria University of Wellington.

9. Playing maths games and maintaining positive maths identities

Maths games and interactive warm up activities in maths can be engaging and fun ways to liven up the maths programme, and they can provide a great means for maintaining prior maths learning. But these games do more than maintain learning in a fun way, they also give crucial messages to students about how to *be* a learner of mathematics. These messages may include that being good at mathematics requires speed or that certain students are good at mathematics and others are not. In this workshop we will play games and we will also critique them, and together develop criteria for evaluating which games are worth playing.

Lisa Darragh is a lecturer of mathematics education at the University of Auckland. She is an experienced intermediate school teacher in New Zealand and overseas. Her doctorate looked at students’ mathematical identities at the transition to secondary school.

10. Targeted teaching

Targeted teaching is a form of differentiated teaching that responds to identified student learning needs in relation to a big idea in mathematics such as trusting the count or multiplicative thinking without which students’ progress in mathematics will be severely impacted. Targeted teaching relies on quality formative assessment data and evidence-based advice to inform teaching. It is most effective where students work in mixed ability groups for the majority of their mathematics classes but participate in small groups on a weekly or fortnightly basis to focus on a specific aspect of a big idea. This session will explore the research-based formative assessment materials and how targeted teaching works in practice.

Di Siemon is a Professor of Education in the School of Education at RMIT University (Bundoora) where she is involved with the preparation of pre-service teachers and the supervision of higher degree students. Di is also actively involved in the professional development of practicing teachers, particularly in relation to the development of the ‘big ideas’ in number, the teaching and learning of mathematics in the middle years, and the use of rich assessment tasks to inform teaching.

11. How can primary school teachers influence innovative and impactful financial literacy teaching and learning?

Money is increasingly invisible. Even so, children bring to school understandings about money that are shaped by their family and community experiences. These understandings influence how children think and feel about financial problem-solving and decision-making. This workshop aims to excite teachers about the possibilities for innovative and impactful "real world" financial education in mathematics classrooms. Drawing on **money and financial mathematics** tasks, this session will explore the potential to develop mathematical knowledge and skills and promote critical and creative thinking through everyday financial problems. Educational research insights will be shared to help you identify opportunities to work with your school community to improve financial literacy teaching and learning.

Carly Sawatzki is an educational researcher who is rapidly gaining national and international recognition for her expertise in the field of financial literacy. Her work primarily focuses on the design of financial literacy tasks and how young people think, feel and respond to financial problems and dilemmas.

12. Modelling open ended scenarios: Students knowing when and how to apply mathematics

This workshop is based on tasks used in a national project funded by the Australian Research Council that aims to promote students capability to use mathematics to solve real world problems. Tasks used in the project draw on real world scenarios and have been carefully designed to provide students with opportunities to choose the mathematics they believe to be appropriate for a task as well as consider the results of that choice. The workshop will also include a discussion of how to encourage students to check and validate their responses to a task.

Vince Geiger is a professor of mathematics education and program director within the Learning Sciences Institute Australia, Australian Catholic University. Before entering tertiary education, Vince was a secondary teacher of mathematics for 22 years, during which time he served a term as President of the Australian Association of Mathematics Teachers. Vince's interests include the areas of numeracy across the curriculum, mathematical modelling, the use of digital tools to enhance mathematics learning and effective teacher professional learning.

Workshop Session Three – 2:00pm -3:00pm

ID	Presentation Title	Presenter/s
13.	Mathematical Superheros: Create a Justification League in your classroom	Marcy Wood
14.	The three acts of mathematics	Megan Clune
15.	Using comparative judgement to assess deep understanding in mathematics	Ian Jones
16.	Korean teachers use of mathematical problems to support conceptual understanding	Mohan Chinnappan
17.	Helping students to see in 3D	Margaret Marshman Mark Barry
18.	Opportunities for student agency in secondary mathematics classrooms	Rachel Restani
19.	Out there to change the world? Change how you teach fractions!	Jana Visnovska

13. **Mathematical Superheroes: Create a Justification League in your classroom**

We usually have a few students who have easily identifiable mathematical superpowers. These students are quick at calculations and can take over mathematical activity. Yet, if we give our students multiple kinds of mathematical activities, we find that each of our students are mathematical superheroes with important problem solving powers. This session will provide activities for uncovering, celebrating, and using our students' mathematical super strengths to create a classroom community focused on justification and mathematical learning.

Marcy Wood is an Associate Professor at University of Arizona, USA. Her research interests arise from her experiences as a third and fourth grade teacher in Albuquerque, NM. She was curious about the mathematical learning of elementary students, and specifically students who have not yet been successful in mathematics classrooms. Her current research uses the tools of discourse and identity to examine mathematical learning (or not) and to assist teachers in supporting the mathematical learning of their students. She also draws upon sociocultural theories, and cognitive theories, and conceptual metaphors as structures for understanding mathematical learning.

14. The Three Acts of Mathematics

Based on the work of Dan Meyer, this workshop explores problem solving scenarios that incorporate deliberate acts of teaching to ensure tasks and pedagogy are low floor, high ceiling. The rationale being that the problems you design are: accessible to all; promote success for all in a variety of ways; and offer multiple opportunities for extension - all the while promoting mathematical discourse as the foundation of the lesson.

Megan Clune is a professional teaching fellow at the University of Auckland, lecturing in primary mathematics, technology and science education. Previously an Assistant Principal and lead teacher of mathematics, Megan has always had a passion for the learning and teaching of mathematics and holds a master's degree in mathematics education. Her areas of interest include: mathematics curriculum change, student engagement in mathematics, and the affordances of digital technologies in the learning of mathematics.

15. Using comparative judgement to assess deep understanding in mathematics

In this workshop we will consider how the limitations of traditional marking methods contribute to the dominant focus on surface learning of facts and procedures in mathematics classrooms. These limitations can now be overcome using a novel assessment method based on *comparative judgement*, which enables deep understanding of mathematics to be assessed in an objective manner. I will explain the method and summarise research demonstrating the effectiveness of comparative judgement for transforming classroom mathematics assessment and learning. Participants will also have an opportunity to try comparative judgement for themselves, and to reflect on how it might help them engage pupils deeply with mathematics in their own classrooms.

Ian Jones is a Senior Lecturer in Mathematics Education at Loughborough University where he leads a programme of research on using comparative judgement to assess mathematics. This research programme has been funded by the Royal Society, Nuffield Foundation and the Higher Education Academy amongst others. Ian has published widely on the assessment of mathematics, and works with assessment bodies such as NZQA and Ofqual.

16. Korean teachers' use of mathematical problems to support conceptual understandings

In this workshop, I will make a short presentation of a lesson from a Korean primary classroom. Following the presentation, we will critique key events in the lesson and discuss their pedagogical value in both engaging students and developing their conceptual understanding. Participants will then develop their own learning activities and share these with colleagues. The workshop will be concluded with an analysis of nature of conceptual understanding.

Professor Mohan Chinnappan is a mathematics teacher and teacher educator with international and national recognition for his research on the development, assessment and support for K-12 numeracy with particular interest in spatial thinking, algebra and teacher knowledge underpinning practice. He was a classroom teacher of mathematics in South Australia, Queensland and Malaysia.

17. Helping students to see in 3D

Spatial reasoning or thinking is an important part of everyday life for example walking along a path, estimating whether you can fit into a car park or more complicated tasks such as rotating an object in your mind or drawing a two dimensional image of a three dimensional object. In this workshop we discuss some activities you can do with your students to help them “see in 3D.” Suitable for teachers in upper primary and secondary.

Margaret Marshman is a Senior Lecture in Mathematics and Physics Education at the University of the Sunshine Coast where she teaches mathematics curriculum and pedagogy and applied mathematics to pre-service teachers. She is interested in how people think and reason in 3D, linking mathematics with the real world and how mathematical beliefs affect learning mathematics. Previously she was a secondary mathematics Head of Department and mathematics and physics teacher.

Mark Barry is the Manager, Visualisation Facilities at the University of the Sunshine Coast where he promotes the use of visualisation and simulation in education, research and business. He has a background in scientific data visualisation and high performance computing and is interested in the use of IT technology to enhance education and understanding of complex data analytics. Previously he was a high school mathematics and physics teacher.

18. Opportunities for student agency in secondary mathematics classrooms

Students of all ages can benefit from classroom environments that provide opportunities to learn deep conceptual knowledge in personally and meaningful ways (Turner, 2003). This mathematical agency can be supported or constrained depending on classroom structures (Varelas, Tucker-Raymond & Richards, 2015). In this workshop, participants will co-construct a definition of agency and compare it to the literature. Transcripts from a high school mathematics classroom will be distributed for discussion. Instances of student and teacher agency will be highlighted and extended. Participants will engage in a discussion about facilitating lessons that allow opportunities for students to employ agency over their own learning processes.

Rachel Restani is a Post-Doctoral Research Fellow at Massey University. She taught high school mathematics in rural and urban areas in the U.S. For her Ph.D., Rachel conducted a teacher action research project where she was the researcher-teacher in a culturally diverse Integrated Mathematics 1 classroom (grades 9-12) in California. Data from this study will be shared in the workshop.

19. Out there to change the world? Change how you teach fractions!!

We will explore a designed sequence of classroom activities in which fractions are introduced conceptually, as a solution to a problem in measuring lengths. By replacing cutting and sharing with measurement scenarios, this sequence avoids several typical "roadblocks" of early fraction reasoning (such as $\frac{1}{3}$ is smaller than $\frac{1}{4}$ because 3 is smaller than 4; and $\frac{7}{5}$ does not make sense as we cannot take 7 parts out of 5). The pedagogical approach that underpins the sequence uncompromisingly pursues learning for all students. The sequence was developed in Year 3-6 under-resourced classrooms and lends itself for modifications and extensions into middle years' content (e.g., percents, decimals, reciprocity, fraction division).

Dr Jana Visnovska is a lecturer in mathematics education at the University of Queensland. Her research interests centre in understanding and designing resources that both support mathematics teachers' work, and provide all students with opportunities to learn meaningful mathematics.