Critical and Creative Thinking in the Mathematics Classroom

The knowledge and skills required for critical and creative thinking must be explicitly taught if students are to develop and apply the skills and learning dispositions that support logical, strategic, flexible and adventurous thinking in mathematics.

A primary mathematics education conference focusing on:
• questions and questioning for deep learning, rich tasks, challenging tasks and inquiry based learning
• reasoning and metacognition
• digital technologies
• early childhood; 4 year old to Year 2 conference stream

For mathematics education leadership
Friday 22 June, 2018
Mathematics leaders and those with an interest in mathematics education leadership within primary schools including Principals, Deputy Principals, Numeracy Leaders, Academics, Vic DET, VCAA and others.

For primary school teachers
Saturday 23 June, 2018
This day is designed for primary teachers regardless of experience level. Sessions will build your confidence and develop your professional ability as a primary mathematics teacher in a supportive, hands-on and engaging series of workshops.

This truly collaborative event is hosted at the Melbourne Graduate School of Education, The University of Melbourne and includes high-quality presenters and a variety of session options. Learn from leaders with practical and educational research experience, from The Mathematical Association of Victoria and Melbourne Graduate School of Education.

www.mav.vic.edu.au/conference/primaryconference2018
**For mathematics education leadership**
**Friday 22 June, 2018**

Join us to explore what mathematics leadership looks like. Increasing critical and creative thinking is an Education State Target, how are you leading your improvement in this area? Sessions will provide practical advice to lead change in your own school context.

<table>
<thead>
<tr>
<th>Session</th>
<th>Presenters</th>
<th>Title</th>
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<tbody>
<tr>
<td>Registration: 8.30am-9am</td>
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<td>Opening: 9am-9.15am</td>
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| Keynote 1 9.15am–10.15am | Paul Swan | A: The Jabberwocky of Mathematics  
*Keynote sponsor: Victorian Government, Department of Education and Training*  |
| Morning tea and networking: 10.15am–10.45am |  |  |
| Workshop rotation 1 10.50am–11.50am | Max Stephens | B1: Key ideas for teaching and learning algorithmic thinking  
Duncan Symons | B2: Using online mathematical problem solving to develop and assess critical thinking  
Kate Copping | B3: The use of non-examples to promote critical thinking in the early years  
*Early childhood - Year 2 conference stream*  
Phillip Clarkson | B4: Language: It is always there  
Joanne Blannin | B5: Digital feedback technologies for mathematical questioning  
Ellen Corovic and Jen Bowden | B6: Embedding creative and critical thinking for continuous and sustainable learning  
Dan Cloney, Ross Turner, Jen Jackson | B7: Learning progression for pre-school children and measuring early mathematics ability  
*Early childhood - Year 2 conference stream*  |
| Workshop rotation 2 11.55am–12.55pm | Paul Swan and David Dunstan | C1: Using tasks to encourage mathematical dialogue  
Cath Pearn | C2: Developing or adapting assessment tasks to reveal critical and creative thinking  
Dan Jazby | C3: Critical communication in primary mathematics  
Nadia Walker | C4: ‘Leadership content knowledge’: What do leaders need to know?  
Scott Cameron and Carmel Mesiti | C5: Digital technologies in rich and challenging tasks  
Derek Holton | C6: What does ‘3 + 4 x 5’ mean? Or BOMorDAorS  
Cathy Tan | C7: Using tablets for deep mathematical learning in early childhood education  
*Early childhood - Year 2 conference stream*  |
| Lunch and networking: 12.55pm–1.45pm |  |  |
| Workshop rotation 3 1.45pm–2.45pm | Roger Wander | D1: Using Geogebra® technology in primary mathematics classrooms to extend creative thinking  
Sara McKee | D2: Metacognitive pedagogical strategies to support critical thinking  
Max Stephens | D3: Key ideas for teaching and learning algorithmic thinking  
Ellen Corovic and Jen Bowden | D4: Embedding creative and critical thinking for continuous and sustainable learning  
Meredith Begg | D5: If a picture speaks a thousand words, what might one mathematical symbol say?  
Parian Madanipour | D6: Using spatial language and gesture in dance to promote early spatial thinking  
*Early childhood - Year 2 conference stream*  |
| Keynote 2 2.50pm–3.50pm | Joanne Blannin | E: Critical thinking, coding and algorithmic thinking  
*Keynote sponsor: Essential Assessment*  |
| F: Drinks, nibbles and networking: 3.50pm–4.30pm |  |  |

**Major sponsor**

[The Education State]  
[Victoria State Government: Education and Training]
# Critical and Creative Thinking - day 1, Mathematics Education Leadership

Friday 22 June, 2018

### Keynote 1:

**Title/abstract**

A: The Jabberwocky of Mathematics

For many students, mathematics can be non-sensical, much like writings of Lewis Carroll (aka Prof Charles Dodson). At times the students may not understand or make out like they understand what is going on, but in reality, it is all Jabberwocky to them. Many students experience difficulty with mathematics because they fail to understand and comprehend what they are being asked to do.

In this keynote, Dr Paul Swan will share ideas for improving the Mathematical Literacies of Mathematics. This in turn will support students to reason and think mathematically. If we are to develop critical and creative thinkers, students need to ask questions like ‘What if …?’ and explore different possibilities. Warning! Do not come along if you just want to passively sit in the audience.

**Presenter biography**

Dr Paul Swan

Dr Paul Swan is an award-winning author, acclaimed speaker and workshop presenter and developer of games and materials to support students to learn mathematics. He is an Honorary Life member of the Mathematical Association of WA and an Honorary Fellow of the Australian College of Educational Leaders (ACEL). He was awarded his PhD for his work identifying the Computational Choices of Upper primary and lower secondary students.

### Workshop rotation 1:

**Title/abstract**

B1: Key ideas for teaching and learning algorithmic thinking

Algorithmic thinking is an approach to solving problems and is intended to exemplify critical and creative thinking. It is the thinking behind coding. It is a systematic way of thinking that helps students to look at a problem and to focus on the best ways to solve it. To do this, students must understand the various constraints in which the problem is embedded, and adopt flexible approaches to its solution. Teaching algorithmic thinking is the opposite of teaching recipes. Algorithmic thinking can be contrasted in several major ways to teaching students to execute the standard algorithms, such as those for multiplication and division. The goal is to teach students how to think logically as they solve problems. Flexibility of thinking is another characteristic of algorithmic thinking, helping students to see that that multiple starting points are possible, and that solution steps can be reviewed, revised and improved by class discussion. Fostering this kind of thinking needs to be supported by use of representations using everyday language, flow charts, diagrams, or using a simple coding language.

**Presenter biography**

Dr Max Stephens

Dr Max Stephens is a senior research fellow in mathematics education. Max’s research areas focus on the emergence of algebraic thinking in the middle years, developing a construct of Teacher Capacity, and the cultural conditions needed for the successful adaptation of Lesson Study outside Japan. He has interests internationally in curriculum and assessment, notably in Japan and in China. Prior to The University of Melbourne, Max occupied senior roles with the Victorian Department of Education and at the Victorian Curriculum and Assessment Authority. He has been a reviewer of the Australian Curriculum: Mathematics for the Australian Government, and has provided interpretations of international assessments in Mathematics for Australian Schools.

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Thank you to our sponsors

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What educational leaders said about the MAVMEG 2017 Primary conference.....

'It can be challenging to build students’ ability to reason with mathematics. I left this conference with ideas on ways in which I can support students to think systematically; ideas which are proven to be successful as they come from evidence based research.'
### B2: Using online mathematical problem solving to develop and assess critical thinking

In this workshop the Victorian/ Australian Curriculum competency of ‘Critical Thinking’ will be investigated. Participants will be invited to consider how critical thinking might be represented in the primary mathematics classroom. A research study where a group of Year 5 students engaged in collaborative online mathematical problem solving will then be considered. Analysis of the students’ work, identifying how and to what extent they engaged in critical thinking will be offered. Student levels of mathematical language and vocabulary development will be shown to be linked to their ability to engage in critical thinking.

**Dr Duncan Symons**

Dr Duncan Symons is a lecturer in science and mathematics education. His primary responsibilities involve preparatory teacher education in the fields of primary mathematics and science. Duncan’s research interests include inquiry, investigative and problem-based approaches to mathematics education in the primary years. He is also interested in how mathematics can be embedded within the broader curriculum. The adoption and promotion of STEM (science, technology, engineering and mathematics) as a means to achieve integration has become an area of research and teaching interest, and Duncan facilitates a program for teacher candidates at the University of Melbourne with this as a focus.

### B3: The use of non-examples to promote critical thinking in the early years

In the Early Years (Foundation – Level 2), the Victorian Curriculum in Critical and Creative Thinking, ‘focuses on developing the knowledge, skills and understanding to express reasoning and to problem solve and learn more effectively’ (VCAA). This session examines the use of examples and non-examples in teaching mathematical concepts. When learning mathematics, students are usually shown only correct examples of how to solve problems or identify shapes or patterns. However, the use of non-examples can help develop critical thinking skills by challenging students’ beliefs and reasoning. This can enable teachers to address misconceptions and for students to better clarify their own conceptual understanding in mathematics.

**Kate Copping**

Kate Copping is a lecturer in Mathematics Education and a Clinical Supervisor for Master of Teaching Candidates, at the Melbourne Graduate School of Education (MGSE). Her primary roles are pre-service teacher education in mathematics and supporting teacher candidates in practice whilst on their placements. Kate’s research interests include leadership in mathematics and teacher professional development. She has taught in schools in Victoria, NSW and USA, and has also worked in teacher education for MGSE since 2008.

### B4: Language: It is always there

The importance of the impact of language on mathematics learning is now well established in research but this is not always the case in the classroom. If students cannot use all their languages, their everyday language, school language and mathematical language insightfully, then their ability to be creative and pursue deep learning when doing mathematics will be compromised. To highlight the importance of language in mathematics learning the workshop begins by considering the context of students who do not have English as their home language but are enrolled in our schools. Participants will then be introduced to a ‘language use model’ that can be used in planning and implementing lessons that highlight important aspects of language for all students. Issues such as questioning and using students’ everyday languages are also explored.

**Philip Clarkson**

Before joining Australian Catholic University, Emeritus Professor Philip Clarkson for nearly five years was Director of a Research Centre at the Papua New Guinea University of Technology. Prior to that he taught at Monash University and tertiary colleges in Melbourne. He began his professional life as a teacher of chemistry, environmental science, mathematics and physical education in secondary schools. Clarkson has led major consultancies and ARC research projects, was President, Secretary and Vice President (Publications) of the Mathematics Education Research Group of Australasia, foundation editor of Mathematics Education Research Journal, severed on various editorial boards of both professional and research journals, and published widely. He continues to supervise research students, speak at various international conferences both in mathematics and science education, gives teachers workshops and publishes regularly. Most recently he has been made an Honorary Fellow of Melbourne University.
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<tr>
<th>B5: Digital feedback technologies for mathematical questioning</th>
<th>Dr Joanne Blannin</th>
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| This workshop will introduce a range of free digital technologies resources that can be used to increase effective feedback in primary school classrooms. Feedback, according to Hattie and Timperley (2007) requires students and teachers to ask and respond to three questions: Where am I going? How am I going? Where to next? Building effective and ongoing feedback into primary mathematics teaching can be enhanced by the careful selection of technologies that support best practice. The resources shared in this workshop will offer opportunities for participants to experience giving and receiving feedback as both a student and as a teacher. Digital technology resources will be shown to enable the following types of feedback for mathematics learning:  
• Student growth and progress;  
• Student to teacher & teacher to student;  
• Peer to peer feedback  
• Whole class progress snapshots, and;  
• Student elaboration of thinking strategies.  
*Please note you will need a laptop or tablet to participate in this session | Dr Joanne Blannin has taught in four countries and developed an in-depth understanding of learning and teaching. Her many education roles have included outdoor education curriculum director, language tutor, bilingual teacher, curriculum leader, leading teacher, teacher trainer, Victorian Department of Education project officer, lecturer, and school leadership coach. Having taught in both the private and public sectors, Joanne now presents internationally on digital technologies and digital pedagogies. Her research foci include teachers’ uses of technology and the development of enterprise skills through the curriculum. Joanne is currently the Digital Learning Leader at Graduate School of Education (MGSE) at the University of Melbourne. |

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<tr>
<th>B6: Embedding creative and critical thinking for continuous and sustainable learning.</th>
<th>Ellen Corovic and Jen Bowden</th>
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| Ensuring that there is a consistency of high quality of teaching across a school is one of the greatest challenges of a leader. Explore how leaders can ensure professional learning in mathematics has a direct and positive impact on student learning outcomes. Examples of achievable, school-based professional learning programs that focus on collaborate practices will be highlighted. A framework of key questions a leadership team should address to maximise their investment in professional learning will be presented. | Ellen Bowden is an Education Consultants for the Mathematical Association of Victoria. She works with teachers to build teacher capacity, increase knowledge of curriculum content, develop pedagogies and establish school-wide improvement plans. She takes a variety of approaches whilst working with teachers, including modelled teaching, coaching, intensive curriculum planning, afterschool workshops and whole school professional development days. Whether it be exploring engaging picture books or investigating big picture thinking, her approach is always engaging, hands-on and guaranteed to challenge teachers’ thinking.  
Ellen Corovic, an education consultant at the Mathematical Association of Victoria is passionate about building teacher’s belief and capacity that they can make a difference to students learning. She works with schools and teachers in a variety of modes including modelled teaching, coaching, curriculum planning, after school or whole day professional development days. Ellen enjoys bringing maths to life in a fun and meaningful way. |
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<tr>
<th>Workshop rotation 2: 11.55am-12.55pm</th>
<th>C1: Using tasks to encourage mathematical dialogue</th>
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<tbody>
<tr>
<td>Dr Paul Swan and David Dunstan</td>
<td>This workshop promotes Reasoning and Fluency through Problem Solving tasks. Some of Jo Boaler’s, ‘Design of Tasks’ elements, such as ‘Adding a Visual Component’, will be showcased. The workshop will also highlight the use of mathematical dialogue in the classroom to assist in the development of student Understanding.</td>
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<tr>
<td>Dr Dan Cloney with Ross Turner and Jen Jackson</td>
<td>B7: Learning progression for pre-school children and measuring early mathematics ability</td>
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<td>Dr Dan Cloney is a Research Fellow in the Centre for Education Policy and Practice at the Australian Council for Educational Research (ACER). Dan’s expertise is in early education, cognitive development, academic achievement, and inequality. His most current work focuses on the potential for high-quality early childhood care and education (ECCE) programs to narrow SES-related development gaps. Dan’s most recent work includes:</td>
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<td>- Project Director of the Overcoming Disadvantage in Early Childhood Project.</td>
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<td>- Technical Consultant for the UNICEF study, Modelling of Universal Pre-Primary Education in the District of Bogor, Indonesia.</td>
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<td>- Project Director of an Asian Development Bank (ADB) study developing a roadmap for Indonesia’s implementation of a one-year ‘Quality Pre-Primary Education for All’ program in support of Sustainable Development Goal (SDG) 4.2.</td>
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<td>- Research Fellow on the E4Kids study; Australia’s largest longitudinal study of the contribution of ECCE programs to children’s learning and development.</td>
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<td>Dan’s recent publications focus on the validation of the Classroom Assessment Scoring System (CLASS), the availability and access of high quality ECCE programs in market systems, and the impact of everyday ECCE programs on children’s early cognitive development and later academic achievement. <a href="https://works.bepress.com/dan-cloney/">https://works.bepress.com/dan-cloney/</a></td>
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### C2: Developing or adapting assessment tasks to reveal critical and creative thinking

**Critical and Creative Thinking** is organised into three interrelated strands: **Questions and Possibilities**, **Reasoning and Meta-Cognition**. Teachers assessing critical and creative thinking in mathematics need to consider how assessment tasks can be created to ensure that these three interrelated strands are included. Assessing increasingly complex and sophisticated processes of mathematical thinking is not simple. Rather than developing new assessment instruments it may be possible to adapt assessments that have been used previously to ascertain students’ mathematical skills, knowledge and understanding. In this presentation we will explore the following:

- the types of questions that can be used both in the classroom, and in assessment instruments, to encourage students to develop logical, strategic, and flexible thinking when solving mathematical tasks
- the analysis of student responses to mathematical tasks to evaluate the appropriateness of their strategies and relevance of their reasoning processes
- the creation or adaptation of mathematical assessment tasks so that critical and creative thinking is revealed.

**Cath Pearn**

Cath Pearn is a lecturer in mathematics education. She has been a lecturer at The University of Melbourne for more than 10 years and has taught in the Master of Teaching programs across all levels – including Early Childhood, Primary and Secondary. She also teaches in the subject Learning Disabilities: Numeracy.

In addition, Cath is a Senior Research Fellow for the ACER Institute where she provides professional development for teachers, particularly about the ways of identifying and assisting students mathematically ‘at risk’. Cath developed Mathematics Intervention, a program for Year 1 students mathematically ‘at risk’, which she continues to support. Her PhD is looking at the links between fractional competence and algebraic thinking.

### C3: Critical communication in primary mathematics

The reasoning proficiency strand suggests that teachers should develop children’s capacity to engage in mathematical reasoning from a young age. In this presentation, we’ll look at practical techniques teachers can employ which can help children become critical communicators in mathematics. We’ll present experts from classes where the teacher developed a culture of making claims and counter claims, and where criteria for the evaluation of student solution strategies were developed. Activities that can be used from Foundation to Grade 6 that can help develop a culture of critical communication will be presented. These tasks can also be used to enable assessment of the mathematical reasoning proficiency strand – a strand which is traditionally difficult to assess.

**Dan Jazby**

Dan Jazby is a lecturer in mathematics education at RMIT University. He is currently completing a PhD which investigates the in-the-moment decision making and noticing of teachers in mathematics lessons. Dan is also currently involved in the Excellence in Science, Technology, Engineering and Mathematics Education (ESTEME) partnership, where he has been investigating how engineering can be incorporated into primary education in a way which enhances the teaching of science and mathematics. This partnership brings together education and engineering academics from the University of Melbourne with local primary schools to develop new approaches to teaching STEM in primary schools.

### C4: ‘Leadership content knowledge’: What do leaders need to know?

Whether you’re a mathematics curriculum leader, an Assistant Principal or Principal, there is key knowledge and skills that are required to enhance the learning of students in mathematics. Most importantly, effective instructional leaders must be able to differentiate between high quality and low quality instruction. In this session we’ll use tasks, work samples and videos from the classroom to identify high quality instructional practices, discuss ways in which leaders provide purposeful feedback to teachers and strategies for communicating expectations of high quality practice to staff.

**Nadia Walker**

Nadia is currently Leading Teaching of Mathematics at Benton Junior College. She has had many varied roles in Education over the last 17 years including classroom teacher, curriculum project officer for Mathematics at DET, pre-service tutor at Melbourne University, research assistant at Monash University, education consultant and Assistant Principal. Recently Nadia has worked with the national research project reSolve: Mathematics by Inquiry as the Victorian Outreach Officer and supporting resource developer. In 2018 Nadia is undertaking further study at Monash University, researching the impact of leadership on mathematics learning.
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<tr>
<th>C5: Digital Technologies in Rich and Challenging Tasks</th>
<th>Scott Cameron and Carmel Mesiti</th>
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<td>This session will explore the use of digital technologies in rich and challenging tasks. Discussion of digital technologies will be focussed around the four elements of ICT described in the Victorian Curriculum. Participants will work through several rich and challenging tasks to gain insight into the different roles of digital technologies and how they can support student learning. Principals for the development of rich tasks that incorporate digital technologies will also be discussed.</td>
<td>Scott Cameron is a PhD student in mathematics education. His research interests include students’ attitudes towards, and use of, technology in the mathematics classroom. After completing Master of Teaching (Secondary) at the University of Melbourne, Scott worked in secondary schools as a Mathematics and Physics teacher. Carmel Mesiti is Centre Coordinator of the International Centre for Classroom Research (ICCR) at the University of Melbourne. She is project manager of the Lexicon Project and a research member of the Australian Lexicon Research Team. She has been involved in education for over 20 years. Her research interests have included lesson structure, lesson beginnings, mathematical tasks and more recently, as part of her doctoral work, the nature of differences in the pedagogical lexicons of education communities internationally. Carmel began her career in government schools as a secondary school Mathematics Teacher and held leadership positions including Year Level Coordinator and Mathematics Faculty Coordinator.</td>
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<th>C6: What does '3 + 4 x 5' mean? Or BOMorD AoS.</th>
<th>Derek Holton</th>
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<td>One of the goals of the current Australian Curriculum is to embed critical and creative thinking across the disciplines (including mathematics) and one way the researchers suggest approaching this is through having our students replicate the way that mathematicians work in their day-to-day mathematics learning. This includes not just creative thinking, but presenting work so that others can read it, as well as being able to read what others write. The pneumonic BOMBAS is an important underlying support for this reading and writing. It is a law (like driving on the left side of the road), which exists to avoid accidents. I will consider the meaning of BOMBAS and how it works. I will also look at what might be seen as some exceptions to the rule.</td>
<td>Derek Holton is an Honorary Professor at the University of Melbourne and Emeritus Professor at the University of Otago. His current interests include working with a range of schools to promote problem solving in mathematics and an understanding of what mathematicians do. Derek provides professional development for teachers related to problem solving and the work of mathematicians. He has produced a number of resources, including co-authoring a recent book in the Creative Activities in Mathematics series.</td>
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C7: Using tablets for deep mathematical learning in early childhood education

Tables are new and popular digital devices in today’s technology-prevalent world, and their presence in early childhood education sectors is also increasingly common. In this workshop, I would like to share the findings of my literature-based research project, in which I systematically reviewed 19 empirical studies (2012-2017) that focus on children’s mathematics learning enabled by tablets. Specifically, I plan to address the key factors that are reported to influence children’s learning outcomes, such as children’s attributes, educators’ knowledge, and the features of tablet apps. Implications for practice will also be discussed.

The second part of this workshop session will be allocated to a discussion in response to the influencing factors reported above, such as the resources needed, possible challenges, or feasible pedagogical means to applying these academic findings.

Cathy Tan

Cathy Tan is a recent graduate from University of Melbourne with a Master of Teaching degree in Early Childhood. Her research project explores key factors that may influence the outcome of children’s tablet-based mathematics learning. Prior to her study in early childhood education, she worked in the Education Section of the British Embassy in Beijing and worked close with high school and college students.

Workshop rotation 2:
1.45pm-2.45pm

D1: Using Geogebra® technology in primary mathematics classrooms to extend creative thinking

The geometric activities we’ll be looking at today can be performed successfully by teachers and students with the usual array of tools (depending on required precision): pencil, ruler, compass, plain or grid paper, templates, protractor, set square. Using Geogebra as a follow-up exploration tool can assist teachers to create accurate diagrams which can be edited to support a ‘what if you did this…?’ atmosphere in the classroom. Objects can be made dynamic, retaining their intended mathematical properties. As it’s freely available, students and families can access teacher-devised or web-supported files or can pursue their own investigations at home.
Participants will be encouraged to download current Geogebra software on their device from www.geogebra.org/download; Victorian Government school teachers will find their DET-owned devices already have the software loaded but may well need to upgrade it to V5.0.

Roger Wander

Roger Wander is a Clinical Specialist in the Master of Teaching (both Primary and Secondary programs). He currently lectures in the STEM stream of School Experience as Breadth.
Roger’s research interests are in the areas of computer algebra systems (CAS) and other technologies in mathematics teaching, and teachers’ statistical literacy. He has designed and delivered professional development workshops for numeracy and mathematics teachers in primary and secondary schools, with a special interest in mathematical literacy, formative assessment in mathematics education and the use of CAS and dynamic geometry technology.

D2: Metacognitive pedagogical strategies to support critical thinking

This session will focus on the development of tasks and questions to develop students critical and creative thinking, with a focus on metacognitive strategies and reasoning. It will focus on how to structure a problem solving lesson to allow students to reflect on their own strategies and thinking and trial different strategies to solve problems based on the strategies of others. This session will also focus on how a Professional Learning Team can plan and assess students critical and creative thinking.

Sara McKee

Dr Sara McKee is an Assistant Principal at Wedge Park Primary School in Melton, with the responsibility of teaching and learning across Prep to Year 6. Her current focus is the implementation of the High Impact Teaching Strategies (HiITS). Previously, she has worked as a leading teacher of mathematics from Prep to Year 9, and has worked as a sessional tutor in primary mathematics education. She has completed her Doctorate in mathematics education, with a focus on building teacher capacity through the use of online, formative assessment tasks. Sara has a particular interest in the area of identifying student misconceptions, and how misconceptions can be addressed through teaching and learning programs which promote student problem solving and reasoning.
### D3: Key ideas for teaching and learning algorithmic thinking

Algorithmic thinking is an approach to solving problems and is intended to exemplify critical and creative thinking. It is the thinking behind coding. It is a systematic way of thinking that helps students to look at a problem and to focus on the best ways to solve it. To do this, students must understand the various constraints in which the problem is embedded, and adopt flexible approaches to its solution. This intention drives the inclusion of algorithmic thinking in the Victorian Curriculum: Mathematics. Teaching algorithmic thinking is the opposite of teaching recipes. Algorithmic thinking can be contrasted in several major ways to teaching students to execute the standard algorithms, such as those for multiplication and division. The goal is to teach students how to think logically as they solve problems. Flexibility of thinking is another characteristic of algorithmic thinking, helping students to see that multiple starting points are possible, and that solution steps can be reviewed, revised and improved by class discussion. Fostering this kind of thinking needs to be supported by use of representations using everyday language, flow charts, diagrams, or using a simple coding language. Algorithmic thinking fits readily with the key content areas and the capabilities of Critical and Creative Thinking in the Victorian Curriculum.

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**Dr Max Stephens**

Dr Max Stephens is a senior research fellow in mathematics education. Max’s research areas focus on the emergence of algebraic thinking in the middle years, developing a construct of Teacher Capacity, and the cultural conditions needed for the successful adaptation of Lesson Study outside Japan. He has interests internationally in curriculum and assessment, notably in Japan and in China. Prior to The University of Melbourne, Max occupied senior roles with the Victorian Department of Education and at the Victorian Curriculum and Assessment Authority. He has been a reviewer of the Australian Curriculum: Mathematics for the Australian Government, and has provided interpretations of international assessments in Mathematics for Australian Schools.

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### D4: Embedding creative and critical thinking for continuous and sustainable learning.

Ensuring that there is a consistency of high quality of teaching across a school is one of the greatest challenges of a leader. Explore how leaders can ensure professional learning in mathematics has a direct and positive impact on student learning outcomes. Examples of achievable, school-based professional learning programs that focus on collaborate practices will be highlighted. A framework of key questions a leadership team should address to maximise their investment in professional learning will be presented.

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**Ellen Corovic and Jen Bowden**

Jen Bowden is an Education Consultants for the Mathematical Association of Victoria. She works with teachers to build teacher capacity, increase knowledge of curriculum content, develop pedagogies and establish school-wide improvement plans. She takes a variety of approaches whilst working with teachers, including modelled teaching, coaching, intensive curriculum planning, afterschool workshops and whole school professional development days. Whether it be exploring engaging picture books or investigating big picture thinking, her approach is always engaging, hands-on and guaranteed to challenge teachers’ thinking.

Ellen Corovic, an education consultant at the Mathematical Association of Victoria is passionate about building teacher’s belief and capacity that they can make a difference to students learning. She works with schools and teachers in a variety of modes including modelled teaching, coaching, curriculum planning, after school or whole day professional development days. Ellen enjoys bringing maths to life in a fun and meaningful way.
| **D5: If a picture speaks a thousand words, what might one mathematical symbol say?** | **Meredith Begg**  
Meredith Begg has been working as a Research Assistant at the Melbourne Graduate School of Education since 2016 and has previously worked at Monash University in the Faculty of Education in a similar capacity. Meredith is a former teacher of secondary mathematics and has a passion for enabling both students and teachers to enjoy and excel in the subject. |
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<td>×: Repeated addition. Groups of. Lots of. Times. Multiply. Of. Product. Inverse of division. There are so many words associated with a single symbol! Do our students always recognise the differences and similarities in the terms we use to describe a concept, or might they be left wondering if mathematical synonyms actually mean different things? The way we describe concepts such as multiplication can shape whether students have solid foundations to flexibly embrace the evolution of a mathematical concept over time, or whether they remain thinking about the concept as they were first taught, never fully grasping the more sophisticated thinking we aim for. For example, a teacher might reasonably explore multiplication of natural numbers in terms of repeated addition, but how might this shape a student’s thinking, when they are later faced with multiplying negative numbers or fractions? In this hands-on workshop, we will work through some examples where mathematical symbols and concepts evolve over the life of a student’s learning, and provide some suggestions as to how to help students develop an understand which supports future flexibility.</td>
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| **D6: Using spatial language and gesture in dance to promote early spatial thinking** | **Parian Madanipour**  
Parian is a part time early childhood teacher. In 2015, she graduated with a Bachelor of Music, where she majored in classical performance from the University of Melbourne and continued her study in Master of Teaching in Early Childhood. She took research as her final option and worked on facilitating children’s spatial thinking through dance. For now, she is thinking of getting into PhD and exploring the role of Artificial Intelligence in Early Childhood Education |
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<td>Early childhood educators should identify how to incorporate spatial thinking into their pedagogy and recognise the importance of spatial thinking in mathematical learning. Since children’s spatial thinking has appeared to be developed through experiences, it is important to provide them with opportunities to engage in learning experiences that support their mathematical learning. Through the implementation of an integrated teaching and learning methods, early childhood educators can enhance children’s mathematical abilities. Given the importance of dance in children’s learning and engagement while stimulating the two key cognitive concepts of embodied thinking and symbolisation, early childhood educators may consider it as a mediated approach to enhance children’s spatial thinking. As such, in this workshop we will consider how the inclusion of two influential early inputs of spatial language and gesture into the art form of dance can build a strong foundation in children’s spatial thinking.</td>
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E: Critical thinking, coding and algorithmic thinking

Critical and creative thinking have long been associated with mathematics learning in schools through problem-solving, collaborative learning and embedded practices. Today’s students, however, have increasing access to learning technologies that provide access to a range of concepts, ideas and strategies that connect mathematics learning to technological skills. How can teachers leverage technologies in the mathematics classroom, as daily life is increasingly facilitated through technology? Through AI, robotics, visual coding and online learning pedagogies this keynote will explore the mathematical learning opportunities presented by technologies and the connection between algorithmic, critical and creative thinking.

Dr Joanna Blannin

Dr Joanne Blannin has taught in four countries and developed an in-depth understanding of learning and teaching. Her many education roles have included outdoor education curriculum director, language tutor, bilingual teacher, curriculum leader, leading teacher, teacher trainer, Victorian Department of Education project officer, lecturer, and school leadership coach. Having taught in both the private and public sectors, Joanne now presents internationally on digital technologies and digital pedagogies. Her research foci include teachers’ uses of technology and the development of enterprise skills through the curriculum. Joanne is currently the Digital Learning Leader at Graduate School of Education (MGSE) at the University of Melbourne.

Keynote sponsor

Essential Assessment
### For primary school teachers

**Saturday 23 June, 2018**

Do you find teaching mathematics a challenge and need support? Or are you looking to find some great new ideas to engage students? Join us to explore mathematics education, teaching and learning, with a focus on critical and creative thinking. Build your confidence and gain practical ideas to implement in your classroom.

<table>
<thead>
<tr>
<th>Session</th>
<th>Presenters</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registration: 8.30am-9am</td>
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<td>Opening: 9am-9.15am</td>
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| **Keynote 1** 9.15am–10.15am | Felicity Furey | **A:** Why we need critical and creative thinking in industry: developing skills early for STEM and engineering  
*Keynote sponsor: Victorian Government, Department of Education and Training* |
| Morning tea and networking: 10.15am–10.45am | |                                                                       |
| Workshop rotation 1 10.50am–11.50am | Duncan Symons and Max Stephens, Scott Cameron and Carmel Mestit, Philip Clarkson, Kate Copping, Dan Jazby | **B1:** How BeeBot and Sphero can foster critical and creative thinking in primary classrooms  
**B2:** Digital technologies in rich and challenging tasks  
**B3:** Strategy games and mathematics: Exploring core aspects of mathematics  
**B4:** The use of non-examples to promote critical thinking in the early years  
*Early childhood - Year 2 conference stream*  
**B5:** Digital feedback technologies for mathematical questioning  
**B6:** Critical communication in primary mathematics  
**B7:** Learning progression for pre-school children and measuring early mathematics ability  
*Early childhood - Year 2 conference stream* |
| Workshop rotation 2 11.55am–12.55pm | Joanne Blannin, Catherine Pearn and Max Stephens, Meredith Begg, Jen Bowden, Ellen Corovic, James Russo | **C1:** Digital feedback technologies for mathematical questioning  
**C2:** Using fraction questions to reveal critical and creative thinking  
**C3:** If a picture speaks a thousand words, what might one mathematical symbol say?  
**C4:** Continuing creative and critical thinking into mathematics in the early years classroom  
*Early childhood - Year 2 conference stream*  
**C5:** Making conjectures using critical and creative thinking in a context-based classroom  
**C6:** SURF Maths |
| Lunch and networking: 12.55pm–1.45pm | |                                                                       |
| Workshop rotation 3 1.45pm–2.45pm | Sara McKee, Ellen Corovic, Michael Bairstow, Rachel Pollitt | **D2:** Metacognitive pedagogical strategies to support critical thinking  
**D3:** Asking the right questions  
**D4:** Moving towards more open and challenging tasks  
**D6:** Spatial reasoning in early childhood education  
*Early childhood - Year 2 conference stream* |
| Keynote 2 2.50pm–3.50pm | Wee Tiong Seah | **E:** When creativity meets creativity in the Australian multicultural maths classroom  
*Keynote sponsor: ACER* |
| F: Drinks, nibbles and networking: 3.50pm–4.30pm | |                                                                       |

**Major sponsor**

[THE EDUCATION STATE](#) [VICTORIA State Government](#) [Education and Training](#)
Keynote 1: 9.15am–10.15am

A: Why we need critical and creative thinking in Industry: developing skills early for STEM and engineering

How do we create, plan and invent a future that doesn’t exist yet? How will we solve the challenges of water or food shortages, energy crises and invent products to make our world a better place?

To build the future we need all citizens to have critical and creative thinking skills. To achieve a high level of ability in this area for future industry we must begin early by:

- embedding critical and creative thinking at the core of learning
- embedding the language of STEM
- understanding the ‘why’ of what we do not just the ‘how’
- developing a mindset of curiosity and leadership
- understanding it is ok to fail, it’s how you fail that counts.

Knowing why critical and creative thinking is important is the first step in developing strategies to ensure our students get thinking early in their schooling.

Felicity Furey

Felicity Furey is passionate about engaging students, particularly girls, in real world maths and engineering. Engineer by profession, Felicity co-founded not-for-profit organisation Power of Engineering in 2012. Since then, the organisation has inspired over 7,000 female and regional high school students across Australia about creative and diverse engineering careers.

Felicity wanted to scale this impact and co-founded Machinam which engages students were with real world maths resources. This work, along with her professional career saw Felicity named as one of six of the Financial Review BOSS magazine’s Young Executives of 2016 and as one of Australia’s ‘100 Women of influence’.

Thank you to our sponsors
<table>
<thead>
<tr>
<th>Workshoprotation 1: 10.50am-11.50am</th>
<th>B1: How BeeBot and Sphero can foster critical and creative thinking in primary classrooms.</th>
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<td></td>
<td>From the early primary years, child-friendly robotic devices such as BeeBot and Sphero introduce young students to systematic thinking to solve problems that are meaningful to them. These codable digital systems allow students to design and test solutions to simple problems using a sequence of steps and decisions. These digital technologies fit readily with key content areas of the primary mathematics curriculum, including number, location, measurement and space, and connect directly with the capabilities of Critical and Creative Thinking in the Victorian Curriculum. This session will be hands-on, interactive and will illustrate practical approaches to utilising robots in the primary classroom. Participants are invited to bring their own devices to the session. There will be additional machines and related resources to illustrate the key goals for mathematical thinking from Early childhood and Prep through to Year 6 with reference to the Victorian Curriculum: Mathematics.</td>
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<td></td>
<td>Dr Max Stephens and Dr Duncan Symons</td>
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<td></td>
<td>Dr Max Stephens is a senior research fellow in mathematics education. Max's research areas focus on the emergence of algebraic thinking in the middle years, developing a construct of Teacher Capacity, and the cultural conditions needed for the successful adaptation of Lesson Study outside Japan. He has interests internationally in curriculum and assessment, notably in Japan and in China. Prior to The University of Melbourne, Max occupied senior roles with the Victorian Department of Education and at the Victorian Curriculum and Assessment Authority. He has been a reviewer of the Australian Curriculum: Mathematics for the Australian Government, and has provided interpretations of international assessments in Mathematics for Australian Schools.</td>
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<td></td>
<td>Dr Duncan Symons is a lecturer in science and mathematics education. His primary responsibilities involve preparatory teacher education in the fields of primary mathematics and science. Duncan’s research interests include inquiry, investigative and problem based approaches to mathematics education in the primary years. He is also interested in how mathematics can be embedded within the broader curriculum. The adoption and promotion of STEM (science, technology, engineering and mathematics) as a means to achieve integration has become an area of research and teaching interest, and Duncan facilitates a program for teacher candidates at the University of Melbourne with this as a focus.</td>
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<tr>
<th>B2: Digital technologies in rich and challenging tasks</th>
<th>Scott Cameron and Carmel Mesiti</th>
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<tr>
<td>This session will explore the use of digital technologies in rich and challenging tasks. Discussion of digital technologies will be focussed around the four elements of ICT described in the Victorian Curriculum. Participants will work through several rich and challenging tasks to gain insight into the different roles of digital technologies and how they can support student learning. Principals for the development of rich tasks that incorporate digital technologies will also be discussed.</td>
<td>Scott Cameron is a PhD student in mathematics education. His research interests include students’ attitudes towards, and use of, technology in the mathematics classroom. After completing Master of Teaching (Secondary) at the University of Melbourne, Scott worked in secondary schools as a Mathematics and Physics teacher. Carmel Mesiti is Centre Coordinator of the International Centre for Classroom Research (ICCR) at the University of Melbourne. She is project manager of the Lexicon Project and a research member of the Australian Lexicon Research Team. She has been involved in education for over 20 years. Her research interests have included lesson structure, lesson beginnings, mathematical tasks and more recently, as part of her doctoral work, the nature of differences in the pedagogical lexicons of education communities internationally. Carmel began her career in government schools as a secondary school Mathematics Teacher and held leadership positions including Year Level Coordinator and Mathematics Faculty Coordinator.</td>
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</table>
### B3 Strategy games and mathematics: Exploring core aspects of mathematics

Doing mathematics and thinking about how you are doing it are quite different. Neither is the easiest thing to do. And yet both are essential if we are to understand deeply the nature of mathematics and why we do what we do. It is a similar process in exploring what strategies you should use, and why, in playing strategy games. We will explore why some strategies are better to use when playing Quarto, Tic Tac Toe and its 3D variation, and Othello, the language we use to communicate when playing these games, and why we are doing what we are doing. We will explore the possible parallels that exist in playing these games and thinking about what you are doing when doing mathematics. Participants will be asked to share ideas in how our insights can be adapted to our mathematics classrooms. The cross over between the two contexts must be insightfully examined by children if they are to see their own parallels.

**Phillip Clarkson**

Before joining Australian Catholic University, Emeritus Professor Philip Clarkson for nearly five years was Director of a Research Centre at the Papua New Guinea University of Technology. Prior to that he taught at Monash University and tertiary colleges in Melbourne. He began his professional life as a teacher of chemistry, environmental science, mathematics and physical education in secondary schools. Clarkson has led major consultancies and ARC research projects, was President, Secretary and Vice President (Publications) of the Mathematics Education Research Group of Australasia, foundation editor of Mathematics Education Research Journal, severed on various editorial boards of both professional and research journals, and published widely. He continues to supervise research students, speak at various international conferences both in mathematics and science education, gives teachers workshops and publishes regularly. Most recently he has been made an Honorary Fellow of Melbourne University.

### B4: The use of non-examples to promote critical thinking in the early years

In the Early Years (Foundation – Level 2), the Victorian Curriculum in Critical and Creative thinking, ‘focuses on developing the knowledge, skills and understanding to express reasoning and to problem solve and learn more effectively’ (VCAA). This session examines the use of examples and non-examples in teaching mathematical concepts. When learning mathematics, students are usually shown only correct examples of how to solve problems or identify shapes or patterns. However, the use of non-examples can help develop critical thinking skills by challenging students’ beliefs and reasoning. This can enable teachers to address misconceptions and for students to better clarify their own conceptual understanding in mathematics.

**Kate Copping**

Kate Copping is a lecturer in Mathematics Education and a Clinical Supervisor for Master of Teaching Candidates, at the Melbourne Graduate School of Education (MGSE). Her primary roles are pre-service teacher education in mathematics and supporting teacher candidates in practice whilst on their placements. Kate’s research interests include leadership in mathematics and teacher professional development. She has taught in schools in Victoria, NSW and USA, and has also worked in teacher education for MGSE since 2008.

### B6: Critical communication in primary mathematics

The reasoning proficiency strand suggests that teachers should develop children’s capacity to engage in mathematical reasoning from a young age. In this presentation, we’ll look at practical techniques teachers can employ which can help children become critical communicators in mathematics. We’ll present experts from classes where the teacher developed a culture of making claims and counter claims, and where criteria for the evaluation of student solution strategies were developed. Activities that can be used from Foundation to Grade 6 that can help develop a culture of critical communication will be presented. These tasks can also be used to enable assessment of the mathematical reasoning proficiency strand – a strand which is traditionally difficult to assess.

**Dan Jazby**

Dan Jazby is a lecturer in mathematics education at RMIT University. He is currently completing a PhD which investigates the in-the-moment decision making and noticing of teachers in mathematics lessons. Dan is also currently involved in the Excellence in Science, Technology, Engineering and Mathematics Education (ESTEME) partnership, where he has been investigating how engineering can be incorporated into primary education in a way which enhances the teaching of science and mathematics. This partnership brings together education and engineering academics from the University of Melbourne with local primary schools to develop new approaches to teaching STEM in primary schools.
**B7: Learning progression for pre-school children and measuring early mathematics ability**

The gap between what is important to early childhood educators and what is actually measured can be vast. In this workshop we will explore (1) an example of a learning progression designed to cover the breadth of mathematical knowledge, skills, and abilities from foundational to proficient, and (2) an example of a one-on-one assessment (MELQO) that measures visual spatial ability, number awareness, counting, and simple operations. We will share our experience in working with early childhood educators and their perceptions of the progression of learning in the early years, the with the construct of mathematical ability and how this is reflected through assessment. The session will be interactive, with educators invited to reflect on their perceptions, practices and programs and to contribute their perspective on how to improve future development of progressions and assessments in the early years.

**Dr Dan Cloney and Jen Bowden**

Dr Dan Cloney is a Research Fellow in the Centre for Education Policy and Practice at the Australian Council for Educational Research (ACER). Dan’s expertise is in early education, cognitive development, academic achievement, and inequality. His most current work focuses on the potential for high-quality early childhood care and education (ECCE) programs to narrow SES-related development gaps. Dan’s most recent work includes:

- Project Director of an Asian Development Bank (ADB) study developing a roadmap for Indonesia’s implementation of a one-year ‘Quality Pre-Primary Education for All’ program in support of Sustainable Development Goal (SDG) 4.2.
- Research Fellow on the E4Kids study; Australia’s largest longitudinal study of the contribution of ECCE programs to children’s learning and development. Dan contributed to the design, implementation, and reporting of the study from 2008 to 2015.

Dan’s recent publications focus on the validation of the Classroom Assessment Scoring System (CLASS), the availability and access of high quality ECCE programs in market systems, and the impact of everyday ECCE programs on children's early cognitive development and later academic achievement. https://works.bepress.com/dan-cloney/

Jen Bowden is an Education Consultant for the Mathematical Association of Victoria. She works with teachers to build teacher capacity, increase knowledge of curriculum content, develop pedagogies and establish school-wide improvement plans. She takes a variety of approaches whilst working with teachers, including modelled teaching, coaching, intensive curriculum planning, afterschool workshops and whole school professional development days. Whether it be exploring engaging picture books or investigating big picture thinking, her approach is always engaging, hands-on and guaranteed to challenge teachers’ thinking.
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<tr>
<th>Workshop</th>
<th>Rotation 2: 11.55pm - 12.55 pm</th>
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<tr>
<td><strong>C1: Digital feedback technologies for mathematical questioning</strong></td>
<td><strong>Dr Joanne Blannin</strong></td>
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| This workshop will introduce a range of free digital technologies resources that can be used to increase effective feedback in primary school classrooms. Feedback, according to Hattie and Timperley (2007) requires students and teachers to ask and respond to three questions: Where am I going? How am I going? Where to next? Building effective and ongoing feedback into primary mathematics teaching can be enhanced by the careful selection of technologies that support best practice. The resources shared in this workshop will offer opportunities for participants to experience giving and receiving feedback as both a student and as a teacher. Digital technology resources will be shown to enable the following types of feedback for mathematics learning:  
- Student growth and progress;  
- Student to teacher & teacher to student;  
- Peer to peer feedback  
- Whole class progress snapshots, and;  
- Student elaboration of thinking strategies.  
*Please note you will need a laptop or tablet to participate in this session* |
| **Dr Joanne Blannin** has taught in four countries and developed an in-depth understanding of learning and teaching. Her many education roles have included outdoor education curriculum director, language tutor, bilingual teacher, curriculum leader, leading teacher, teacher trainer, Victorian Department of Education project officer, lecturer, and school leadership coach. Having taught in both the private and public sectors, Joanne now presents internationally on digital technologies and digital pedagogies. Her research foci include teachers’ uses of technology and the development of enterprise skills through the curriculum. Joanne is currently the Digital Learning Leader at Graduate School of Education (MGSE) at the University of Melbourne. |
| **C2: Using fraction questions to reveal critical and creative thinking** | **Catherine Pearn and Dr Max Stephens** |
| Critical and creative thinking processes are fundamental to effective learning across the curriculum. Identifying students’ thinking, and choosing the appropriate questions that will help to develop their understanding, can be a challenge for teachers. Fractional thinking, with its interconnected constructs, can reveal students’ understanding of number and use of multiplicative strategies. This presentation examines the results of six tasks completed by middle years’ students from Victorian schools. These tasks, administered as part of a Fraction Screening Test, not only reveal students’ thinking, but also provide examples of the types of questions teachers could use to reveal students’ increasingly complex and sophisticated thinking processes. These questions prompt ‘reverse thinking’ and are powerful in challenging students to generalise as they trial alternative ways to solve these fraction tasks as their previous solution methods no longer apply. These tasks allow teachers to examine students’ strategies and reflect on the thinking processes students have used to complete these fraction tasks. | **Catherine Pearn** is a lecturer in mathematics education. She has been a lecturer at The University of Melbourne for more than 10 years and has taught in the Master of Teaching programs across all levels – including Early Childhood, Primary and Secondary. She also teaches in the subject Learning Disabilities: Numeracy. In addition, Cath is a Senior Research Fellow for the ACER Institute where she provides professional development for teachers, particularly about the ways of identifying and assisting students mathematically ‘at risk’. Catherine developed Mathematics Intervention, a program for Year 1 students mathematically ‘at risk’, which she continues to support. Her PhD is looking at the links between fractional competence and algebraic thinking.  
**Dr Max Stephens** is a senior research fellow in mathematics education. Max’s research areas focus on the emergence of algebraic thinking in the middle years, developing a construct of Teacher Capacity, and the cultural conditions needed for the successful adaptation of Lesson Study outside Japan. He has interests internationally in curriculum and assessment, notably in Japan and in China. Prior to The University of Melbourne, Max occupied senior roles with the Victorian Department of Education and at the Victorian Curriculum and Assessment Authority. He has been a reviewer of the Australian Curriculum: Mathematics for the Australian Government, and has provided interpretations of international assessments in Mathematics for Australian Schools. |
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<th>C3: If a picture speaks a thousand words, what might one mathematical symbol say?</th>
<th>Meredith Begg</th>
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<td>×: Repeated addition. Groups of. Lots of. Times. Multiply. Of. Product. Inverse of division. There are so many words associated with a single symbol! Do our students always recognise the differences and similarities in the terms we use to describe a concept, or might they be left wondering if mathematical synonyms actually mean different things? The way we describe concepts such as multiplication can shape whether students have solid foundations to flexibly embrace the evolution of a mathematical concept over time, or whether they remain thinking about the concept as they were first taught, never fully grasping the more sophisticated thinking we aim for. For example, a teacher might reasonably explore multiplication of natural numbers in terms of repeated addition, but how might this shape a student’s thinking, when they are later faced with multiplying negative numbers or fractions? In this hands-on workshop, we will work through some examples where mathematical symbols and concepts evolve over the life of a student’s learning, and provide some suggestions as to how to help students develop an understand which supports future flexibility.</td>
<td>Meredith Begg has been working as a Research Assistant at the Melbourne Graduate School of Education since 2016 and has previously worked at Monash University in the Faculty of Education in a similar capacity. Meredith is a former teacher of secondary mathematics and has a passion for enabling both students and teachers to enjoy and excel in the subject.</td>
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<th>C4: Continuing creative and critical thinking into mathematics in the early years classroom.</th>
<th>Jen Bowden</th>
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<td>There has been considerable quality research, development of resources and examples of practice into the use of rich tasks, challenging tasks and inquiry-based learning in primary schools. In this workshop we will investigate the research behind implementing the pedagogy in such tasks into the early years and prior to school settings (such as kindergartens and long-term day care). We will discuss the learning opportunities of creative and critical thinking that arise within prior to school settings and how we can utilise these experiences to enhance the transition to school, and within and early years classroom.</td>
<td>Jen Bowden is an Education Consultants for the Mathematical Association of Victoria. She works with teachers to build teacher capacity, increase knowledge of curriculum content, develop pedagogies and establish school-wide improvement plans. She takes a variety of approaches whilst working with teachers, including modelled teaching, coaching, intensive curriculum planning, afterschool workshops and whole school professional development days. Whether it be exploring engaging picture books or investigating big picture thinking, her approach is always engaging, hands-on and guaranteed to challenge teachers’ thinking.</td>
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<th>C5 Making conjectures using critical and creative thinking in a context-based classroom.</th>
<th>Ellen Corovic</th>
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<tr>
<td>Through collecting and collating class data via whole class exploration, Ellen will explore how teachers may lead students to generalize, generate ideas and possibilities and create learning actions. These actions can then be used as a form of differentiation. In this session, teachers will explore two investigations where teachers critical and creative thinking will affect their learning path, just like in an effective classroom investigation. This workshop will get you thinking so be prepared to hypothesis!</td>
<td>Ellen Corovic, an education consultant at the Mathematical Association of Victoria is passionate about building teacher’s belief and capacity that they can make a difference to students learning. She works with schools and teachers in a variety of modes including modelled teaching, coaching, curriculum planning, after school or whole day professional development days. Ellen enjoys bringing maths to life in a fun and meaningful way.</td>
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</table>
### C6: SURF Maths

Mental computation strategies have become increasingly emphasised in the teaching of mathematics, because they support the development of number sense and help develop computational fluency. This presentation will overview the SURF Maths framework, designed to support the learning and teaching of mental computation in primary schools. SURF Maths is currently being used in several schools across Victoria. It is an acronym that stands for Strategies, Understanding, Reading, and Fast Facts. The framework aims to build meta-cognition, support dialogue between learners and teachers through introducing a common mathematical language, and to make the learning and teaching of mental computation more dynamic and enjoyable. Following the introduction of the framework, a series of games emphasising mental computation skills and ideas will be workshopped. These games will help to demonstrate to participating teachers how to ‘build’ the SURF Maths framework in their classrooms.

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<th>Workshop</th>
<th>Rotation 3: 1.45pm -2.45pm</th>
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<tr>
<td>D2: Metacognitive pedagogical strategies to support critical thinking</td>
<td>Sara McKee</td>
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<td>This session will focus on the development of tasks and questions to develop students critical and creative thinking, with a focus on metacognitive strategies and reasoning. It will focus on how to structure a problem solving lesson to allow students to reflect on their own strategies and thinking and trial different strategies to solve problems based on the strategies of others. This session will also focus on how a Professional Learning Team can plan and assess students critical and creative thinking.</td>
<td>Dr Sara McKee is an Assistant Principal at Wedge Park Primary School in Melton, with the responsibility of teaching and learning across Prep to Year 6. Her current focus is the implementation of the High Impact Teaching Strategies (HITS). Previously, she has worked as a leading teacher of mathematics from Prep to Year 9, and has worked as a sessional tutor in primary mathematics education. She has completed her Doctorate in mathematics education, with a focus on building teacher capacity through the use of online, formative assessment tasks. Sara has a particular interest in the area of identifying student misconceptions, and how misconceptions can be addressed through teaching and learning programs which promote student problem solving and reasoning.</td>
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| D3: Asking the right questions | Ellen Corovic |
| This workshop will focus on the ‘craft’ of being an effective mathematics teacher. Knowing when to ask the right question to influence students learning experience and ensure that they are engaged in completing a mathematical challenge using creative and critical thinking. In this workshop we will investigate a variety of questioning techniques that may enable or extend students, ensuring they are applying their thinking skills. Participants will be asked to be critical and critical and creative thinkers as we explore their own teaching and learning context. | Ellen Corovic, an education consultant at the Mathematical Association of Victoria is passionate about building teacher’s belief and capacity that they can make a difference to students learning. She works with schools and teachers in a variety of modes including modelled teaching, coaching, curriculum planning, after school or whole day professional development days. Ellen enjoys bringing maths to life in a fun and meaningful way. |
**D4: Moving towards more open and challenging tasks**

Teachers are hearing more and more about the importance of using rich, open tasks and embracing challenge. However this, like all changes, can be confronting for teachers and schools. How do we create and find tasks that are open and challenging? What parts of our pedagogy need to change? How are teacher groups, learning intentions and explicit teaching used within this pedagogy? These questions and others will be explored as we explore how one school has transitioned towards using open tasks and pedagogy that increases challenge.

**Michael Bairstow**

Michael Bairstow is the Mathematics Leader at St. Dominic’s Primary School in Melton and has worked as a consultant for the Mathematical Association of Victoria. He completed his Masters in School Leadership (Mathematics) in 2014 and has been a Mathematics leader at two schools. Michael enjoys working with teachers and supporting them in implementing a Mathematics program that is engaging, challenging and focuses on developing student understanding and important life-long mathematical skills, such as problem solving, reasoning and creativity.

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**D6: Spatial reasoning in early childhood education**

Children are highly mathematical and explore mathematics concepts through play. Recent research suggests that spatial reasoning is a key concept underpinning all mathematics learning. In this workshop we will consider how children, from a young age, benefit from intentional teaching specifically focused on supporting the learning of spatial reasoning skills. In the workshop we will investigate the implementation of a suite of assessment activities on teacher beliefs about mathematics in early childhood education, by analysing teaching practices that included observations, assessment, and evidence-based planning for mathematics curricula. Findings of a study will be shared demonstrating a reciprocal influence between the implementation of the assessment activities, teacher beliefs about mathematics and mathematics teaching practice. These findings will be used to highlight practical implications for mathematics assessment and play-based pedagogies, and the contribution of a focus on spatial reasoning in early childhood curricula.

**Rachel Pollitt**

Rachel Pollitt is a graduate of the Master of Teaching (Early Childhood) program at the University of Melbourne. In the final stage of her doctoral research, supported by an Australian Postgraduate Award, Rachel’s research focuses on spatial reasoning and assessment in early childhood teaching. She is currently employed by the University of Melbourne as a clinical specialist and has also taught in the Numeracy in Early Childhood subject in the Master of Teaching (Early Childhood). Her research interests include how early childhood educators support, identify and assess mathematical thinking in play-based early childhood curricula.

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**Keynote 2:**

2.50pm – 3.50pm –

**E: When creativity meets creativity in the Australian multicultural maths classroom**

In today’s world – and classroom – creativity does not manifest itself in one or two forms only. Different cultural groups (including different jobs, different religions, etc) develop and express their own creativity ideas differently through their mathematical activities. What might these look like? How might teachers recognize, acknowledge, and develop these amongst their students? This session aims to shed some light on these and other related questions.

**Wee Tiong Seah**

Associate Professor Wee Tiong has been teaching pre-service and in-service courses at Bachelor, Masters and PhD levels since 2002, both locally and overseas. Wee Tiong leads a 22-nation research consortium called the ‘Third Wave Project’ which coordinates research studies into values/valuing in mathematics education. He is also part of a multi-disciplinary team examining the mathematics learning experiences of immigrant students. Wee Tiong was featured in the 2014 ‘Encyclopaedia of Mathematics Education’ for one of his studies investigating the professional socialisation experiences of immigrant teachers of mathematics in Australian classrooms.

**Keynote sponsor**

[ACER logo]
Critical and creative thinking in the mathematics classroom

Investigate critical and creative thinking, focusing on:
• questions and questioning for deep learning
• rich tasks, challenging tasks and inquiry based learning
• reasoning and metacognition
• digital technologies
• early childhood; 4 year old to Year 2 conference stream

Dates
Friday 22 June 2018 - for mathematics education leadership
Saturday 23 June 2018 - for primary school teachers

Venue
Melbourne Graduate School of Education, The University of Melbourne, 234 Queensberry Street, Carlton

Time
9am–4.30 pm (including networking drinks and nibbles). Registration opens from 8.30am.

• Online booking only accepted
• Registration is not confirmed until payment is received
• Registrations will close when capacity is full, or on Friday 15 June, whichever comes first.

Special MAV membership offer
MAV Member (20% discount): $280 per day
Non member: $350 per day
To receive the member rate, you must first be a MAV member. If you are not a MAV member and wish to attend this conference, you can join the MAV with a 35% discount off a ‘School membership’ from only $148. Alternatively, as an individual member for 35% off - only $109.

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For information about bookings email Jacqui Diamond: jdiamond@mav.vic.edu.au. For other inquiries, contact maths-ed@unimelb.edu.au.