### BCME9 Programme

<table>
<thead>
<tr>
<th>TIMINGS</th>
<th>3 April 2018</th>
<th>4 April 2018</th>
<th>5 April 2018</th>
<th>6 April 2018</th>
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<tr>
<td>0900-1000</td>
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<td>*Session B</td>
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<td>1110-1140</td>
<td>Residential Delegates</td>
<td>Break with Publishers’ Exhibition</td>
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<tr>
<td>1140-1240</td>
<td>MA Presidential Address Tom Roper Panorama Room, Rootes Building and **Xtras</td>
<td>Plenary Ruth Merttens Panorama Room, Rootes Building and **Xtras</td>
<td>Closing Plenary 12:40-1300 Paul Ernest Butterworth Hall, Arts Centre</td>
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<tr>
<td>1240-1400</td>
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<td>1400-1530</td>
<td>Opening Plenary David Spiegelhalter Butterworth Hall, Arts Centre</td>
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<td>1600-1730</td>
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<td>1740-1900</td>
<td>ATM AGM Chancellors 2, Rootes Building</td>
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<td>Evening Meal in Rootes Building</td>
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<td>2100-</td>
<td>A Taste of MathsJam Katie Steckles Panorama Room, Rootes Building</td>
<td>Quiz Panorama Room, Rootes Building</td>
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### Exhibition (Lunch and Refreshments) Location

- **Tuesday, 1100-1600**
  - Mathematics Inspired Exhibition
  - Mead Gallery, Arts Centre

- **Wednesday - Thursday, 0900-1700**
  - Publishers’ Exhibition
  - Mead Gallery and Butterworth Hall, Arts Centre

*Session Classrooms: Humanities, Social Sciences, Panorama 1, 2 & 3 (Rootes Building) and Chancellors 1, 2 & 3 (Rootes Building)

**Xtra Session Classrooms: Humanities, Social Sciences and Panorama 1, 2 & 3 (Rootes Building)*
## Classroom Allocation

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*BCME reserves the right to reallocate sessions as required*
Notes:

*Sessions marked with an asterisk (*) are part of a combined group, made up of two to three individual sessions that have been scheduled together in one slot that can run for either sixty or ninety minutes depending on when they take place within the programme.

When reading through the programme you may notice that some numbers within the session group have not been allocated. This is not an error and all available sessions within the programme are listed.

Learn and share! New to using technology in your mathematics classroom? We will look at the bewildering array of digital resources, and pick a path through the possibilities, with the overriding maxim that the chosen technology is transparent, letting the mathematics shine through. We will discuss the hardware scene: laptops, desktops, whiteboards, touch-tvs, visualisers and tablets, then look at web-based resources, including data, simulations, blogs and online texts. Finally, the dynamic software scene: Geogebra, Desmos, Cabri, Sketchpad and Autograph. Delegates should bring a laptop, mouse and power lead, and/or a tablet with a sensibly sized screen.

KS3, KS4, Post-16, Teacher Professional Development

A2 - Descartes the father of x, y and z Coordinate Geometry - a Historical perspective - Garrod Musto

A brief look at the development of measures of pinpointing location, developing a sense of how this has impacted on STEM throughout the years. With some hands on activities to take back to the classroom.

KS3, KS4, Post-16

A3 - Fluency with Reasoning - Ruth Trundley and Helen Eversett

Fluency involves understanding; understanding of relationships between numbers and operations, and understanding of the number system. Fluency involves using this understanding to: ‘notice things’, make connections between what is known and what is unknown’ and make decisions. Whilst fluency is the first of the aims of the National Curriculum, it requires the second aim, reasoning, to be effective. Practise that focuses on reasoning strategies, looking for connections, patterns and relationships, is likely to be more effective. This workshop will explore some different ideas for developing fluency underpinned by reasoning with children from KS1 to KS3.

KS1, KS2, KS3

A4 - The Geometry of Number systems - András Hraskó

How to plan an optimal set of weights to measure salt by weights on two scales of a balance, how to play twenty questions, how to find cyclic numbers? We see a panorama of problems from Secondary level to MAT and STEP exams and solve them to get an insight to number systems. When we understand them better we can extend them to the plane where they generate fractals and a fascinating system of circles.
**A5 - Bring enrichment into your teaching** - Gerry Leversha

I will be discussing strategies for teaching the GCSE (and maybe parts of A level and primary) curriculum that emphasise enrichment, understanding and depth, stress the fact that different aspects of the subject are interconnected, and with a high element of problem-solving rather than algorithmic learning.

*KS2, KS3, KS4, Post-16, Teacher Professional Development*

**A6 - Variation: beyond the definitions** - Anne Watson

This session will be a workshop of mathematics tasks and discussion to open up a range of meanings and roles for 'variation' in mathematics teaching. Some of the jargon around this word is taken as prescriptive, when it is merely descriptive - there is more to describe.

*Initial Teacher Education, KS2, KS3, KS4, Post-16*

**A9 - Finding the adult in adults learning mathematics: an academic and political study** - David Kaye

I have previously commented on mathematics education research, with particular reference to 'adult numeracy'; a focus on what is being taught. I now see a greater need to explore who is being taught. The evidence for this new research problem is to be found in the content of ICME-13 sessions. An analysis of these sessions reveals the extent to which the experience of the adult learner is ignored. The use of the term ‘non-traditional student’ is considered, some comments are made on the need to redress this situation and the ‘hidden adult’ is revealed.

* This Adult Learning session is linked to D9, G26 & J9. Sessions can be attended separately or in conjunction

**The professional identities of mathematics and numeracy teachers in Further Education** - Diane Dalby

The professional identities of teachers within Further Education in England have remained difficult to define, despite various iterations of professional standards and attempts at regulation. For those who teach mathematics, professional identities are further complicated by their association with an academic subject within a vocational environment and historical divisions between teachers of mathematics or numeracy. Any collective professional identity is also affected by the dispersion or centralisation of these teachers within college structures. Within this study, teachers’ own narratives about their working lives are used to examine the complex roles they fulfil and the professional identities they construct.

* This Adult Learning session is linked to D9, G26 & J9. Sessions can be attended separately or in conjunction
The 'crisis of statistics', and some implications for teaching - Jeff Evans

Statistics is a crucial element of approaches to mathematics and the sciences. However, recently, the role of statistics has been challenged overtly as being distant and the preserve of 'experts'. It may also be challenged more covertly, by those concerned to undermine democratic consideration of policy. I will consider the current 'crises' of statistics in the historical context of the development of its key ideas. I go on to consider the meaning and consequences of several important trends at the current time: the rise of 'big data', the growth of 'identity politics' and the seemingly inexorable development of globalisation.

* This Adult Learning session is linked to D9, G26 & J9. Sessions can be attended separately or in conjunction

Post-16 Talk

*A10 - Mathematics from East to West - Andra Ghencea

The aim of the session is to look at the differences and similarities between the approach in the teaching and learning of mathematics in Eastern versus Western Europe. The opportunity to explore both worlds in depth, through personal education and work in the educational sector, has given me a clear image of what leads to mastery in the subject.

KS3, KS4, Post-16, Teacher Professional Development Research Presentation

Solving the Problem of Problem-Solving - Andra Ghencea

This session is looking at a variety of ideas to support and develop teaching and learning, so that learners become competent and independent in solving problems. The session covers various levels from Early Years to A level, with a clear focus at GCSE level.

EYFS, Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16, Teacher Professional Development Workshop

A11 - Encouraging Mathematical Conversations within an A Level Classroom - Heidi Steele

Tools and techniques that encourage and develop mathematical conversations within your classroom. This workshop is aimed at helping teachers gain the confidence to develop rich mathematical conversations between students using a variety of resources and techniques. Including case studies and pupil interviews.

Post-16, Teacher Professional Development Workshop

*A12 - Teaching in key stages 3 and 4 for a growth mindset - Jonathan Robinson

How to incorporate the principals of a growth mind set in every day KS3 and 4 mathematics lessons. By linking the stages of a lesson together students learn how to make connections between strands of mathematics. Using this approach students learn to see mathematics as fluid and continuous so new learning extends and consolidates prior learning. Students gain confidence in applying what they know as it is constantly refreshed and reviewed in lessons. This confidence leads to greater risk taking and ultimately a growth mind set.

KS3, KS4, Teacher Professional Development Demonstration, Talk
Mathematical problem solving in students with Autistic Spectrum Disorder (ASD) - Max Goulding

An exploration of mathematical problem solving in students with Autistic Spectrum Disorder (ASD) describing a case study of mathematical problem solving in an individual with autistic spectrum disorder in an English secondary school.

KS3, KS4, Post-16  
Research Presentation

Growth Mindset for Low Prior Attainment: An Alternative - Dan Draper

Students with low prior attainment often have negative emotions connected with mathematics, and while lots of schools have policies in place to promote resilience and a 'growth mindset', these can be tokenistic leaving a strong element of shame for students. This becomes amplified by the place mathematics holds within public consciousness. In this talk I intend to share my critical reflections on how I’ve approached these issues by focusing explicitly on the student experience using techniques typically used within the creative industries, and offer a positive call to arms for changing the way we talk about mathematics.

KS3, KS4, Post-16  
Talk

A13 - The Missing or Unknown Polyhedra - Adrian Pinel

3D Polyhedra are more rarely studied in the curriculum these days, so it is perhaps unsurprising that those that are most studied are the most symmetrical types. I have researched instead some of the alternatives and will present findings on previously rarely recorded or unrecorded polyhedra, starting with deltahedra.

The presentation will be interspersed with a workshop opportunity to visualise and construct generic examples of such polyhedra.

KS2, KS3, KS4, Post-16, Teacher Professional Development  
Research Presentation, Workshop

*A14 - The new Jericho: Why we must break down the walls of the Maths classroom. - Graeme Austin

Maths is taught differently to other subjects in schools where connections to the world outside the classroom are made nearly every lesson e.g. the weather in Geography. In Maths, we open our resources and close our minds, creating fake examples to demonstrate our learning points. This turns pupils off our subject and create barriers to their understanding because they do not see the relevance of the subject, even though they use it every day in their ordinary lives. We must change how we teach Maths and we must start right now.

Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16  
Talk
Enhancing Mathematical Thinking through Game Based Learning - Pedro L. Montecillo Jr

Digital technologies through game based learning have become inseparable from development and research in enhancing mathematical thinking. Nevertheless, it has not been fully incorporated into the sphere of mathematics teaching and game based learning. The vast majority of teachers does not use technology in meaningful ways in their instruction (Guzey & Roehrig, 2012). There is potential for supporting game based learning in enhancing mathematical thinking in exploring the use of animations, and simulation. It aims to equip with skills on how to utilise selected online and offline resources in designing and implementing lessons with engaging and fun learning activities.

Context based learning - Simon von der Goltz

This session will explore how context based learning can promote student engagement and better prepare students for exams.

A15 - Ratio: from jelly babies to trigonometry - Mundher Adhami, Lynda Maple and Sarah Seleznyov

In practice, children aged 6 can happily cope with ratio in practical contexts. However, ratio is regarded as more challenging than fractions in the national curriculum, an example of the complexity of mathematics education. In this workshop, we look at examples of Thinking Maths lessons focused on ratio in practical and real life contexts across Key Stages 1-4. We address questions like: Should ratio be more explicitly addressed in the primary classroom, as well as in trigonometry lessons? How useful is it for teachers to study progression in concepts from the lowest to the highest in order to design mathematics lessons rich enough to challenge a wide range of achievement in the classroom?
**A6 - Chartered College & evidence informed practice: what does it mean for you** - Joe Treacy and Cat Scutt

Hear from the Chartered College of Teaching about the importance of using research and evidence to inform teaching practice. We will introduce our theory about how engaging with evidence can transform teaching practice. We will also speak about the story of the Chartered College to date and how you can join.

*EYFS, Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16, Research Presentation, Talk*  
Teacher Professional Development

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**Let’s publish! A beginners guide to seeing your name in print** - Ems Lord

Think publishing is just for academics? Think again. You can share your favourite classroom activities, Masters project or even book reviews with an audience of teachers across the UK. In this session, NRICH Director, Ems Lord, a member of the editorial team for Primary Mathematics, will demystify the publication process and explain the wealth of benefits from seeing your name in print, both for you and your school.

*EYFS, Initial Teacher Education, KS1, KS2, Teacher Professional Development*  
Talk

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**Being the teacher that’s remembered for all the right reasons** - Sophie Carr

The Mathematics Teacher Training Scholarship Scheme’s key aim is to increase the number of inspirational mathematics teachers across England. In this fully interactive thirty minute workshop, the partner organisations of the scheme will bring together some of the many different ways we have helped those undertaking ITT and NQT years become inspirational mathematics teachers by drawing together resources, techniques and approaches to engaging all students to ignite their love of mathematics and see its purpose in everyday life. Come along ready to join in, give your thoughts and be blown away by the wonders of mathematics within schools.

*KS3, KS4, Teacher Professional Development*  
Workshop

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**A17 - A young person's introduction to integral calculus** - Peter Merrotsy

The area of a triangle and the volume of a pyramid can be approximated using centicubes. If you can add up how many centicubes are used, and apply a little bit of algebra and an intuitive notion of limits, then you can derive the general results using a process, inspired by Eudoxus, Archimedes and Cavalieri, that is essentially integral calculus. The two examples are accessible for Years 6-8 and Years 9-10 respectively. Derivation of the volume of a tetrahedron is also modelled.

*KS2, KS3*  
Workshop
A18 - Developing Early Number Sense - Viv Lloyd, NCETM

This session will focus on the development of mathematics for children aged 3-5. It will explore what constitutes Number Sense and look at some activities to support the development of specific aspects of Number Sense.

Teacher Professional Development, Research Presentation, Talk, Workshop

A19 - 3D Objects from circles - George Connell

If you can draw a circle then we can help you create the following 3D Objects: Great Dodecahedron, Truncated Icosahedron (Soccerball), Concave Dodecahedron, Hexagonal Prism and a few more possibilities.

KS2 Workshop

A20 - Visualising Quadratic, Cubic, and Quartic Equation Solutions: An Introduction to Complex Numbers, Functions, and Mapping Diagrams - Martin Flashman

Understanding a quadratic, cubic or quartic equation and finding its solutions (roots) is a challenging part of the curriculum where students encounter a rich domain of mathematics - including geometry, numbers (real and complex), and functions. Visualising the solution of these equations is a valuable tool for meeting this challenge at any level. Starting with the representation of linear and quadratic equations, participants will take a hands on tour through visualisations including connections to the complex plane and 3D mapping diagrams for linear and quadratic complex functions, and concluding with recent work on visualising solutions to equations.

KS4, Post-16, Teacher Professional Development, University Demonstration, Talk, Workshop

A21 - Japanese Lesson Study in Essex - Janine Blinko

After being inspired by seeing the rich use of research lessons in Japanese schools, I have been engaging with 3 local schools to build this style of lesson study into their professional development programmes. Without exception, schools have found this an exciting and empowering process. The session will share those experiences, including: - Getting started - What a research cycle entails? - What a research session might look like? - What impact does this have? - How does this link with whole school action planning? This will be an interactive session, with discussion, video footage, activities and photographs.

Initial Teacher Education, KS1, KS2, Discussion Group, Talk, Workshop

Teacher Professional Development
A • Session • Tuesday 16:00-17:30

A22 - Exploring Number Sense in Early Years Education - Katherine Milner and Sarah White

One of the recommendations from the APPG (All Party Parliamentary Group) for Maths and Numeracy states: 'The government should increase the focus of maths and numeracy in the early years curriculum, by including number sense as a prime area for development'. This workshop will aim to explore what is meant by 'number sense' and will include practical activities, based upon research in mathematics education, in order to develop participants' understanding of the pedagogical approaches that could be used to achieve this recommendation. The effective use of resources and representations will also be explored.

EYFS Workshop

A23 - Bridging the divide between Primary and Secondary Mathematics - Ian Hibbert

An approach to taking Secondary Mathematics into Primary Schools to try to provide Primary learners with a broader picture of the cohesion of Mathematics alongside a deeper understanding of its patterns and to offer an insight into some aspects of the Mathematics they will meet at Secondary Level. The session will offer practical lessons that have been tried and tested with a view towards providing and seeking ideas on how to develop further resources. It is suitable for anyone who wants to facilitate a smoother transition at the end of KS2.

Initial Teacher Education, KS2, KS3, Teacher Professional Development Talk, Workshop

A24 - Mastery at KS4 - Emily Curtis-Harper

A session exploring and demonstrating how to use the core principles of mastery to teach KS4 Mathematics.

KS4, Teacher Professional Development Demonstration, Talk, Workshop

*A25 - Medical graduate views on statistical learning needs for clinical practise: Promoting curriculum reform through development of a practitioner-focused evidence base - Margaret MacDougall

I will report on recent research on the statistical learning needs of undergraduate medical students that I led through funding from the University of Edinburgh Principal’s Teaching Award Scheme. This survey-based research relies on a rich evidence base gleaned from existing medical graduates on which competencies in statistics and probability are required for clinical practise. It is therefore intended to support curriculum reform through introduction of learning opportunities in statistics and probability into the undergraduate medical curriculum. This session ought to inspire educators who are faced with the challenges of promoting statistical learning within non-specialist disciplines.

Post-16, University Research Presentation, Talk
Statistics concepts - getting the Big Picture - Sidney Tyrrell

In my experience many students initially find statistics confusing, boring, hard or all three and fail to glimpse the big picture with its power, excitement and sheer usefulness. So this session offers bite sized hands on ideas with simple bits and pieces that I have found helpful for teaching statistical concepts to such students. From summary measures to hypothesis testing with much in between here are ideas, links to web based resources, useful real data sets, and Excel spreadsheets.

KS4, Post-16, Teacher Professional Development, University Workshop

A26 - The Transforming Power of Maths Games - John Keyworth

Einstein said: Play is the highest form of research. In this session we will explore how fun maths activities, both indoors and outdoors, can develop children’s problem-solving skills, promote logical thinking, mental fluency and perseverance, all of which are transferable life skills. Maths games and puzzles have a bonding effect with parents and families in supporting their child's progress, whilst allowing children to hone their ability to tackle unfamiliar tasks. Maths games have the power to connect generations and I will provide practical ideas for schools to set up high-impact maths clubs and parent workshops.

KS1, KS2, KS3, Teacher Professional Development Demonstration, Discussion Group, Workshop

A27 - Making Construals of Mathematics - Steve Russ and Meurig Beynon

The session introduces a new experiential way of using computers to support learning. It’s called ‘making construals’ and was part of an EU project CONSTRUIT! (2014 - 2017). Participants will explore and modify some simple mathematical construals to develop activities for curriculum topics at KS2, KS3 and Post-16. A laptop running a recent version of Chrome or Firefox will be useful for this. Links to explanatory materials, and the main environment, can be found at: http://go.warwick.ac.uk/em/construit/year4/. Some of the best learning experiences can arise from students, or teachers, making construals for themselves - where possible collaboratively.

KS2, KS3, Post-16 Workshop

A28 - Gattegno (30th anniversary): films - Dave Hewitt and John Mason

Gattegno saw the study of geometry as involving more obviously the whole brain compared with other areas of mathematics. He considered that the use of film allowed the possibility to structure the students' mental vision in order to engage with dialogues that lead to geometric awarenesses. We will ask you to work on a particular mathematical film and reflect upon the way in which you use yourself in doing so. We will consider ways in which film might be employed in the mathematics classroom.

KS1, KS2, KS3, KS4, Post-16, University Discussion Group, Workshop
A Session • Tuesday 16:00-17:30

A29 - Active Maths - Using physical activity to raise attitudes and attainment in mathematics - Jon Smedley

The session looks at the research, rationale and benefits of ‘active learning’ and gives teachers practical ideas on how to implement ‘Active Maths’ in to the curriculum. Delegates will be introduced to the highly acclaimed and praised resource ‘Maths of the Day’ - a website that provides teachers and teaching assistants with over 1000 lesson plans on how to deliver ‘active maths’. The resource is used in schools across the UK and internationally and is having a huge impact on attitudes to mathematics, attainment in mathematics, levels of physical activity and whole child development.

EYFS, KS1, KS2

A30 - Introduction to hypothesis testing using the binomial distribution - Stella Dudzic

Hypothesis testing using the binomial distribution is in all AS and A level Mathematics specifications for teaching from 2017. This session will look at ideas for introducing this with students, show how to develop understanding of the concepts and language and give examples of practical applications where these ideas are used.

Post-16

A31 - Area of a circle: Do we have to teach area of a circle = Area of a circle = πr²? - Angela Wolsey

Many students fail to answer basic questions on circumference and area of a circle. Examiners report that; ‘Students can’t differentiate between circumference and area formulae. Or, they don’t understand that squared and ×2 are not the same thing.’ So, is it an algebra misconception or a circle misconception? We are free to choose how we teach – so how about a fresh approach? We will consider whether the formula Area of a circle = πr² is a useful tool in everyday life and the world of work. Who says that we must use the formula set out in the specification?

KS2, KS3, KS4, Post-16

A32 - Graphic Calculators for A-level - Stephen Kean

Graphic calculators are an ideal way for students to engage with the mandatory technology requirements for the new A-levels. This workshop will look at activities to enhance student conceptual understanding of mathematics that can only be achieved by the effective use of technology. Reference will be made as to how graphic calculators should be used as verification tools in examinations. Calculators will be provided.

Initial Teacher Education, Post-16, Teacher Professional Development

A34 - Learning mathematics with origami - Sue Pope and Tung Ken Lam

Paper is a cheap and readily available resource and a great starting point for mathematical exploration with learners of all ages. In this workshop you will have the opportunity to explore some starting points for yourself and consider how you might incorporate these into your lessons.

KS2, KS3, KS4

Workshop
B1 - ICT Strand 02: Finding and interpreting large data sets - Mick Blaylock

Improve your data handling skills! Join this session to learn and share ideas about large data sets that now feature in the specifications for AS, Core Maths and A level. In the session delegates will work with the awarding organisation large data sets and other sources. Extracts from the data set spreadsheets (single variable, bivariate data, random samples and more) will be represented and analysed in both Geogebra and Autograph. Implications and further options for teaching and assessment will be considered. Delegates should bring a laptop, mouse and power lead.

KS3, KS4, Post-16, Teacher Professional Development

Discussion Group, Workshop

B2 - Making Numbers: the role of talk, mark making, drawing and symbolic recording in developing number sense. - Jenni Back, Sue Gifford and Rose Griffiths

This interactive workshop based on the leaders' Nuffield Foundation funded research project 'Using manipulatives in the Foundations of Arithmetic' will look at examples of children's responses to a number of tasks that they have developed. We will analyse both the way in which they reveal aspects of number sense and also consider the transitions between concrete, pictorial and abstract realms of experience that they demonstrate. We will look at strategies to help teachers observe and develop learning, set appropriate learning goals and deepen understanding.

EYFS, Initial Teacher Education, KS1, KS2, Teacher Professional Development

Workshop

B3 - Intervention in the Mastery Context - Andy Tynemouth

Many schools are beginning to adopt a mastery approach to teaching mathematics and for many of them this will require that they reappraise their approach to the ways in which they support their struggling learners. This workshop will explore the role of different types of intervention in supporting struggling learners within a mastery context.

KS1, KS2, Teacher Professional Development

Workshop

B4 - Can our coinage system be improved? - Peter Shiu

There are some interesting problems associated with our current coinage system. A simple classroom exercise is to ask participants to show that six coins are sufficient to deliver the sum of n pence if 0< n< 99. A more taxing exercise is to show that the average number of coins required to represent all such n is 3.4. Can the system be 'improved' by changing the values, or even the number, of the denominations for the coins?

Post-16, Teacher Professional Development, University

Talk
**B5 - Identities and Representations in Mathematics Teaching - Lucy Rycroft-Smith**

Who or what are we as mathematics teachers? Why is representation important? In this session I will look at ideas around the identity of the mathematics teacher and the way we are portrayed inside and outside the profession.

*EYFS, Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16, Teacher Professional Development* 

**B6 - A-level Mathematics contact group and CPD - Richard Craster**

The learned societies in Mathematics have supported an A-level Mathematics contact group, to coordinate feedback on A-level Mathematics and Further Mathematics to government and interested parties such as the Royal Society. The activities of the contact group will be discussed, A-level content reform and its implementation will be a particular focus of this session. Also to be discussed are approaches to support teacher training in terms of CPD and how universities can contribute, and whether the contact group can coordinate activity.

*Post-16, Teacher Professional Development, University* 

**B7 - Let's talk about number - Pamela Moffett**

Understanding the language of mathematics is essential for the development of mathematical proficiency. The teacher plays a critical role in supporting children's language acquisition. However, it seems that meaningful vocabulary instruction is often overlooked in mathematics. 'Number Talk' is a practical handbook for teachers to support their planning and instruction in early number, focusing in particular on the associated vocabulary. Year 1 teachers who implemented the Number Talk ideas and activities in their classroom practice reported an increase in the quality and quantity of mathematical talk and observed a growth in children's understanding of number concepts.

*EYFS, Teacher Professional Development* 

**B8 - Exercises in Mathematical Imagining: From Practice to Theory to Practice - Christof Weber**

The teaching tool 'Exercises in Mathematical Imagining' is rooted in my own practice as a secondary mathematics teacher in Switzerland. Using an action research approach, I related my tacit knowing-in-action to German-speaking mathematics education theories, thus making it explicit by putting it into (German) words and terms. I was then able to refine its design and substantiate its impact.

As I am now introducing 'Exercises in Mathematical Imagining' to English-speaking teachers and education researchers, appropriate English words and terms have to be found, with their own, different history of ideas.

My talk reflects how putting into words and theorising changes practice.

*Post-16, Teacher Professional Development*
**B9 - Further Mathematics: Student Transition and Development** - Andrew Neate and Sofya Lyakhova

There is long running concern that students entering undergraduate courses are not fully prepared to progress from school to university level mathematics with many arriving ‘only to be confronted by the subject they do not recognise’ (Hoyles et al., 2001). The mismatches often identified concern learning abstract mathematics, thinking mathematically and applying mathematics. Using data collected from surveys and interviews of school students, undergraduate students and postgraduate secondary mathematics student teachers, this paper explores student choice in studying Further Mathematics and the implications of this choice on their development from school to university mathematics.

*KS4, Post-16, Teacher Professional Development, University Research, Presentation*

**National Network for Excellence in Mathematics in Wales: action research in 3-18 mathematics classroom in focus** - Sofya Lyakhova, Laura Morris, Rachel Wallis and Marie Joubert

The National Network for Excellence in Mathematics in Wales (NNEM) aims to support the development of effective practice in mathematics teaching and learning. It aims to support teachers and schools in implementing the ambitious recommendations of the Successful Futures Report on the Curriculum and Assessment arrangements in Wales, by Prof Graham Donaldson. One approach NNEM being explored is to create a network of teacher-researchers; promoting action research across teachers of primary, secondary and post-16 students. In the session we will share our approach to action-research in mathematics classrooms and report on the first findings.

*Teacher Professional Development Talk*

**B11 - Making Resits Work** - Emma Bell and Anna Bellamy

Compulsory mathematics GCSE resits are a thorn in the side for students and practitioners alike. In this session - run jointly by two teachers, for teachers - research and practice come together to examine how we can best help those students. Anna Bellamy's research focusses on Student Voice and the effects the forced resits have on those students while Emma Bell specialises in motivation, ensuring that students have belief and confidence in their mathematical abilities. How can we make mathematics resits work for all of our students?

*Post-16 Research Presentation, Talk*

**B12 - Low Stakes Testing in the Mathematics Classroom** - Colleen Young

To strengthen connections in areas of Mathematics studied and solve complex problems students need to easily recall many concepts and procedures automatically. This session looks at a practical way of helping students do this in the Mathematics classroom through the regular use of low stakes tests. These 'Mini-tests' as they became known by my students are a regular part of my teaching for any year group. The tests are short, so are easy to incorporate into lessons. Learning techniques vary considerably in their effectiveness for students; retrieval practice has been shown to be a very effective technique.

*KS3, KS4, Post-16 Talk*
**B13 - How to inspire a whole primary school in mathematics, using only triangles** - Declan Byrne

Discover how a whole-school mathematics event inspired children, parents and teachers at a London primary. Come prepared to play, create and be inspired to hold your own whole-school mathematics event. (Sneak peek video here: www.tinyurl.com/triangley)

**KS1, KS2, Teacher Professional Development**  
**Discussion Group, Talk, Workshop**

**B14 - Improving access to professional development** - Jo Sibley

This session will discuss the feedback and future plans developed from MEI’s pilot study of an asynchronous professional development programme for teachers of Mathematics. Designed to complement existing programmes of live professional development that are offered via same-room-same-day courses, live online courses and courses which blend the two approaches, this new programme is intended to ensure that all teachers can access professional development to support their delivery of post-16 mathematics courses without compromising either work-life balance or commitment to a day-time teaching role, and without loss of quality in the development received.

**Post-16, Teacher Professional Development**  
**Research Presentation, Talk**

**B15 - Geometric reasoning and problem solving** - Ruth Bull

The primary geometry curriculum should aim at the development of geometric reasoning and spatial sense. Geometric explorations can develop problem solving skills and spatial reasoning is an important form of problem solving. This is a workshop session where people can explore the properties of 2D shapes through various activities and think about these shapes and their relationships to 3D shape. There will be lots of opportunity to experience shapes in different forms. Hands-on, reflective, and interactive experiences are at the heart of good geometry activities in the primary school. This session aims to explore some of these!

**Initial Teacher Education, KS1, KS2**  
**Workshop**
B16 - Research Led Teacher Training - Joel Haddley

Representatives from The University of Liverpool and Liverpool John Moores University will discuss their new joint MMath Mathematics with Education degree programme. As well as receiving Qualified Teacher Status, students on this programme will have the opportunity to engage in original pedagogical research.

Initial Teacher Education, University Talk

B17 - Teaching multiplication with deep conceptual understanding - Katie Crozier

This workshop will explore how deep conceptual understanding and visualisation of multiplication can be developed through exposing structure and making connections. Part of the workshop will explore the use of the Numberlink Board, developed through action research in the Y4 classroom, to teach multiplication facts with understanding.

KS1, KS2 Research Presentation, Workshop

B18 - Challenging Topics in GCSE Mathematics - Carol Knights, NCETM

What topics did students find most challenging in last year’s GCSE examinations? Work Groups within one of the Maths Hubs Network Collaborative Projects have been exploring classroom approaches and associated professional development to tackle some of the big issues.

Teacher Professional Development Research Presentation, Talk, Workshop

B19 - Terms of Enfearment - Annette Margolis

This session is aimed at those teaching KS4 and KS5 pupils whose first language is not English, and/or who have literacy issues, and wish to assist those learners in getting to grips with the language and terminology in mathematics questions with a particular focus on wordy problems in probability and mechanics.

KS4, Post-16, Teacher Professional Development Discussion Group, Workshop
**B20 - Dyscalculia and Singapore Maths - The Perfect Match? - Judy Hornigold**

This workshop will explore how the approaches used in Singapore Maths can support learners with Dyscalculia and those with more general difficulties in mathematics. The session will look at how the concrete - pictorial - abstract approach can give learners a much deeper understanding of a concept and how to develop visualisation and number sense through techniques such as bar modelling and the number bond diagram. The session will identify the specific difficulties that dyscalculic learners have and highlight how to ameliorate these difficulties through development of the five core competencies in mathematics - namely visualisation, metacognition, generalisation, number sense and communication.

*Initial Teacher Education, KS1, KS2, Teacher Professional Development*  
*Workshop*

**B21 - Variation: implications for task design in English primary classrooms - Laurie Jacques**

A feature of teaching in Shanghai has been the teachers' carefully conceived use of variation in the examples they use. This session will share a summary of research from China, Hong Kong and Sweden where variation has been influencing task design for a number of years. There will be an opportunity to share and discuss some possible implications for teaching in England as we look to adapt classroom practices inspired by a 'Shanghai approach'. This research review and discussion is stimulated by a current PhD thesis asking whether teachers in England will be able to begin to use variation effectively in their task design. This session will complement a practical workshop for teachers that explores tasks designed with variation (D3).

*Initial Teacher Education, KS1, KS2, Discussion Group, Research Presentation*  
*Teacher Professional Development*

**B22 - Collaborative Maths and the power of a growth mindset - Simon Ayres**

An insight into how a collaborative, inclusive approach not only boosts confidence but develops more resilient and skilled mathematicians. Collaborative Maths and Carol Dweck's 'Growth Mindset' really help to engage pupils and allow them not only to grow as mathematicians but as learners.

*KS1, KS2*  
*Workshop*
B Session • Wednesday 09:00-10:00

B24 - A (very) brief history of problem solving (1982 - 2017) - Paul Metcalf
A session intended for those of you who have never heard of opposite corners, painted cubes, skeleton towers, equable shapes or tethered goats. The session will look at 35 years of problem solving and ask why we still have difficulties getting our pupils to think mathematically? At this moment I have no idea but I promise I will think about it. Be prepared to try out some old coursework tasks (suitably differentiated for a mixed ability audience) and assess your efforts against examination board criteria. Please feel free to bring your own examples of tasks that have worked in your classroom.
KS2, KS3, KS4 Discussion Group, Talk, Workshop

B25 - Using Noticing to Promote Mathematical Thinking - Karen Wilding
As to `educate' means to `draw out', the value placed upon what children notice and can then describe should play a very significant role in teaching mathematics. This interactive workshop will share ways of engaging children of all ages in meaningful thought and discussion that develops their ability to think critically, make connections and learn from each other.
EYFS, Initial Teacher Education, KS1, KS2, KS3 Workshop

B26 - What does research say about teaching mathematics at KS2 and 3? A review of reviews and meta-analyses - Jeremy Hodgen, Colin Foster and Rachel Marks
We recently carried out a wide-ranging review of mathematics teaching for the Education Endowment Foundation, looking at evidence relating to how students learn mathematics and effective teaching approaches across KS2 and KS3. The review adopted an innovative methodological approach based on a systematic review of meta-analyses (N=67). In this session, we will reflect on the strengths and weaknesses of the methodological approach, share some of our findings relating to different pedagogic approaches, and discuss the implications of our review for the field. Finally, we will consider approaches to disseminating the review to schools and teachers.
KS2, KS3 Research Presentation

B27 - The interplay between expectation and interest in a mathematics class - Paola Ramirez
The purpose of this paper is to present the analysis of the interaction between teacher and students in 8th grade (age 13-14) mathematics lessons when students were studying rational numbers, exponents and powers, square roots and solving a modelling task in a school in Chile. Following the completion of observations, video recordings and interviews, this study reveals that there is an interplay of the expectations and interests between the students and teacher. I suggest that taking into account this interplay could contribute to clarifying ways of working in mathematics classrooms, thus enabling more effective reflection on learning.
KS4, Teacher Professional Development Research Presentation
B • Session • Wednesday 09:00-10:00

*B28 - Collaborative task design with student partners in a STEM foundation mathematics course: the Catalyst Project - Dave Hewitt, Stephanie Thomas and Barbara Jaworski

This project involves the development of interactive tasks using Autograph and GeoGebra on a STEM foundation course. We report on the design of the tasks by four Student Partners, who had been on the foundation course the previous year. The Student Partners worked collaboratively on the tasks as well as with the researchers, the lecturer of the course and an externally hired expert in the use of Autograph. We reflect on the use of the tasks in tutorial sessions and consider the implications of the way the tasks were developed and how the process might be improved in the future.

Post-16, University

Robot design and construction: Secondary students perceptions of a transdisciplinary STEM project - Karen Skilling

This session reports on a unique transdisciplinary STEM project in one UK secondary school. Over ten months, a team of A level students have designed and constructed several heavy weight robots. The robots have been tested and refined in a cycle of ‘real life’ competitive battles. Research about this project draws on in-depth interviews to elicit student perceptions of STEM, links to subject choice, influences on career aspirations, skill development and applications. Importantly, commonalities in mathematical, scientific, and engineering habits of mind are identified.

KS3, KS4, Post-16, Teacher Professional Development

B29 - The NRICH Roadshow: is it just a bit of fun? - Becky Warren

In the current climate of accountability in the UK, perceived pressure is felt by many teachers to abandon ‘playful’ mathematics and replace with the mathematics demanded in tests. This session will explore the dichotomy faced by many schools and teachers and questions whether this is now a necessary part of mathematics education or a missed opportunity. The NRICH Roadshow provides a context for this discussion.

KS2, KS3, KS4

B30 - Data modelling as a framework for teaching statistics - Darren Macey

Many international curricula are beginning to build on the growing body of research in the field of statistics education promoting interaction with real and relevant data, and student-generated questions. In this practical workshop we will explore what this may look like in practice and consider approaches to developing data modelling activities in KS3 and KS4 classrooms.

KS3, KS4

A dice and numbers game - Antal A. Jarai

I will present dice games that are easy to explain to children at KS3 and above. Strategies for the games can be appreciated at several levels (up to post-16 and beyond), depending on children’s understanding of probability.KS3, KS4, Post-16, Teacher Professional Development, University
B32 - Group Flow When Engaged with Mathematics - Sipho Morrison

Learners often have a great enjoyment when carrying out mathematical tasks, questions or problems. This experience can be labelled as 'flow'. The learner experiences 'flow' when he or she is totally absorbed in the situation and/or task to the exclusion of all else, with a complete connection. Flow has been described as 'being in the zone' and is a quality of experience. Specifically, we will look at the advantages of 'group flow' as it relates to the mathematics classroom. Teachers of all phases should be able to relate the findings and suggestions to their own experiences and practices.

KS3, KS4, Teacher Professional Development

B33 - It's all about area! - Chris Pritchard

Large portions of the mathematics curriculum can be enhanced by simply having a picture of what's going on. So, as the sequel to my book, 'A Square Peg in a Round Hole', begins to take shape, I have been exploring the possibilities for using area as a justification for standard results met in lessons on algebra, trigonometry and series. You may find some of them helpful when teaching Y8-Y12.

KS4, Post-16

B34 - What can mathematical thinking look like post-16? - Elizabeth Kimber

Video provides an opportunity to observe and 'listen in' on what students say and do as they work on rich mathematical tasks. It also offers an opportunity to reflect on what mathematical behaviour we value and would like to foster in students. We will work together using video examples from Underground Mathematics to bring to light diverse and rich mathematical thinking that our post-16 students are capable of and discuss how this can be supported further in the classroom.

Post-16
C • Session • Wednesday 10:10-11:10

C1 - ICT Strand 03: Desmos for teachers and students - Stephen Britton

Improve your skills! An introduction to using Desmos on a variety of devices, its user interface and its procedures for entering equations and sliders in various categories (Cartesian, polar and parametric). How to access the teacher online environment on teacher.desmos.com, and how a teacher can create a dedicated student space on student.desmos.com. There, teachers can keep an eye on student scores, and students can share graphs around the world. Delegates should bring a laptop, mouse and power lead, or a tablet with a sensibly sized screen.

KS3, KS4, Post-16, Teacher Professional Development

Discussion Group, Workshop

C2 - Practical approaches for teaching mixed attainment mathematics classes at KS3 & 4 - Helen Hindle

I often get asked, as a teacher of mixed-attainment mathematics classes, How do you manage to ensure all students are both challenged and supported? In this workshop, I will share examples of strategies and tasks I frequently use to seek to achieve these outcomes and discuss the impact of these on student engagement and attitudes towards mathematics. I will also explain how I use Learning Journeys to support students to select tasks at an appropriate level of challenge. Participants will be given opportunities to collaboratively create differentiated activities for use in the classroom.

KS3, KS4

Workshop

C3 - Supporting children to be active and influential participants in mathematics lessons through effective use of pre-teaching and assigning competence - Ruth Trundle and Helen Eversett

Writing in the 1960s, Bloom suggested that given enough time all students can conceivably attain mastery of a learning task, i.e. understanding mathematics is theoretically available to all, if we can find the means for helping each student. The challenge within mathematics teaching is how to give all pupils the time they need to understand. During this session we will share findings from our year-long research project that explored the use of pre-teaching as a way of providing additional time, coupled with intervening in lessons to assign competence to ‘low-status’ pupils.

KS1, KS2

Research Presentation
C4 - The IMPaCT Taxonomy - Encouraging Deep and Varied Questioning in the Mathematics Classroom - Jo Denton

Presentation of a recent doctoral thesis submission about how engaging with a newly developed taxonomy specifically for mathematics can support mathematics teachers to vary the types of question used in their lessons and move from a surface approach to a deeper approach to questioning. The potential impact on the questions that learners themselves begin to ask will also be shared. The evidence presented is based on empirical research carried out with four participant teachers and five participant classes over the course of an academic year.

Initial Teacher Education, KS3, KS4, Post-16, Research Presentation, Talk
Teacher Professional Development

C5 - Changes to mathematics education in England - what has happened and what can we learn from it? - Charlie Stripp

Much has happened to change mathematics education in England in recent years. These changes have impacted on all stages of education from early years through to post-16, and on initial teacher education and teachers' professional development. This session gives an overview of the changes and their impact so far, and discusses what can be learned from them to inform how mathematics education can develop in ways that will improve mathematics education for all. Getting this right is crucial to improve the life chances of individuals and to support the economic success of the country as a whole.

EYFS, Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16, Talk
Teacher Professional Development

C6 - Using manipulatives to enhance understanding in secondary mathematics - Michael Anderson

Join me to consider the support available from the National STEM Learning Centre when developing the use of manipulatives to enhance understanding in secondary mathematics. Manipulatives (counters, interlocking cubes, Cuisenaire rods, dominoes, dice etc.) have long been used to aid understanding in primary mathematics - in this workshop we will explore hands-on ideas for their use when teaching secondary concepts in number, algebra and more.

KS3, KS4 Workshop
C7 - From log tables to the iPad - Ro Bairstow

I will highlight how teaching resources and their methods of production and delivery have changed over the years focusing on the recent developments in digital technology. I will demonstrate the resources I have produced and distributed free to teachers and students. These include eBooks, games, Apps and a content website for Years 7 to 12 covering all of the topics covered by most courses. I will also provide student feedback, comment on how my teaching has changed and the impact on learning and achievement of these new resources.

KS2, KS3, KS4, Post-16

Demonstration, Talk

*C8 - Developing a taxonomy for rich assessments of mathematics - Julian Gilbey and David Robson

In order to design and deliver an assessment test for applicants for undergraduate mathematics degrees (the Test of Mathematics for Undergraduate Admission), we have developed a new taxonomy for rich mathematics assessments that is applicable to all age groups. We will show how this can be used both to evaluate the nature of existing tests and to design new tests that support the National Curriculum aims of developing reasoning and problem-solving skills in mathematics. We will present a variety of examples from different key stages to show the taxonomy in action.

KS2, KS3, KS4, Post-16, University

Research Presentation

Dynamo Assessment: what it may tell us about primary school children’s mathematics. - Ann Dowker and Karima Esmail

Dynamo Assessment is a computerised assessment that tests children’s performance on 14 mathematical components. Four of these components involve number magnitude (visual quantity approximation, ordering numbers, number comparison, estimation); four involve number meanings (counting; single-digit number symbols; multi-digit number symbols; sequencing) and six involve number relationships and arithmetic (number facts; mental strategies; number bonds; problem solving; tens; and multiplication. It has mainly been used to plan interventions. In this session, we discuss how it can be used to study typically developing children’s performance.

KS2, Teacher Professional Development, University

*C9 - Problem Solving in the New A-Level: A Year of Experience - Carole Tham

Come and share experiences of developing problem solving skills in the first year of the New A-Level specifications. Bring your own resources or have a go with some that I have used mainly from freely available sources. This session will focus on developing independence and resilience among learners who have previously been happy to learn and follow processes.

Post-16

Discussion Group
Exploring mathematics examples from a teacher's and students' perspectives - Paola Ramirez

The purpose of this paper is to explore a teacher’s and students' perspectives regarding the use of examples in the context of mathematics lessons. This will be done by taking into account the significance of examples as determined by students and their teacher. Following the completion of observations and interviews, some new perspectives regarding examples were discovered. These perspectives were real-life examples; examples with advice and the role of writing; the language when students created their own examples; metaphor as examples and the importance of distinguishing between easy and difficult examples.

Post-16

Research Presentation

*C12 - Exploring Core Maths: uptake, challenges and stakeholder experiences - Matt Homer

England has one of the lowest post-16 participation rates in mathematics amongst developed nations. This is seen as a key policy problem in terms of meeting the growing demands for quantitative skills in the modern workplace, in HE and for life in general. One policy solution is Core Maths, a relatively new and distinct Level 3 qualification. This session presents interim findings of a large-scale three-year mixed-methods project funded by the Nuffield Foundation investigating how the provision of Core Maths is developing, and what the experiences of students, teachers and other stakeholders are of this potentially important new qualification.

Post-16

Research Presentation

Exploring Core Maths: From design intentions to implementation - Geoff Wake

Core Maths provides an overarching qualification-type with a range of different models being developed by the Awarding Organisations working to guidelines initially designed by an ACME convened expert panel. These qualifications underwent considerable scrutiny by both DfE and Ofqual before being accepted as suitably reflecting expectations. This session explores an analysis of the qualifications' assessment using a framework developed as part of the Evaluating Mathematics Pathways Project. This allows mapping and comparison of a range of qualifications. Here assessment papers will be compared and contrasted with each other and with GCSE qualifications providing insight into whether design intentions are being realised.

KS4, Post-16

Research Presentation
C13 - Resources to support active learning at A Level - Stephen Lyon

Join me on a journey through the wealth of A-level resources available in the National STEM Learning Centre's website that promote 'Active Learning' at A level. We will meet some old favourites as well as many new resources, stopping off to try some activities yourself. Along the way you will learn how the National STEM Learning Centre website can be used to make your own resource packages to support your scheme of work, what the community area can offer and what other support is available from the Centre.

C14 - Inquiry based instruction in mathematics classrooms: The role of mindset for students with mathematics difficulties - Jennifer Rice

The goal of this research is to develop an understanding of how students with mathematics difficulties (MD) experience inquiry based instruction and to what extent their mindsets (also known as implicit theories of intelligence) influence that experience. The literature review explores the extensive body of research in support of inquiry based instruction in mathematics classrooms, with special attention paid to the apparent incompatibility of such methods for use with students with MD. Preliminary results from a pilot case study conducted in a UK secondary school suggest mindset influences the perception of inquiry based instruction in students with MD.

C15 - Enhancing students' problem-solving skills with Prompt Videos - Andrew Stewart-Brown

Students often find themselves at a loss when asked to solve problems rather than follow memorised procedures. In order to support preparations at one school for the UKMT's Challenges, 'prompt videos' were prepared. The video reads a Challenge question and suggests approaches to its solution. On the condition that the resource was non-commercial, the UKMT gave permission for access to the videos to be made available on the web via a google-sheet. Hard copies of the corresponding past Junior Mathematics Challenge papers were made available to some schools in an informal trial in 2017. One school noticed a definite improvement in results, other feedback was positive and appreciative. Such an easily disseminated resource may have promise at many levels, as few schools find it possible to teach 'problem-solving' effectively.
C • Session • Wednesday 10:10-11:10

C17 - Some Calendar Issues - Tony Robin
We shall look at finding the day of the week of a given date, by both a mental method, and a method easily used on a machine. We shall see how the latter can be adapted to count the number of days between two historical events, using both Gregorian and Julian calendars. We shall also look at the moon’s motion and how this affects the tides.

KS2, KS3, KS4

C18 - Maths Hubs Work Groups – What are they and how do they work? - John Westwell, NCETM
Session on the principles behind WGs and how they offer a high impact model for collaborative professional development

Teacher Professional Development

C19 - Praying souls out of purgatory: ratio and proportion in the secondary classroom - Peter Ransom
The session will be as follows: 1) A short historical introduction 2) General work on some intriguing problems 3) Paired work using a novel way of checking answers. 4) Making an old mathematical instrument based on ratio and some geometry 5) Participants working through some enrichment materials on ratio and proportion. There will be plenty of resources to take away as well.

KS3, KS4

C20 - The Singapore approach to textbook use and the variation theory - Sue Lowndes
This session is for primary teachers and anyone interested in primary education. We will explore the key principles of the Singapore approach and support you in developing a pedagogical understanding of the Singapore approach to teaching and learning mathematics. We will look at how Inspire Maths textbooks apply learning principles and theories based on educational research and support children to move from concrete to abstract mathematical understanding.

KS1, KS2, Teacher Professional Development
C21 - Using Story as a Reasoning Tool in the teaching of Primary Calculation - Dave Godfrey

We will explore ways in which the creation of story narrative can help develop conceptual understanding across all four operations. I have challenged Primary teaching staff to create narratives illustrating otherwise abstract calculations. This process has proved to be both revealing and intriguing, and it has transformed my calculation training. Story creation has highlighted a lack of understanding of the different models underpinning each operation. It has also provided an exciting vehicle for moving forward the understanding of teaching staff. How might the creation of a story telling culture impact the children's conceptual understanding of arithmetic?

KS1, KS2  
Talk, Workshop

C22 - EYFS Mathematics - For New or Non-EYFS Practitioners - Lacey Flook

The EYFS provides the basis for subsequent mathematics education. This session will look at how mathematics in the EYFS works including cross-curricular planning for continuous provision.

EYFS, Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16  
Workshop

Teacher Professional Development, University

C23 - What aspects of professional development courses do mathematics teachers find effective? - Debbie Barker

Findings from a research Masters in to what aspects teacher participants on professional development courses found effective. This session will include discussion of examples of these effective aspects.

Teacher Professional Development  
Research Presentation, Workshop

*C24 - Connecting mathematics and French? Mais oui! - Pauline Palmer and Sarah Lister

This workshop will explore how learning mathematics in French can enable your children to revisit mathematical ideas and consolidate their understanding. Learning a new language and mathematics are both about a search for patterns. Teaching in both means using visual cues, tactile experiences and finding opportunities for repetition of key vocabulary. This approach, Content and Language Integrated Learning (CLIL), is widely used across Europe and learners make good progress in both areas. So come along and try out some practical mathematical activities in French. You don't need to be able to speak the language. We can show you how, with a minimum of vocabulary and some creative ideas, you can connect the two.

KS2  
Workshop

Using animated characters to convey numerical concepts - Fiona Curtis

How do you make maths more fun? In existing efforts the 'fun' is often bolted on arbitrarily, without enhancing the mathematics. The antics of animated characters (such as Minions) are enjoyable - can their stories be used to communicate numerical concepts such as place value, arithmetic, directed number and ratio? Stories educate by enhancing understanding through the creation of meaningful context, and encouraging motivation through emotional engagement, while the novel animated format might also reconnect the disengaged. In this talk I share the decisions made regarding the creation of a series of stories using animated characters (Knitwits) and share learners' reactions.
KS1, KS2, KS3

C • Session • Wednesday 10:10-11:10

*C25 - Purposeful Progress - A case study of NRICH’s collaboration with Tower Hamlets primary schools - Frances Watson

Pupils should make rich connections across mathematical ideas to develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems. (National Curriculum, 2014). This talk/discussion chronicles the successful 2016/17 collaboration between NRICH and 42 teachers in Tower Hamlets, to embed the aims of the mathematics primary curriculum into their schools. Their thoughtful reflections, individual journeys and careful support of each other, make for an inspiring account of developing a close knit professional community that really made a difference! The 2017/18 sequel (to support the assessment of problem solving, reasoning and fluency) will be two terms underway by April 2018, so we'll be able to share the epilogue of part one and give you a flavour of what came next.

KS1, KS2, Teacher Professional Development Discussion Group, Talk

Developing Geometrical Reasoning - Rachael Horsman

During this session we will explore a series of ideas, approaches and problems that help support the development of geometrical reasoning in younger pupils (KS1 to KS3). Through developing visualisation, verbal skills, and written communication in a variety of contexts, alongside really looking deeply at the mathematical content of what we teach younger children, we embed the necessary skills to allow them in later years to attempt more challenging problems successfully, as well as understand the need for clear and succinct communication. The ideas presented will be a combination of research and classroom practice.

Initial Teacher Education, KS1, KS2, KS3 Workshop

C26 - Inspiring ideas for maths clubs - Emily Fleming

Experiences helping to run maths camps in Kenya have led to new ideas for running a maths club back in a UK secondary school. This workshop will share ready to use inspiring resources for secondary school maths clubs, with a focus on extra-curricular maths and technology. Ways for secondary school maths clubs to collaborate globally with African partner schools via online puzzles and investigations will also be discussed.

KS4, Post-16 Talk, Workshop

*C27 - Transitioning in the first year of an Engineering degree - Stephanie Thomas and Clare Trott

This study aims to better understand and support students during their initial transition into university engineering mathematics as part of an engineering degree. To this end, we surveyed first year students from three engineering degree programmes: Electrical, Chemical and Materials Engineering. The research design comprised several stages. Data collected in Stages 1 and 2 related to students' study habits, maths anxiety and dyslexia. Stage 3 is the development of an online, interactive resource that seeks to support a holistic approach to the revision of calculus topics. It is aimed primarily at students who are at the beginning of university study.

Post-16, University Research Presentation
From A level to HEI – Edward Banks

We have looked in detail at the gap between A levels and university from both a mathematics and a general well being point of view. We started with a focus group at Birmingham University to establish what they wish they had been advised about whilst in sixth form. The responses proved interesting. In response, the hub and Birmingham University has compiled a brochure of this information written by undergraduates for undergraduates. We believe very strongly that it is not just the mathematics they are studying that people need support with. We have also offered Inside Maths days to help the transition.

Post-16, University

C28 - Reasons to Reason - Alison Borthwick and Alan Cross

Mathematics and science are connected in many ways, but a particularly strong link is the extent to which they both use reasoning to work towards testing out conjectures and hypotheses. This workshop will explore what we mean by reasoning and what it is not and how reasoning contributes to two of the primary STEM subjects. We will explore how reasoning skills in mathematics and science are very similar and thus offer justification for the connection of these two subjects in certain areas. We will include responses from teachers and learners as well as offering different theoretical views.

Initial Teacher Education, KS1, KS2, Teacher Professional Development

*C29 - Plickers - How I use them in my teaching - Rob Smith

An insight into how I have used Plickers in the mathematics classroom using a variety of Multiple Choice Questions. The session will give an overview of Plickers, question design, and how it can be used to assess student learning. The session will be based around my own teaching and the learning of students in my classes.

Initial Teacher Education, KS2, KS3, KS4, Teacher Professional Development

Secondary Mathematics and Digital Technology - Alison Parish

In a digital age secondary school mathematics is often reported for the non use of digital technologies. When computers were first introduced into schools in the early 1980s many mathematics teachers were put in charge - so what has happened? My research has revealed a list of missed opportunities, of control, the effect of high stakes examinations, the quality of professional development whilst showing that there are a huge amount of resources most mathematics teachers are unaware of. The question becomes - can anything be done to address the situation and is it really something that needs to happen?

Initial Teacher Education, Teacher Professional Development

Teacher Professional Development

Research Presentation
C30 - Teacher A and Teacher B: Differences in teacher beliefs and practices for promoting cognitive engagement in mathematics - Karen Skilling

Concerns about student engagement in mathematics are persistent, continuing to highlight student disaffection, lack of interest in and desire for post-compulsory participation in mathematics. Cognitive engagement is concerned with student approaches to academic tasks, psychological investment and willingness to master complex concepts that influence learning outcomes. Using two teacher vignettes, the beliefs and practices of 40 teachers in 10 UK schools were investigated, with a specific focus on how they promoted students' goal setting, cognitive strategy use, and self-regulation when learning mathematics. The findings report two teachers' approaches toward cognitive engagement, focusing on teachers who believed in promoting cognitive engagement by supporting student autonomy and independent self-regulation in mathematics for secondary students of all ages and levels of achievement.

KS2, KS3, KS4, Teacher Professional Development

Research Presentation

C31 - Visual Mathematics - Teaching Made Simple - Nadeem Chaudhry

To hold the mathematics rope is to pull on connected threads. The conundrum - mathematics is abstract but people cognitively retain images. When listening we transform words into mental images. Standing on the shoulders of giants - for the past ten years plus - I have been developing a framework (version 3.x). With this framework teachers show - with ease - how to peel back the layers and draw still or moving 'pictures' of the elements and relations that constitute the language of mathematics. Thus learners get to see, hear and manipulate abstract ideas with reasoning. It has been a delight to watch the aha! moments as learners connect the dots.

KS2, KS3, KS4, Teacher Professional Development

Talk, Workshop

C32 - Primary children's multiplicative thinking: resorting to instrumental learning - Ray Huntley

A presentation of data and analysis from an multi-national project looking at how children in Years 5 and 6 are able to connect and understand elements of multiplicative thinking using knowledge of arrays, factors and multiples, inverse relationships, commutative and distributive properties and the 'times bigger' relationship.

Initial Teacher Education, KS2, Teacher Professional Development

Research Presentation

C33 - Exeter Mathematics Certificate: how education should be? - Kerry Burnham

Students need to learn how to fail, get stuck, persevere, fail some more, collaborate, conduct research, present findings, apply mathematics, think creatively, become resilient, work independently and (did I mention?) fail. Through the Exeter Mathematics Certificate (EMC) students have the inspiration and opportunities to truly develop as mathematicians and scientists. Working closely with industry and university academics, teachers have developed this course over the past four years. In this talk I will share the successes and challenges of EMC and explore whether this model could be universal rather than unique to one school.

Post-16

Talk
C34 - Using graphical calculators in the A Level classroom – Sam Hoggard

Demonstration, advice and help on how to effectively use graphical calculators in the A Level Maths and Further Maths classroom to enhance teaching and learning

Post-16 Workshop
D1 - ICT Strand 04: Problem Solving using Web Resources - Douglas Butler

Improve your skills! We will explore the web for problem-solving ideas, including objects on Google Earth, the aim being to help you to find the best resources, and discuss how best to incorporate them into your lesson plans. We will find data, simulations, tutorials, texts and blogs. Then we will look at the best of the professional sites (e.g. NRICH), and amateur sites (e.g. Mr Barton Maths). Finally, we will look at ways to create your own resources and share them, using screen recording software - a must! Delegates should bring a laptop, mouse and power lead, and/or a tablet.

KS3, KS4, Post-16, Teacher Professional Development Discussion Group, Workshop

*D2 - Hands-on with the ScratchMaths curriculum: Blending computational and mathematical thinking in primary education - Alison Clark-Wilson, Celia Hoyles, Piers Saunders and Richard Noss

A three-year design-based research project in England, ScratchMaths, has developed a set of curriculum materials for the last two years of primary school. These materials use the Scratch programming language to blend computational and mathematical thinking. In this workshop you will have the opportunity to explore some of the curriculum activities as a means to discuss the potential impacts of the underlying pedagogy and curriculum content on pupils' classroom experiences. You will need to bring (or share the use of) a fully-charged wifi-enabled tablet/laptop in this session.

Initial Teacher Education, KS2, Teacher Professional Development Workshop

Learning to Scratch: exploring mathematical knowledge through programming - Piers Saunders

A three-year design-based research project in England, ScratchMaths, has developed a set of curriculum materials for the last two years of primary school. These materials use the Scratch programming language to blend computational and mathematical thinking. This presentation will explore early research to trace the evolution of teachers' mathematical knowledge as they learn to program using Scratch to express the core mathematical concepts of place value and variable. The research follows a group of teachers as they learn to programme, teach the ScratchMaths curriculum and intends to show that through learning to program in Scratch teachers can be helped to build an epistemological map of connections between mathematics and the programming instantiation of the mathematical idea which shapes their mathematical knowledge for teaching.

Initial Teacher Education, KS2, Teacher Professional Development Research Presentation

D3 - Designing mathematical tasks with variation for primary classrooms - Laurie Jacques

This workshop will offer primary practitioners some examples of mathematical tasks and exercises for primary pupils that have been designed with attention to variation. The workshop will enable participants to try out these tasks, reflect on the pedagogy that could accompany them and to consider how they might design their own tasks using a similar approach. This workshop will complement a separate research session (B21) that will present a summary of the literature that supports an approach to teaching with attention to variation and its implications for teachers' use of variation in task design in primary classrooms in the UK.

Initial Teacher Education, KS1, KS2, Teacher Professional Development Workshop
*D4 - The Chinese Abacus: An exploration of mental calculation from 4-7 - Kieran Mackle

It is the aim of this presentation to outline the impact, if any, of employment of the Chinese abacus can have on pupils' early mental calculation skills, self-efficacy and competency when problem solving. Based on the experiences of the first year of a four year study, this talk will seek to highlight any potentially transferable practices that can be garnered from our South East Asian counterparts with regards to the development of fluent mental calculation processes.

EYFS, KS1, KS2

Talk

Talk for Writing, in Maths - Tracey Adams

Focus on creating visual readable maps that explain mathematical concepts and support children to learn and internalise key ideas.

EYFS, Initial Teacher Education, KS1, KS2

Demonstration, Talk, Workshop

Game-structured learning of mathematics - Ferenc Arató

Mathterminds is a tool-kit for effective and joyful mathematics learning based on card and board games invented by Andrea Auth and supported by University of Pécs. In this presentation I will summarise both the approaches and results of our complex research related with this tool-kit. We use qualitative and quantitative methods for investigation of learning effectiveness, efficiency, and equity. In the first phase we examined the curricular coverage by the means of document analysis. In the second phase we investigated both operational effectiveness and frequency of subject-oriented interaction during classroom work. We start our longitudinal examination in September 2017.

KS1, KS2

Research Presentation

D5 - Maths Marmalade - Andrew Jeffrey

The fourth episode of Rob and Andrew's sideways look at the world of mathematics. An entertaining romp through some surprising applications, proofs, magic tricks and more, all with a mathematical flavour. And in their typical innovative style, for the first time ever the Maths Marmalade show will even feature a live penalty shoot-out. Not a talk for the faint-hearted (or the humourless).

EYFS, Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16

Talk

Teacher Professional Development, University
D6 - Challenging inequity in mathematics education: Sharing teachers' pedagogical rationale with learners - Pete Wright

This practical workshop is aimed at teachers and teacher educators interested in developing pedagogies that address issues of equity and social justice in the mathematics classroom. Bernstein argues that children from more privileged backgrounds are more likely to succeed in school mathematics by being better positioned to decipher the 'rules of the game', i.e. knowing how to recognise relevant meaning from classroom tasks and how to formulate appropriate responses. The workshop draws on ideas from a small-scale research project in which teachers explored how making their pedagogical rationale more explicit to learners could make mathematical success more achievable for all.

Initial Teacher Education, KS3, KS4, Teacher Professional Development

D7 - Problem Based Learning in Mathematics - Shobha Bagai

Problem-based learning (PBL) is a learner-centric instructional approach in which students learn about a subject through the experience of analysing, discussing and solving a real world problem. It empowers the learner to integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem. The talk will focus on some of the problems that were taken up during the teaching assignment at the Cluster Innovation Centre and demonstrate how these problems led to research at the undergraduate level. These problems are taken from the fields of calculus, ordinary differential equations, linear algebra and discrete mathematics at elementary level.

Post-16, University

D8 - Reasoning First: A randomised controlled trial evaluation - Terezinha Nunes

Reasoning First is a set of five programmes that aim to promote mathematical reasoning in primary school. Activities include teacher led sessions and games played independently by pupils, which promote quantitative reasoning and also number sense. The Year 2 programme was evaluated in two randomised controlled trials (RCT) supported by the Education Endowment Foundation. This mini-symposium will present an overview of the programmes, their theoretical background and the results of the RCTs. Presenters will be the programme developers (Nunes & Bryant, University of Oxford) and researchers involved in the scaling-up trial (Crossley, NCETM; Hollier, Howell & McNeil, University of Gloucestershire).

Initial Teacher Education, KS1
**D9 - Third chances in Education - David Martin**

This session discusses the role of the U3A in Education in retirement.

KS4, Post-16, Teacher Professional Development Discussion Group, Talk

**First Language Interference: a guide for teachers of mathematics - Jenny Stacey**

The delivery of mathematics in English to classes of students containing those whose first language is not English is present in the UK, where the language of education is English, but for parts of the population it may be a second, or even third, language. The impact of the language content and structure on students' abilities to engage with the material in mathematics classes and exams can reduce students' mathematical competencies from between one and eight levels. This presentation is to show the extent and content of the differences between English and other languages which might impact on mathematics' learning.

* This Adult Learning session is linked to A9, G26 & J9. Sessions can be attended separately or in conjunction

Post-16 Talk

**Thinking about the use of dialogue scenes when developing adult mathematics - Graham Griffiths**

This session is a continuation of work investigating the reading aloud of a scene of dialogue with adult mathematics learners. Through the use of the 'real world', hands-on context of rail ticket prices, the scene and its associated task have been produced to encourage learners to engage with mathematical ideas. The session will discuss some key elements in the analysis of the scene, related tasks and adult learner responses to these tasks. The analysis employs discursive approaches to mathematics education promoted by Sfard and frameworks explored Candia Morgan and others.

* This Adult Learning session is linked to A9, G26 & J9. Sessions can be attended separately or in conjunction

Post-16 Talk

**D10 - Developing excellence in mathematics – three new projects - Simon Singh**

Having made his name as the author of Fermat's Last Theorem, Simon Singh is now focussing on three projects that enable more students to achieve mathematical excellence. First, Who Wants to Be a Mathematician is an American competition that is now open to UK students. Second, the Parallel Project offers curious and challenging maths at weekends via a website. Third, and most ambitious, is the Top-Top Set Project, currently being piloted in four schools, which embeds maths excellence in the school timetable from Year 7 upwards. As well as these projects, Simon will discuss his books and films.

KS3, KS4, Post-16 Talk
D11 - Breathe life into the teaching and learning of mathematics - Izak9 - Franz Schlindwein

Izak9 is a highly interactive shared learning device designed for children in KS2 and KS3. TIMMS 2015 shows the number of children saying they are NOT CONFIDENT in mathematics increases from 19% to 43%, between the ages of 9 and 13. We have university research to show that the use of Izak9 can improve pupil attitudes to mathematics, especially for girls, only 13% of whom choose a STEM based subject at university, compared to 39% of boys. For a fun-filled, highly interactive, shared learning experience with the device that is used by 40% of schools in Northern Ireland, where children are now the highest attaining mathematics pupils in the English speaking world, come along and try Izak9.

KS2, KS3, Teacher Professional Development, University

Workshop

D12 - How can we support teachers to develop their own practice through action research? - Ruth Trundley and Stefanie Burke

Engaging teachers as willing participants in their own learning is one of the challenges for those responsible for supporting professional development. During 2016/7 we ran an action research project with a group of teachers and whilst they researched how best to support the learners in their schools, we considered how best we could support them as learners. This session will explore some of our findings from researching ‘How can we support teachers to develop their own practice through action research?’ and consider the implications for everyone working with teachers.

KS1, KS2, Teacher Professional Development, University

Research Presentation

D13 - Expressing Generality with Number Grids - John Mason

Participants will be invited to work at expressing generality and using that to prove facts about one or more grids of numbers.

KS3, KS4, Post-16, Teacher Professional Development

Workshop

D14 - Building mathematical fluency with board games - Lucy Rycroft-Smith

How has the genre of film changed in the last twenty years? Now imagine the amazing changes that have occurred in board gaming. A romp through some of the most recent and excellent board games around, with an eye for ways they might be used to develop arithmetic fluency, estimation, concepts of negative number, chronology and times tables.

KS1, KS2, KS3, KS4, Teacher Professional Development

Workshop
D15 - Underground Mathematics: Supporting teachers and students to develop Mathematical Thinking – Julian Gilbey & Colleen Young

Underground Mathematics provides free rich resources for teaching A level mathematics. This workshop will focus on the teacher support materials provided on the site. We will explore some resources in detail by working collaboratively on the mathematical problems and considering how the teacher notes, sample student work and classroom video clips could help your students to meet some of the demands of the new A level.

Post-16, Teacher Professional Development

D17 - Pop-Up Maths - David Sharp

In this creative and active session, you'll make pop-up 3D shapes, including cubes, tetrahedrons and dodecahedrons. You'll also make flexagons, including tri-tetra-flexagons and tri-hexi-flexagons. We'll look at how these can be used in the classroom.

Initial Teacher Education, KS1, KS2, KS3, KS4, Teacher Professional Development

D18 - Post 16 in Maths Hubs - Andy Tharratt, NCETM

Session on the range of post-16 work in Maths Hubs including supporting the teaching of the new GCSE as a resit, supporting Core Maths, embedding technology in the teaching of the new A levels and supporting institutional leadership and Level 3 mathematics pathway development.

Teacher Professional Development

Research Presentation, Talk, Workshop
D19 - What actually IS a rhombus, Miss? - Corinne Angier

There is often a strong emphasis on number and algebra at KS3 so that students approaching GCSE may not have had the opportunity to explore the properties of shapes. This leaves them with a sparse toolkit with which to approach topics such as congruence, vectors, proof, etc. In this session we will approach the rhombus from multiple directions. We will use a range of tasks that not only develop knowledge and understanding of the rhombus but also make connections to big ideas in geometry. We will review how these kinds of tasks and approaches might fit into a KS3 scheme of learning.

KS2, KS3  Workshop


Understanding a quadratic equation and finding its solutions (roots) is a challenging part of the curriculum where students encounter a rich domain of mathematics - including geometry, numbers (real and complex), and functions. Visualising the solution of these equations is a valuable tool for meeting this challenge at any level. Starting with the Greek representation of the problem connected to finding areas and squares, participants will take a hands on tour through various visualisations including connections to graphs and mapping diagrams and concluding with recent work on visualising complex functions with 3D mapping diagrams using Geogebra.

KS3, KS4, Post-16, Teacher Professional Development, University  Demonstration, Talk, Workshop

D21 - Mathematics in whose real world? - Helen Farmery

Through an activity that attempts to expose our own cultural response to a mathematical symbol this session will discuss the teaching of mathematics from a socio-cultural perspective. Participants will consider how they are supporting new and experienced teachers in their ability to be culturally responsive in their diverse classrooms in order that ‘real life’ mathematics really does relate to the lives of those they are teaching.

Initial Teacher Education,  Demonstration, Discussion Group, Research Presentation
Teacher Professional Development

D22 - Maths Sticks - Juliet Robertson

Sticks and stones won’t break Napier’s bones. A practical, outdoor workshop designed to provide participants with a multitude of ways of using natural materials for making mathematics concepts stick. The approach is very open-ended, with the aim of participants being able to take the concepts and develop their own ways of using sticks and stones outside. This will include simple resource acquisition, preparation and encouraging children to think mathematically through this process. The ideas work well in any outdoor space and are great for those with little or no mathematics budget.

KS1, KS2  Workshop
D23 - Triumphant Tables - Rachel Rayner and Charlie Harber

Why do some pupils find it so hard to learn tables facts? Is being able to chant tables sufficient? What does it take to be fluent in multiplication? These are all familiar questions. Based on their research project, currently running in and around Hertfordshire, Charlie and Rachel, will share proven activities that can be immediately used in your classroom. This is your chance to hear about this innovative yet simple to implement approach that ensures all pupils develop multiplicative reasoning. This is a no testing zone!

*Initial Teacher Education, KS1, KS2, KS3,*  
*Research Presentation, Workshop*  
*Teacher Professional Development*

D24 - Ideas for Using Creative Writing to Nurture Mathematics Learning - William Lacefield

Creative writing can serve as an avenue for learners to examine and portray their understanding of mathematics vocabulary, concepts and skills. In this session, participants will immerse themselves in opportunities to create prose and poetry inspired by standards-based mathematics learning. Types of writing will include sentence frame completion, definition poetry, memory joggers, concept-infused stories, riddles and limericks. Participants will be invited to share how they have incorporated writing into mathematics learning opportunities.

*Initial Teacher Education, KS2, KS3*  
*Workshop*

D25 - History of Mathematics and the Curriculum - Leo Rogers and Sue Pope

In this session we will present recent research results and some curriculum activities covering a wide age range for developing mathematical concepts and investigating epistemological processes based on easily accessible original historical materials.

*KS2, KS3, KS4, Post-16,*  
*Discussion Group, Research Presentation, Workshop*  
*Teacher Professional Development*

D26 - The Shadow of Dimension: Hypercubes and Beyond! - Zack Bassman

Edwin Abbott’s 1884 novella Flatland shows us that it is possible to understand higher dimensions through analogy, and by investigating their 'shadows' and cross sections. If we can visualise the shadow cast on a wall by a wire model of a cube, we see that while information is lost in the projection from 3D to 2D, much of the structure can still be appreciated. We will use Zometool to construct models of the Platonic solids and their planar projections, then explore multiple perspectives of the Hypercube by observing its 3D shadow.

*KS4, Post-16, University*  
*Demonstration, Discussion Group, Workshop*
D • Session • Wednesday 14:00-15:30

D27 - Three Ways with Displays - Clarissa Grandi

A session outlining three different ways to use displays in the mathematics classroom: to stimulate students' interest in mathematics; to support students' learning of mathematics; and to use as a vehicle for collaborative mathematical art activities. Attendees will be introduced to a selection of free, ready-made mathematics classroom display resources and ideas, and will also be given the opportunity to design their own. The second half of the session will involve a collaborative mathematical art display activity.

KS2, KS3, Post-16, Teacher Professional Development

Talk, Workshop

D28 - Supporting Transition from KS2 to KS3 - Alison Hopper

Supporting Transition from KS2 to 3 - Strategies and Opportunities The session will share successful work in transition, looking the benefits of effective practice whilst also considering potential barriers. The session will provide the opportunity to consider how better channels of communication between schools can be encouraged to maximise the progress and continuity in both curriculum and pedagogical approaches for children as they move from KS2 to KS3. There will be the chance to explore and reflect on the implications of the focus on Teaching for Mastery in Primary schools on transition.

KS2, KS3

Workshop

D29 - To the eighties and back to today - a tribute to the influence of Malcolm Swan - Anne Haworth and Barbara Binns

We were both fortunate enough to have been able to work with Malcolm over many years, and have witnessed the effect of his creative materials on learners in our classes. Come to this seminar to work together on some of the many classroom activities that Malcolm devised and experience his skill first hand. We will discuss the relevance of the materials to today's secondary mathematics classrooms and the influence they may have on learners' enjoyment, understanding and appreciation of mathematics.

Initial Teacher Education, KS3, KS4, Teacher Professional Development

Discussion Group, Workshop

D30 - Inquiry Maths - Andrew Blair

Inquiry Maths is an exciting model of teaching mathematics that has been used in classrooms around the world. It encourages students to regulate their own activity while exploring a prompt. Inquiries start with students' questions and conjectures and might involve a class on diverse pathways of exploration and proof or in requesting a teacher's explanation. The workshop will introduce the Inquiry Maths model, include advice about how teachers can use the model with their own classes and give participants the chance to experience the creativity of classroom inquiry.

KS2, KS3, KS4

Workshop
D • Session • Wednesday 14:00-15:30

D31 - Geometric proof, reasoning and artistic and cultural applications - Mick Blaylock

Constructions and circle theorems are often taught with limited reference to the underlying geometry and applications. GCSE requires that students: conjecture and derive results about angles and sides; use known results to obtain simple proofs; and apply and prove the standard circle theorems. This session focuses on proving various constructions and circle theorems integrating compass and ruler constructions with dynamic geometry demonstrations with opportunity for constructing tessellations such as the eight-sided star ("the breath of the compassionate") and the Cairo pavement. Artistic opportunities will also be explored with images from the Alhambra palace and the Villa Romana del Casale mosaics.

KS3, KS4

D32 - It's not all pizza fractions: maths that is literally good enough to eat! - Alison Eves and Linda Wood

We have found that a sure way to intrigue and motivate pupils is to combine two of our passions: food and maths! Spaghetti graphs; rice statistics; chocolate fractions; Moam volumes... to name but a few. Come and try some of the edible activities we have both developed from scratch or have found and adapted for use in our classrooms. Please also bring and share any ideas you have for food as maths education (samples welcomed!) Some of the resources you will want to take away, some you will want to eat! Activities adaptable for many ages and stages.

KS2, KS3, KS4

D34 - Gattegno (30th anniversary): Cuisenaire rods (KS2 Gattegno Curriculum Chart) - Ian Benson and Anne Crosby

With his Curriculum chart Gattegno demonstrated how a study of permutations and combinations of Cuisenaire rods can animate an enriched mathematics curriculum, extending from KS1 to KS5. The chart is organised as a directed acyclic graph: its nodes labelled by concepts, and its edges representing a temporal hierarchy. Each root corresponds to the study of a restriction on the pattern of all permutations equivalent in length to a rod. This is a practical session using both Cuisenaire rods and a related software system. We will explore the mathematics and computer science that teachers need to know to use the chart.

KS1, KS2, KS3

Workshop
E • Session • Wednesday 16:00-17:30

E1 - ICT Strand 05: Spreadsheets in mathematics - Mick Blaylock

Improve your skills! Spreadsheet challenges will be set giving delegates opportunity to use formulae in spreadsheets for generating number grids, investigating series, mathematical modelling, including optimisation problems, statistical concepts and calculus. Issues relating to spreadsheet algebra including iteration, absolute and relative references will also be considered. We will also look at how Excel can be used to perform simple simulations, for example a coin toss or a geometric progression. Bring your own device (laptop with power lead, tablet, etc.) with Excel or Google Sheets loaded.

KS3, KS4, Post-16, Teacher Professional Development Discussion Group, Workshop

E3 - Exploring data with graphing technology - Gerard Dummett

We will look at exploring statistics and data charts using graphing technology. The session will particularly appeal to teachers wishing to extend ways of engaging with the A-level large data set.

Post-16, Teacher Professional Development Workshop

E4 - The lighter side: a maths miscellany - Michael Fox

My rag-bag contains puzzles, pastimes, problems, procedures and paradoxes based on simple maths and logic. Topics may include deceptive games; sharing a bequest; unusual sequences; dividing liquids; using squared paper to measure curves; wrapping a cube; the unwelcome surprise; Hansel and Gretel’s cash problem and more! There will be audience participation.

KS3, KS4, Post-16 Talk
E • Session • Wednesday 16:00-17:30

E5 - Fact and Fiction in the History of Mathematics - David Acheson

The history of our subject can be a great teaching aid, but just how, exactly? I will look at a wide variety of examples (both good and bad), ranging from primary mathematics to the frontiers of research.

Teacher Professional Development

Talk

E6 - Teaching problem solving in the classroom - the primary perspective - Helen Farmery and Anne Mulligan

We represent the Association of Mathematics Education Teachers (AMET). During this session we will share experiences of how some ITE providers support trainees and newly qualified teachers to embed problem solving into their classroom practice. This session focuses on the primary classroom.

Initial Teacher Education, KS1, KS2, Teacher Professional Development

Workshop


In this workshop, we will draw on the outcomes of a large international study on this theme to think about the nature of mathematics teachers’ collaborative work and how we might understand teachers’ professional learning. We will consider questions such as: What is the nature of the collaborative tasks that teachers work on together? What do we all learn in such settings? and How might we decide if any of this impacts on students' learning? A crucial session for anyone designing or leading collaborative projects with teachers!

EYFS, Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16, Teacher Professional Development

Workshop

Teachers learning from research - Marie Joubert

Teachers learn in many and complex ways, sometimes through formal professional development activities and frequently through more informal activities such as collaborations designed for joint planning. Teacher learning also takes place through teachers’ involvement in research; not only doing their own research but also taking part in research projects. This presentation explores the learning reported by teachers who have taken part in various ways in mathematics education research. Many of these teachers have participated in research funded by the National Centre for Excellence in Teaching Mathematics in England and the National Network for Excellence in Mathematics in Wales.

Teacher Professional Development

Research Presentation
E8 - What does mathematical thinking look like in the primary classroom? - Janine Blinko, Jeffrey Goodwin, Matt Lewis and Karen Skilling

The session will engage practitioners in recognising mathematical thinking. We will consider how children demonstrate this and how lesson design can enable thoughtful responses. Reflecting on the outcomes of some specific tasks from both adult and child perspectives we will consider how the following impact learning:

- How teacher-learner dialogue might impact development of active problem solving?
- How engagement in a lesson is central to the development of confident mathematical thinkers?
- How teachers’ access to and engagement in an international community of practice (including Collaborative Lesson Research, lesson study) is influencing the schools in which we work?

KS1, KS2, Teacher Professional Development

Talk, Workshop

E10 - Concrete, Pictorial, Abstract and Language - The Use of Algebra Tiles - Mark McCourt

In this hands-on workshop, Mark will outline ways in which algebra tiles can help pupils to grasp new concepts. Connecting learning through the use of these concrete manipulatives and imagery before moving onto efficient symbolic methods, not only allows pupils a higher chance of gaining initial understanding, but also improves retention by providing opportunities for pupils to think about mathematics. Delegates will use algebra tiles and consider ways they can embed their use in classroom practice across the age and ability range. Come along, have some fun and discuss with colleagues how algebra tiles might benefit your pupils.

Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16

Workshop, Teacher Professional Development

E11 - Gattegno (30th anniversary): Geoboards - Geoff Faux and Charlotte Webb

Geoboards are just one of the tools invented by Caleb Gattegno. A working practical session using both virtual geoboards and physical geoboards with elastic bands. Questions that will be raised in the seminar include: What do students need to know before they start to use a geoboard? What specific awareness are developed by using a geoboard? Is there a line of questioning that has the potential for students to gain some of these awarenesses?

Initial Teacher Education, KS1, KS2, KS3, KS4, Teacher Professional Development, University

Workshop
E12 - Computing divergent series - Martyn Quigley

Established by Srinivasa Ramanujan more than 100 years ago, \( \sum_{i=1}^{\infty} \frac{1}{i} = -\frac{1}{12} \), seems to be a very odd result. Several 'proofs' are available on Youtube. Others consider the result patently absurd. However, as is often the case, all is not quite as it seems. In this talk/discussion session, we shall explore some methods that allow us to compute this and other similar series.

KS4, Post-16, Teacher Professional Development, University Discussion Group

E13 - To tell or not to tell? - Heather Davis

There are moments when, as a teacher, you directly tell students some information and others where students 'discover' things for themselves. We shall try a variety of tasks and consider how much we might 'tell' students in order for them to learn mathematics whilst working on them.

KS3, KS4 Workshop

E14 - Investigative Tasks for Further Mathematics Pure - Jonny Griffiths

A chance to try out some new exploratory activities for the Pure side of the Further Mathematics syllabus. These tasks will hopefully supply engaging entry points for vital topics. These activities have been written in the spirit of the popular Risps for Mathematics A level at www.risps.co.uk

Post-16, Teacher Professional Development, University Workshop

E15 - The mathematics in Islamic Art: a hands-on KS2 to 4 exploration - Jennie Golding

Many resources offer a highly Euro-centric view of mathematics, yet much of the mathematics we know and love derives from more far-flung cultures. I would argue it is important we recognise, celebrate and work with that wider heritage in our classrooms, and in doing so can enhance inclusivity, creativity and, in this case, fine motor skills and geometric appreciation, as well as mathematical reasoning. A hands-on session that can be adapted for 7-16 year olds.

KS2, KS3, KS4, Teacher Professional Development Workshop
E16 - Classification: from counting to data handling - Mundher Adhami, Lynda Maple and Sarah Seleznyov

Implicit in the meaning of number is the concept of classification. This applies to counting objects in a set as well as to coping with overlapping sets in statistics. In this workshop, we look at examples of Thinking Maths lessons from Early Years and KS1, and KS3 (Venn diagrams for types of numbers and of polygons) in order to explore progression in classification. The workshop also debates the value of engaging teachers in explicit discussions about classification in data handling activities, in order to enable them to design appropriately challenging mathematics activities.

**EYFS, KS1, KS2, KS3, Teacher Professional Development Discussion Group, Workshop**

E18 - Ensuring Continuity in Mathematics Across Years 5 - 8- Alison Hopper, NCETM

The session will focus on developing continuity in the teaching of calculation strategies across Years 5 to 8. The use of resources and modelling to secure understanding of the structure of calculation will be explored along with the progression to formal written methods.

**KS2, KS3, Teacher Professional Development Workshop**

E19 - How did Euclid and Archimedes manage without calculus? - Bob Burn

(i) Integration only; (ii) Archimedean Order as precursor to completeness (iii) Euclid X.1 as precursor to limits (iv) argue without infinite processes. Exercises all through.

**Post-16, Teacher Professional Development, University Workshop**

E20 - Making Sense of Complex Analysis with Mapping Diagrams: A New Visualisation Tool Enhanced by Technology (GeoGebra) - Martin Flashman

Understanding functions is an important challenge in studying complex numbers and complex analysis. Mapping diagrams, frequently coupled with tables, are a valuable alternative to graphs for visualising real variable functions and without a comparable alternative for complex variables. The session will start with basics of mapping diagrams to visualise real and complex linear and linear fractional functions. Participants will take a hands on mapping diagram tour using GeoGebra through visualisations of complex functions and integration theory and practice, concluding with visualisations to make sense of numerical methods for estimating integrals, Cauchy's Theorem and the Cauchy Integral Formula.

**KS4, Post-16, Teacher Professional Development, University Demonstration, Talk, Workshop**
E • Session • Wednesday 16:00-17:30

E21 - Lessons from history - Peter Merrotsy

In this workshop I will provide several examples of how learning and teaching resources can be developed by tracking down historical documents. First, we will use technology to locate a sample of historical sources (e.g. Euclid, Apollonius, Archimedes, Galileo, Kepler, Saccheri). Second, we will use the sources to develop investigation activities and enrichment that address a range of outcomes related to mathematics, as well as science and engineering.

KS2, KS3, KS4

Workshop

E22 - Why exams do not tell you what students actually know – Andrew Talyor & Craig Barton

In this session, fellow Northerners Craig and Andrew will look at the strengths and limitations of exams and good exam questions. We dive into the research evidence surrounding low-stakes quizzing and effective formative assessment, and challenge the value of Question Level Analysis (QLA) in identifying understanding and misconceptions. By breaking down the skills required to be effective in high stakes summative assessment, we will show what effective, forensic diagnostic assessment could look like both inside and outside of the classroom. You should come away from this session viewing exams in a new light, and with a new found love for Lancashire.

KS3, KS4, Post-16

Workshop

E23 - There's a lot more to times tables than meets the eye - Christine Lenghaus

Making maths visual = understanding and meaning not rote. Wouldn't we all love our students to have their times tables at their fingertips, without a calculator? That doesn't match the reality of my classroom. In this hands on workshop, use the resources that I have developed, in a visual and kinaesthetic system for teaching multiplication and division, which goes beyond rote and is suitable for starting to teach these concepts through to completing the square and even polynomial division! Understanding multiplication is essential as it is the foundation of nearly all secondary mathematics but very few of our students see the patterns in numbers that carry over into topics such as algebra.

KS3, KS4, Teacher Professional Development

Workshop

E24 - Variation for problem solving - Simon Mazumder

Using systematic variation to enrich problem solving by example, suitable for KS2-4

KS2, KS3, KS4, Teacher Professional Development

Workshop

E25 - Extension materials for whole-class teaching for Years 4-8 - Tony Gardiner

What kind of extension materials can support whole-class teaching? Acceleration certainly does not (and mostly leads to superficial understanding). We explore a collection of problems directly linked to the classroom curriculum (via the Maths No Problem textbooks), and designed to deepen understanding of the standard material studied in class.

KS2, KS3

Workshop
E • Session • Wednesday 16:00-17:30

**E26 - Exploring the NRICH-STEM Learning collaboration** - Stephen Lyon, Alison Borthwick and Charlie Gilderdale

As we move into the twenty-first century employers are looking for people who can do more than follow rules and procedures. The world needs students who have an intrinsic desire to learn, to advance, to solve problems and to question. This workshop, suitable for teachers of primary and secondary mathematics, explores how NRICH, known as the home of rich mathematics, has collaborated with The National STEM Learning Centre to link complementary activities on the two sites. You will have the opportunity to 'have a go' at some of our favourite activities.

*KS2, KS3*  
*Workshop*

**E27 - Using Art in the Mathematics Classroom** - Clarissa Grandi

This session will outline some of the pedagogical benefits of using mathematical art activities in the KS2, 3 or 4 mathematics classroom. Participants will be introduced to a selection of ready-made mathematical art lesson resources and will look at ways of using these resources to maximise engagement and support learning across different areas of the curriculum. Finally, there will be the opportunity to explore one activity in more depth. The session will include time for discussion and exploration, as well as some hands-on mathematical art-making. No prior experience necessary.

*KS2, KS3, KS4, Teacher Professional Development*  
*Talk, Workshop*

**E28 - Using Maths Toys to Drive Engagement** - Zoe Griffiths and Katie Steckles

There are a variety of mathematical toys and games that are available to buy in shops and that can be recreated by your students using everyday resources. We will introduce you to several different activities using these toys and games that drive engagement and encourage problem solving and mathematical thinking in the classroom. Pick up new and exciting task ideas that touch on topics ranging from shape and geometry to probability.

*Initial Teacher Education, KS3, KS4, Teacher Professional Development*  
*Workshop*

**E29 - Talking mathematics: can signalling really improve mathematics participation post-16?**  
*A debate hosted by the Royal Society Advisory Committee on Mathematics Education*

2017 was a significant year for mathematics education with Sir Adrian Smith’s review of post-16 mathematics highlighting the need for greater uptake, and the Chancellor announcing significant funds to incentivise schools to encourage students to take mathematics. This session will explore the potential role of universities and industry to increase participation in mathematics courses for post-16 students.

*Post-16, University*  
*Discussion group*
E30 - The problem with problem solving is learning how to teach it - Rosa Archer and Ros Hyde

We represent the Association of Mathematics Education Teachers (AMET). During this session we will share experiences of how some ITE providers support beginning secondary teachers embed problem solving into their classroom practice.

Initial Teacher Education, KS3, KS4, Workshop
Teacher Professional Development, University

E31 - Number, algebra and geometry across KS2 and KS3 - Mike Ollerton

This 90-minute active workshop will comprise a range of ideas for delegates to work on for the first hour and then discuss pedagogical and organisational implications for the final 30 minutes.

KS2, KS3, Teacher Professional Development Workshop

E32 - Gattegno (30th anniversary): Cuisenaire rods (KS1 Gattegno Product Chart) - Jenny Cane and Suzanne Spencer

The Gattegno product chart used in book 2 of Numbers in Colour has evolved through studying the 39 products of numbers 1-10, excluding the 1x table. This has been particularly powerful in the preparation for end of KS1 expectations and bridge towards place value and calculation. We will aim to demonstrate how a deep understanding of multiplication, division, fractions and factorisation can be achieved through studying this chart. How the mental agility of the child can be strengthened and visualisation can play a strong role in the recall of facts and their use in Y2.

KS1, KS2 Workshop

*E34 - The role of the bar model in developing mathematical understanding - Yvette Solomon, Sue Hough and Steve Gough

In this paper we discuss the usefulness of the bar model, drawing on our work with GCSE re-sit students in which we employed a Realistic Mathematics Education (RME) approach. RME prioritises connectivity and the role of context in mathematising/modelling, where the role of the bar is to sustain modelling across multiple contexts. We show that use of the bar can support diagnostic understanding of these students' difficulties, and enable them to make connections and vertically mathematise.

KS4, Post-16 Research Presentation

Comparing the bar model approaches from Singapore and the Netherlands - Sue Hough, Steve Gough and Yvette Solomon

Use of the bar model has gained momentum in England in recent years through the introduction of Singapore maths. Yet bar models originating in Holland, such as the fraction bar, the percentage bar and the double number line have been available since their introduction as part of the National Numeracy strategy in the late 1990s. In this session we take a hands on approach to considering subtle differences in the way the bar model is introduced through resources associated with Singapore and with the Dutch approach known as Realistic Mathematics Education. In particular, we consider the potential of this method to unify the curriculum.

KS2, KS3, KS4, Post-16 Workshop
F • Session • Thursday 9:00-10:00

F1 - ICT Strand 06: Autograph for KS3 and 4 - Douglas Butler

Improve your skills! This session will start with an introduction to creating objects in Autograph: points, lines, circles, polygons, shapes and graphs, and using the calculator to manipulate and plot attributes. Then we will look at a series of tried and tested lesson plans for KS3 and 4, including circle geometry, quadratic and cubic graphs and vectors. Data handling topics will cover linear regression and the proper demonstration of a histogram. Delegates should bring a laptop, mouse and power lead. Software will be provided.

KS3, KS4, Post-16, Teacher Professional Development

Discussion Group, Workshop

F3 - Progression towards open access environments in the teaching of statistics to non-specialists in medicine and allied health sciences and to promote statistical literacy within schools - Margaret MacDougall

Firstly, I shall provide an update on the project 'Statistics in Medicine: A risky business?' that was previously funded by the Mathematics, Statistics and Operational Research Network of the Higher Education Academy and which, through further funding, has expanded to deliver open access statistics resources for non-specialist learners in statistics from Medicine and allied health sciences. Secondly, I will seek feedback from the community of non-specialist teachers of statistics in higher education and teachers of statistics at earlier learning stages to identify opportunities for optimising use of my online resources within their courses and forming partnerships to support funding bids.

KS2, KS3, KS4, Post-16, University

Workshop
F4 - Prioritising students' engagement through and in mathematical reasoning at A-level - Nicola Bretscher

This session introduces some intriguing tasks that prioritise students’ engagement through and in mathematical reasoning at A-level. It is very much aimed at supporting beginning teachers and NQTs who are new to teaching A-level mathematics. This free FMSP-funded course aims to develop both subject knowledge and pedagogy for teaching A-level mathematics. We will tell you a bit about the AMTEC course, focussing on our iterative development of five pedagogic messages (of which the session title is one!) that make explicit the approaches to teaching A-level mathematics valued in our course.

Initial Teacher Education, KS4, Post-16, Teacher Professional Development

F5 - Closing the attainment gap in mathematics - Catherine Knowles

The Fair Education Alliance working group, focused on numeracy in early years and primary settings, released a report on how to close the attainment gap in mathematics between children from different socioeconomic backgrounds. The panel will discuss and share key findings and next steps.

EYFS, KS1, KS2

F6 - Drawing a mathematics lesson - Ashley Compton

Year 3 pupils in ten schools in Lincolnshire were asked to draw themselves in a mathematics lesson. These pictures, which included speech bubbles, were analysed looking at the organisation of the lesson, pupil attitudes and interactions among pupils and adults. Pupils were generally positive about mathematics but needed greater encouragement to ask for help. The girls were more likely to draw the teacher among the pupils and giving positive feedback. The boys were slightly more likely to demonstrate confidence in their mathematical ability. A similar study was undertaken with primary ITE students drawing their ideal mathematics lesson.

Initial Teacher Education, KS1, KS2

Perceived barriers to integrate children's literature in mathematics teaching: Perspectives of pre-school and primary teachers in England - Natthapoj Vincent Trakulphadetkrai

Research has shown that children's literature can be used to enhance mathematics teaching. However, little is known about the extent to which pre-school and primary teachers in England use this resource, and their perceptions on barriers, if any, that prevent them from using it in their teaching. Open-ended survey data, collected from 130 pre-service teachers and 50 in-service teachers throughout England, were analysed thematically. The study found that the resource was not utilised very frequently, particularly in the primary phrase, and some perceived barriers, such as lack of awareness of mathematical children's literature, can be easily addressed.

EYFS, Initial Teacher Education, KS1, KS2, Teacher Professional Development
F • Session • Thursday 9:00-10:00

F7 - Dyscalculia and maths learning difficulties - Peter Jarrett

Many people suggest that they have the 'number form of dyslexia', but what is dyscalculia, and how does it differ from other barriers to learning and other specific learning difficulties? This talk will examine what we know about a range of maths learning difficulties and offer a protocol to aid differentiation in the classroom.

KS2, KS3, KS4, Post-16, Teacher Professional Development

*F8 - Promoting Mathematics Literacy in Europe - Jaime Carvalho e Silva

The outcomes of European countries in international comparative studies (such as PISA and TIMSS), and surveys in individual countries, suggest that the mathematical skills of most European young people are inadequate. The international comparisons suggest that lower attaining students and students from disadvantaged backgrounds have particularly weak skills. Also, comparing the content of national examinations in several countries, we conclude that there is a lack of content related to mathematics literacy. Teacher development is a priority if the mathematical literacy of all learners, regardless of their background and prior attainment, is to be nurtured and developed. Ways of promoting mathematical literacy in initial and continuing teacher education will be discussed.

Initial Teacher Education, Teacher Professional Development

Mathematical Thinking, Curriculum Change, and Testing - Nick Peatfield

Mathematics performance in the UK has long been a source of concern for policy makers, business leaders, and educationalists alike. There have been manifold initiatives to remedy these complaints, as far back as the Cockcroft Report in 1982. In this session we address the question of why such a prolonged and varied effort on the part of so many institutions has thus far not had the positive impact expected, and whether the constant pressure on schools as institutions to produce students to perform in standardised tests might bear some of the blame for this.

Initial Teacher Education, KS3, KS4, Post-16, Discussion Group

Teacher Professional Development

F9 - Deconstructing disability through/and promoting inclusive education in elementary mathematics classrooms: the case of blind learners: Preliminary findings from a two-phase study - Angeliki Stylianidou and Elena Nardi

We present preliminary findings from the first phase of the lead proposer's doctoral study that explores the ways in which inclusion of blind learners in primary mathematics classrooms in the UK is experienced by both blind and sighted pupils, teachers and support staff. In the first phase we collect classroom observation and pupil and teaching staff interview data in order to gain insight into pupil and teaching staff experiences. Findings from the first phase will inform the second phase in which we will investigate the impact of classroom-based, collaboratively designed, inclusive mathematics teaching interventions on pupils and teaching staff.

KS1, KS2

Research Presentation
F11 - Exploring collaborative problem-solving in the classroom - Ems Lord

In this interactive session, NRICH Director Ems Lord, will explore the challenges and opportunities arising from collaborative problem-solving. Reporting on the findings from a pilot study with ten primary schools, Ems will share how teachers addressed the issues arising from combining group work with problem-solving. This project was funded by NESTA following their recent report Solved! Making the case for collaborative problem-solving (Luckin et al., 2017)

Initial Teacher Education, KS1, KS2, Teacher Professional Development

F12 - Investigating teachers' changes in practice with low-achieving students - Rita Santos Guimaraes

In this session I will present the main results from my PhD research. During eighteen months, I visited a school in a low income area and observed lessons from three mathematics teachers to low-achieving groups. My interest was in how these teachers changed the way they teach fractions for low-achieving students due to an intervention set up to implement a different teaching approach. A model to explain how teachers changed is suggested. For this presentation, I will illustrate how the model derived from the data and also discuss some of the prominent features that influenced changes in these teachers' practice.

Teacher Professional Development

F13 - A Context for Generalising Number Sequences in the Primary Years - John Mason

Participants will be invited to use a family of number grids involving constant differences as a context for expressing generality

Initial Teacher Education, KS1, KS2

Workshop
F14 - Learning from work on the new level 3 Core Maths qualifications, developing tasks from interesting starting points - Terry Dawson

The session will examine resources MEI, CMSP and others have produced for Core Maths. Whilst exploring some of the tasks and discussing their design we will consider the question, should these ideas be limited to Core Maths?

KS3, KS4, Post-16 Demonstration, Workshop

F16 - Getting it wrong is right - the use of collaborative working and problem-solving skills in mathematics as an extra-curricular activity in secondary schools - Teresa Willmore and Elena Boguslavskaya

Looking at how the use of advanced mathematics in secondary schools can promote individual pupils' problem solving skills through collaborative working. By allowing pupils to work on an advanced mathematics question in groups, without the aid of technology, they have to discuss and work through various possible solutions in order to reach their final conclusion. They will need to work through many wrong methods before arriving at one that works - indeed they may well find that there is no one right method and will then need to argue for their chosen method.

KS3, KS4, Teacher Professional Development Talk

F17 - Curriculum Planning for Problem Solving - Lucy Kilgariff

A talk and guided discussion on ways to embed problem solving across KS3 and KS4. We will look at curriculum design, lesson planning and extra curricular opportunities.

Initial Teacher Education, KS3, KS4, Teacher Professional Development Discussion Group, Talk

F18 - Communicating Mastery or Mastering the Communication? - Steve McCormack, NCETM

To what extent do we need a common understanding of the phrase ‘teaching for mastery?’ If so, how do we collectively communicate it?

Teacher Professional Development Research Presentation, Talk, Workshop
F19 - Concept-Based Mathematics - Jennifer Chang Wathall

This interactive workshop will look at the tenets of concept-based mathematics and how to focus practice on conceptual understanding. Traditional mathematics learning has focused on rote memorisation of facts and skills with little attention paid to the concepts in mathematics. How do we plan for conceptual understanding with our students?

EYFS, Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16, Workshop
Teacher Professional Development, University

F20 - Inequities in maternal and child healthcare associated with poor performance in junior secondary school mathematics in Nigeria - Anne Meremikwu

Inequities in access to healthcare tend to coexist with inequitable access to social services and education. The study's hypothesis that children in areas with poor maternal and child health (MCH) indices were more likely to perform poorly in mathematics. MAT scores of 2124 junior high school children across Nigeria were compared across sub-categories of inequity in MCH indices. Results showed that poor MCH indices (viz: stunting, underweight, immunization, antenatal care and child birth) were highly significantly associated with lower MAT scores. This double jeopardy in health and educational inequities calls for collaborative action between health and educational authorities.

KS3, KS4 Research Presentation

F23 - Mathematical etudes: procedural fluency through rich tasks - Colin Foster

Fluency in key mathematical procedures is critical for students' mathematical development. But are repetitive, routine exercises the only way to achieve this? In this session, I will share several 'mathematical etudes' (Foster, 2013), tasks designed to embed extensive practice of a well-defined mathematical procedure within a rich problem-solving context. I will report on recent research into their effectiveness in comparison with traditional exercises, and we will discuss how such tasks might be designed and used effectively in the classroom.

KS3, KS4 Research Presentation, Workshop
F • Session • Thursday 9:00-10:00

F24 - Mathematical Agency: Explorations of children's problem solving in the Early Years - Catherine Gripton and Deliah Pawluch

The session provides a forum for sharing work in progress. It centres on practical approaches through which young children model and explore mathematical problems or challenges. Drawing upon a range of approaches from England and the United States, we will provide examples of children demonstrating mathematical agency through ownership of their strategies and solutions. The ideas presented are suggested as a potentially powerful way or working with children in the early years, with the mathematics residing firmly in the child's world. The workshop offers an opportunity to ponder and reflect upon children's mathematical agency in the early years.

EYFS, Initial Teacher Education, KS1

Workshop

F25 - The life of a STEP question: birth and transfiguration - Stephen Siklos

I will talk about a particular STEP question for two purposes: first as a peg upon which to hang a discussion of the process of setting STEP papers; second as a way of illustrating how a STEP question can be tackled and how it can have a life even after you have found a solution.

Post-16

Talk

F26 - Theoretically informed design for professional learning - Geoff Wake

We report current work seeking to improve teaching and learning for post-16 GCSE. The focus of the presentation is our design of professional learning that is informed from three different perspectives. First we consider Wenger’s theorisations of learning and explore how these have informed our design at a tactical level. In our development at the technical level we draw on the theory of instrumental genesis to develop tools for teachers in-the-moment classroom actions. Finally we consider what we might learn from the structure of Japanese problem solving lessons to support fundamental mathematical understanding, procedural fluency and problem solving.

KS3, KS4, Post-16, Teacher Professional Development, University

Research Presentation

F27 - Making GCSE resit Mathematics work (and making students resitting GCSE Mathematics work harder) - Fiona Allan

Many students resitting GCSE Mathematics do not enjoy mathematics nor do they have a positive work ethic. During this session, we will look at activities that make students work harder and help them to realise that they can be successful at mathematics. Participants will take away ideas, strategies and activities to use with their students. Fiona taught students resitting GCSE mathematics for almost twenty years before working on programmes such as the Standards Unit, Thinking Through Maths and, more recently, the Maths Enhancement Programme.

Post-16

Workshop
F28 - Nattering about Numbers - Developing Classroom Discourse to Support Deeper Understanding - Pinky Jain

This session will be a workshop where the group will be able to engage, through hands on tasks, with the research outcomes and consider the applications of the work in a range of settings.

Initial Teacher Education, KS1, KS2, Teacher Professional Development Workshop

F29 - Linearity and the new AS/A Level Mathematics - Will Hornby

In this session we will look at the changes that linearity makes to teaching, learning and assessment in the new A Level Mathematics qualifications. This workshop session will include hands-on activities for the classroom and discussion of assessment items from OCR's Sample Assessment Material and Practice Papers. The discussions and material covered will be useful to teachers of any A Level Mathematics qualification.

Post-16 Workshop

F30 - Technology and the mathematics curriculum: Why you can't have your cake and eat it - Martyn Quigley

Over the past few decades the use of technology in mathematics classrooms has proliferated, however research on the effect this has had on children's achievement has produced effect sizes that have remained stubbornly, typically in the range 0.2 to 0.4. In this discussion/workshop we shall examine the interplay between the use of technology and legacy methods by deconstructing solutions to a typical problem that participants will be invited to solve beforehand. This will lead us to reconsider the place of technology in the mathematics curriculum.

KS3, KS4, Post-16, Teacher Professional Development Discussion Group

F31 - Connected A-Level PoS - Dominic Oakes

Mathematics is the classification and study of all possible patterns. (Walter Warwick Sawyer - author of Mathematician's Delight.) Programmes of Study tend to work through specifications topic by topic. Can we improve on this by developing mathematical thinking through looking at the connections in the material and travelling through the mathematics in a different way? FMSP Wales has written SoWs for the new Mathematics and Further Mathematics A-Levels. They map prior and dependent topics for every topic in the syllabi. Can we use this resource to grow our students' (and teachers') understanding of the patterns running through mathematics?

Post-16 Workshop
F32 - Developing effective primary mathematics subject leaders: lessons from the Primary Science Quality Mark (PSQM) - Clare Warren

During this interactive session participants will learn about and discuss the findings of recent research into PSQM and consider how it might inform primary mathematics subject leadership. The effectiveness of PSQM has been widely recognised; Ofsted has noted that PSQM provides an important mechanism for improving attainment and raising the profile of science. Recently an evaluation of PSQM noted that through providing a structure and promoting an understanding of the role, during the programme, the profile of the subject leaders developed and their influence grew. We will consider ways that leadership of mathematics might be enhanced based on this learning.

KS1, KS2  Workshop

F33 - Mathematics outreach: fun or rigorous, systematic or fragmented? - Sofya Lyakhova, Andrew Neate, Mary Capraro and Robert Capraro

While many University Mathematics Departments offer an outreach programme to local schools, there is little research done into methods, topics and pedagogy of enrichment mathematics programmes. Do they primarily inspire and broaden children’s appreciation of mathematics or enhance and deepen their knowledge? Do they cover all areas of mathematics or is it a selection of topics? The session will offer an overview of research available in the field of mathematics outreach followed up by a discussion on what constitutes good practice in institutional approaches to mathematics outreach.

KS4, Post-16, University  Discussion Group

F34 - Using technology in the classroom to develop understanding, is it any good? - Simon May

A presentation to discuss the impact the use a various ICT can have on the understanding of students and their development as problem solvers

Post-16  Workshop
G Session Thursday 10:10-11:10

G1 - ICT Strand 07: Geogebra for Beginners - Tom Button (MEI)
Improve your skills! A chance to explore GeoGebra and to grow in confidence using it for visualisations and investigations. There will be an opportunity to learn how to use the two basic 'apps': Graphing and Geometry. Examples for using it in the GCSE and A level classroom will be explored, for both teacher demonstrations and student tasks. We will also look at how to make use of the extensive collection of existing resources online.
Delegates should bring a phone, tablet or laptop with the GeoGebra app/software installed. No previous experience of GeoGebra is required.

KS3, KS4, Post-16, Teacher Professional Development
Discussion Group, Workshop

*G2 - Mathematics for the reformed science A-levels - Mary McAlinden and Andrew Noyes
A new policy approach to mathematics in the reformed science A-levels stipulates statutory minimum requirements for mathematics within assessments. This 'embedding policy' has been introduced in parallel to an 'adding policy' that advocates the study of mathematics for all to age 18. In this session we will present results of our analysis of the mathematics within the sample assessment materials for the reformed science A-levels: physics, chemistry and biology. We will examine the scope and limitations of these two policy moves and consider their implications for A-level study and the transition to university.

Post-16, University
Research Presentation, Talk

Teaching Core Maths at Scale - Ayesha Allen
ELAM is a specialist Music and Media sixth form. Part of our vision is that every student studies both mathematics and English alongside their music or media qualification. Our bespoke double level three course allows students to continue to develop their mathematics throughout their post 16 study. ELAM is one of the few centres offering Core Maths at scale and our course has been heavily endorsed by our partners. This session would address the challenges we faced in setting up our course, how we have made Core Maths work at scale and our plans for the future.

Post-16
Talk

G3 - Mathematical Play: Circle time, problem solving and discussion - Kartar Uppal
I will be looking at the results of my MPhil 'Mathematical Play: Games, problem solving, investigations and discussions' at the University of Birmingham and demonstrating how mathematics can be taught with minimal input from a teacher and the maximum involvement of students. I see myself as a director: directing students to access, create and scrutinise mathematical knowledge.

Initial Teacher Education, KS3, KS4, Post-16
Demonstration, Discussion Group, Workshop
Teacher Professional Development, University
G4 - Many Mischievous Mathematical Misconceptions - Craig Barton

Using data from the tens of millions of answers to questions on my Diagnostic Questions website, together with the actual written explanations given by students, I will unearth some of the most surprising, interesting and deadly mathematical misconceptions that our students hold. How do these misconceptions vary by age group? What are the most important misconceptions to resolve early in order to prevent problems further down the line? And is attempting to resolve misconceptions more trouble than it is worth? Expect a bit of controversy, as well as a fresh round of everyone's favourite quiz: Guess the Misconception.

KS2, KS3, KS4

Demonstration

G5 - Topics taught by trainee secondary mathematics teachers - Simon Woodage

This session provides an overview of the topics taught during the 24 weeks trainee mathematics teachers spend in school during their PGCE. We will then discuss the implications of those topics extensively taught and those that trainees have limited opportunity to teach, and consider the possible influence of examinations, especially GCSE grades 4 and 5, on pupils’ experience in mathematics lessons.

Initial Teacher Education, KS3, KS4

Discussion Group, Research Presentation

G6 - When is mathematics 'mental' in KS1 and how do you know? - Anne White, Margaret Young and Annalee Toon

Based on the experience of leading moderation of KS1 mathematics in 2017, we will share common misconceptions about what is meant by 'evidence of mental mathematics'. We will share our approach to developing mental mathematics strategies and enabling greater depth of learning. Participants will work on tasks that are designed so children make decisions to use mental strategies and show this by recording in their own way. We will examine examples which show how recording can represent thinking rather than interrupting it.

KS1, Teacher Professional Development

Workshop

G7 - Preparing students for Mathematical Olympiads - Jeremy King

As chair of the British Mathematical Olympiad setting committee, and lead marker for BMO1, I will discuss what the markers are looking for in Olympiad scripts, and how best to prepare schoolchildren to sit these challenging papers.

KS3, KS4, Post-16

Talk
*G8 - Challenging the fear: a framework for addressing anxiety in adults learning mathematics education - Karen Wicks
This presentation extends the initial stages of my research where I observed a positive change in attitudes towards learning mathematics education in a group of 75 first year undergraduate education students (Wicks, 2014). Analysis of student questionnaires identified a range of factors that may have supported this change. Focus group discussions were held to probe more deeply into the students' experiences and were analysed against Knowles' assumptions for adults learning (1984). A framework for supporting the teaching of mathematics education to adults was constructed and will be presented for discussion.

Initial Teacher Education, Teacher Professional Development, University

Bridging the gap? Reflections on helping students adjust to university mathematics - Pamela Docherty
I used to be good at maths at school. Our students arrive with top grades in mathematics, and are often faced with a crisis of confidence when they encounter a maths problem at university which they cannot see how to solve right away. This leads them to believe that they are no longer ‘good at maths’. During this presentation I will discuss our recent induction work in helping students to overcome these difficulties.

Post-16, University

G9 - Lesson study as a means of transforming school practice - Rosa Archer and Sylwia Glazewska
Rosa would like to share experiences of using 'lesson study' as a tool to broaden knowledge of mathematics teaching in a typical secondary school and its impact on a teacher's practice. Sylwia would like to share her experience as a head of department where she introduced teaching mixed ability classes and implementing strategies that bring a positive experience of mathematics lessons for students.

KS3, KS4, Teacher Professional Development, University

G10 - The pathway to understanding functions - Anne Watson
I will summarise the published findings of a research project about students' growing understanding of functions throughout secondary school. The project compared small samples of Israeli students and UK students and identified some effects of curriculum differences. This would be of value to secondary school teachers, and particularly those teaching at KS4 and 5, although the roots of the differences lie in KS3 as well.

Initial Teacher Education, KS4, Post-16, Teacher Professional Development

Research Presentation
**G11 - Mastery learning in mathematics: boon or boondoggle - Martyn Quigley**

Although a century or so old, mastery learning has made something of a comeback in recent years. In this discussion/workshop we shall examine the provenance and characteristics of mastery learning in mathematics and also in more general settings. By deconstructing solutions to a typical problem (that participants will be invited to solve beforehand) we shall try to establish critically the proper place of mastery learning in the teaching of mathematics.

*KS3, KS4, Post-16, Teacher Professional Development*  
*Discussion Group*

**G12 - How has the meaning of excellent teaching in Chinese classrooms evolved? A longitudinal analysis of six exemplary mathematics lessons in China in two decades - Dongchen Zhao**

In this study, we selected six exemplary mathematics lessons, all focusing on the same topic 'knowing and understanding fractions', videotaped in different years, 1993, 1997, 1999, 2000, 2005 and 2008, in China to investigate the characteristics of high quality teaching in Chinese classrooms. These lessons were analysed in five dimensions: learning objectives, lesson structure, content of teaching and learning, interactions between teacher and students, and use of textbooks. The results revealed both similarities and differences in these lessons. The findings suggest that the recent mathematics education reform in Chinese classrooms has been a successive and gradually changing process.

*KS2, Teacher Professional Development, University*  
*Research Presentation*

**What role do learning resources play in students' learning of mathematics? Findings from Shanghai schools - Yi Wang**

Over the recent years, mathematics education researchers, school teachers and policy makers have paid increasing attention to the importance of instructional sources in the teaching and learning of mathematics. In this session, we will present the findings from part of a larger research project aiming to investigate students’ use of mathematics learning resources in schools in Shanghai and England. The data reported are mainly collected from two secondary schools in Shanghai through questionnaires and interviews, and a conceptual framework, focusing on socio and cultural aspects and Vygotsky's activity theory, is established to analyse the results obtained in the study.

*KS3, Teacher Professional Development, University*  
*Research Presentation*

**G13 - GCSE Resit - Approaches to integrating more than one area of mathematics into learning tasks - Katharine Davies**

GCSE Resit is a difficult course to teach. With the addition of new topics, some teachers may be worried they will not be able to cover all the content in a year. This session will look at creating resources that cover more than one topic from the GCSE course.

*Post-16*  
*Workshop*
G • Session • Thursday 10:10-11:10

G14 - Ideas that transformed my teaching - Jo Morgan

In 2014, Jo joined the mathematics teaching community on Twitter. Within months it had transformed her teaching. Immersed in resources, debate and advice, Jo felt empowered to try new ideas in the classroom. Inspired by best practice, she started to refine her teaching routines and approaches. In this session Jo will share some of the most effective changes she’s made over recent years.

KS3, KS4, Post-16

Talk

G15 - Working with STEM Ambassadors to Link Mathematics to the Workplace - Sarah Myers and Leslie Whyte-Venables

Come to this interactive workshop to meet STEM Ambassadors from a range of industries to learn how they use mathematics in the workplace. Participate in activities and discussions to help contextualise your teaching back in the classroom and learn how to access the STEM Ambassador Hub network to request your own STEM Ambassador to support you locally in school.

Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16

Discussion Group, Workshop

G16 - The future of the UK Mathematics Trust - Steven O'Hagan

In 1996, the UKMT was formed “to advance the education of young people in mathematics”. Over 20 years on the Mathematical Challenges are taken by over 600,000 secondary school students in the UK each year and the Team Maths Challenges have become an annual fixture in many schools. Our National Mathematics Summer Schools have inspired hundreds of young mathematicians and our Olympiad training programme has helped to produce outstanding performances in international competitions. But how can the UK Mathematics Trust continue to advance the education of young people in mathematics in the years to come?

KS3, KS4, Post-16, Teacher Professional Development

Discussion Group

G17 - What do we know about girls choosing and doing mathematics? - Cathy Smith

This session will combine both a research report and discussion of strategies that may encourage girls, in particular, to continue with mathematics post-16. Case-study research of schools with high girls' participation in A-level mathematics identified classroom factors that contribute to these choices. Teachers in a follow-up pilot study prioritised developing problem-solving approaches for the new GCSE and found this supports girls in collaborative ‘have-a-go’ strategies. There is however a contrast between girls' reported classroom perseverance and their responses to unfamiliar survey tasks. The discussion will focus on participants' views of the effects of new GCSE teaching on attitudes and choice.

KS4, Post-16

Discussion Group, Research Presentation
G • Session • Thursday 10:10-11:10

G18 - The essentials of subject knowledge enhancement – How Maths Hubs are supporting teachers and teaching assistants - Ione Crossley, NCETM
Exploring messages from collaborative projects across Maths Hubs.  
Teacher Professional Development  Research Presentation, Talk, Workshop

G19 - Writing up your research presentation for the BCME9 peer-reviewed proceedings: A practical workshop – Jeremy Hodgen & the BCME Proceedings Editorial Team
All delegates who have submitted a Research presentation are invited to write a related research paper for peer review and possible inclusion in the BCME9 proceedings, that will be an occasional publication for the British Society for Research into Mathematics. This session will offer advice to less experienced authors in a collaborative and supportive workshop.  
EYFS, Initial Teacher Education, KS1, KS2, KS3, Teacher Professional Development  Workshop

G20 - Using technology to understand graphs – Simon May
An interactive session looking at using different technology to understand concepts to do with graphing  
KS4, Post-16  Workshop

G21 - Teaching A Level Mechanics for the first time - Howard Fay
The intention of this talk is to offer helpful suggestions to teachers new to mechanics, covering the things to emphasise and the pitfalls.  
Post-16  Talk

G22 - New 9-1 GCSE Statistics - Lucy Kilgariff
A look at the new GCSE Statistics course. Focus on changes to the syllabus, teaching strategies and discussion of which students it is suitable for.  
Initial Teacher Education, KS4, Teacher Professional Development  Discussion Group, Talk
G Session Thursday 10:10-11:10

G23 - Cambridge Mathematics Espressos - filtered mathematics education research - Lucy Rycroft-Smith

A discussion of the format and content of the CM Espressos - filtered research reviews organised by topic - within a discussion about the wider issues of bridging research and classroom practice. Feedback and dialogue welcome.

EYFS, Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16, Discussion Group
Teacher Professional Development

G24 - Using large whiteboards to promote a dialogic approach to teaching and learning post 16 - Clare Hill

My presentation will focus on using large wall mounted whiteboards to promote a dialogic approach to teaching A level mathematics. Using student interviews and recordings I will demonstrate the ways in which Robin Alexander's criteria for dialogic teaching are naturally reflected through the whiteboards' use. Within the workshop delegates will attempt an accessible problem using oversized post-its to replicate the process of working at the whiteboards and to test my claims.

KS3, KS4, Post-16, Workshop

G26 - Lifelong Mathematics Learning - a discussion - Jackie Ashton, Diane Dalby, Jeff Evans, Graham Griffiths, David Kaye, Beth Kelly and Jenny Stacey

The seminar will begin with this statement. 'The research domain itself is not clearly defined. The discourse on how numeracy is conceptualised and its relationship with mathematics and literacy is still a matter of debate. There is tension between what policy makers define as numeracy and what is subsequently implemented on the ground through the provision that is offered. . . . . Thinking about a good definition for the research domain and its boundaries is an important part of working in this area?' [Safford-Ramus, K. et al. (2016) The Troika of Adult Learners, Lifelong Learning and Mathematics Springer Open]

* This Adult Learning session is linked to A9, D9 & J9. Sessions can be attended separately or in conjunction

Post-16, Discussion Group
G27 - Starting to do your own research: guidance for teachers from teachers - Marie Joubert and Sofya Lyakhova

Many teachers recognise the value of doing their own research, which could, for example, be a funded initiative or something they decide to do as a school. However, they feel daunted when they think about starting. This workshop provides guidance and advice for teachers who fit the description above. It draws on the authentic voices of teachers who have done, or are currently doing, their own research: teachers who understand how hard it is to get started and keep going.

KS1, KS2, KS3, KS4, Post-16 Workshop

G29 - Linearity and the new AS/A Level Further Mathematics - Will Hornby

In this session we will look at the changes that linearity makes to teaching, learning and assessment in the new A Level Further Mathematics qualifications, focusing on the Pure Core content which is common to all qualifications. This workshop session will include hands-on activities for the classroom and discussion of assessment items from OCR’s Sample Assessment Material and Practice Papers. The discussions and material covered will be useful to teachers of any AS/A Level Further Mathematics qualification.

Post-16 Workshop

G30 - What would Galileo do? - Vinay Kathotia

If a picture is worth a thousand words, then an animation could be priceless. We will explore the use of short animations to illuminate mathematical principles and results. A particular example will be an approach that Galileo could have taken to analyse the behaviour of a coin as it rolls around another coin without slipping.

Initial Teacher Education, KS2, KS3, KS4, Post-16, Teacher Professional Development, University Workshop

G31 - Proof and Pudding - Richard Earl

What proof means to people, its role alongside doing mathematics, and just what should be proved, are themes leading to very different opinions. This talk is about what proof might be to different sectors of mathematical education and aims to suggest new opportunities. Audience participation is very much welcome on what might be possible with proof and its role. Commonly there is no pudding in the proof with proofs aimed at seemingly elementary or obvious things, the practice with axioms being pudding enough. To what extent might proof be about more surprising results and so be seen as more genuinely a part of mathematics?

Post-16, University Discussion Group, Talk
G32 - Modelling - James Lewis-Coll

a) How long is a railway line? From a child’s drawing of a railway track where the lines converge to a point, see how proportion and A-level mathematics can derive an expression to calculate the length of the line from a base sleeper to a point of convergence. The modelling process involves using proportion, partial fractions and summations of a series to derive an expression for the overall length of a child’s railway line. b) Link combinations of transformations to physical manipulations of shapes e.g. square, rectangle and equilateral triangle. Can be made to link to A-level work on matrices.

KS4, Post-16 Demonstration, Talk, Workshop

G33 - A Phenomenographic Approach to History of Mathematics - Amir Asghari

The often quoted recapitulation law that students follow the same intellectual path passed by our mathematician fathers is easier believed than shown. The impossibility and as some believe, even the unnecessity, of reproducing the historical conditions of developing an idea has been a mythological obstacle to directly investigate the recapitulation law and pedagogically put it into practice. We offer an alternative approach to bypass those obstacles, connecting the experiences of our students to the mathematicians of the past regardless of all the differences they have. We also discuss the possibility of using the live data for studying history of concepts.

University Research Presentation, Talk

G34 - Practical ideas to engage! - Greg Thomas and Paul Treversh

Practical approaches and ideas to stimulate, engage and enhance pupil learning that can easily be recreated in the classroom.

We will offer exciting teaching and learning ideas that will help raise achievement and support the development of understanding. We will be engaging participants using resources provided by Cosy Maths.

KS1, KS2, KS3 Workshop
H • Session • Thursday 14:00-15:30

H1 - ICT Strand 08: Geogebra for Experienced Users - Tom Button (MEI)

Improve your skills! This session will look at a number of tried-and-tested ideas for using GeoGebra in GCSE and A level. There will be an opportunity to learn how to use some of the more advanced 'views' Graphics 2, 3D Graphics, Spreadsheets (including for Statistics) and CAS. Finally, a look at how to save to the web and how to make resources available on a variety of devices. Delegates should bring a laptop, mouse and power lead.

KS4, Post-16, Teacher Professional Development

H2 - Different Problem - Same Answer - John Burke

A selection from approximately 60 resources will be presented whereby each pupil has a problem with different parameters to that of his/her neighbour (so no copying!). But each answer is the same (but they don’t know that), making it easy for the teacher to check. There is a wow factor (how can all the answers be the same?) and the more able pupils will want to find out why, which leads them to want to prove it voluntarily! Every solution is documented so it is easy for a teacher to pick it up and run with it.

KS3, KS4, Post-16

H3 - Assessing Mathematical Thinking: Talking to children - Ruth Trundley and Stefanie Burke

Assessing mathematics should involve assessing mathematical thinking, related to key mathematical ideas. Talking to children is the best way to do this, as it allows teachers to probe children’s understanding, reasoning and decision making. This workshop will explore how to construct key questions related to key mathematical ideas and provide the opportunity to observe and examine the assessment information resulting from key questions being used in KS1 and KS2.

KS1, KS2

*H4 - A Blended approach to developing teacher Subject Knowledge : An invaluable way to widen Mathematics teacher recruitment, but full of interesting challenges - Jennifer Shearman

Canterbury Christ Church University runs Subject Knowledge Enhancement (SKE courses) in Primary and Secondary mathematics, for teachers yet to start their ITE course and for qualified teachers of other subjects wishing to retrain in mathematics. We will outline the different ways we blend access to online SKE materials with live webinars, and discuss the benefits this has had for our participants, and challenges we have faced in ensuring we have a positive impact on the development of all who undertake the course.

Teacher Professional Development
The pedagogy of an asynchronous online course: tutor presence for supporting students’ e-learning - Cosette Crisan

As part of the MA Mathematics Education programme at UCL Institute of Education, we offer an online module Digital Technologies for Mathematical Learning that focuses on the teaching and learning supported by digital technologies. We will outline and reflect on the emergence of the online pedagogy of the tutors, ensuring that asynchronous online teaching and learning is effective in developing the participants’ RITPACK (Research Informed Technological Pedagogical Content Knowledge) as they start experimenting with the digital technology in their classroom and linking it with the research knowledge base of the module.

Teacher Professional Development, University  
Research Presentation

Learning to teach through webinars: what has to change, and what is the impact of that? - Jennie Golding and Nicola Bretscher

We discuss how, and why, we have designed changes to the ways in which we teach a synchronous online version of a short course that is also taught face to face in a ‘classroom’ setting, drawing on video clips of sessions on Differentiation and on Mechanics. Course participants are early career teachers looking to develop teaching for A Level Mathematics, so the course has a twin focus on developing subject knowledge in appropriate ways and developing pedagogy for teaching A Level. Those aims frame the evaluation and critique of our pedagogy.

Teacher Professional Development  
Research Presentation

*H5 - Promoting inclusion for children with autism through pattern activities - Helen Thouless

This session presents case study research that examines what a nursery child with autism spectrum disorder learned when included in a pattern project designed for children in mainstream nurseries. This presentation considers the growth the child made in pattern recognition, number knowledge, and communication skills during the course of his participation in this project. The discussion will investigate the different forms of inclusion, the role of inclusion in supporting children’s academic and social skills, and a consideration of which children benefit the most from inclusion.

EYFS  
Research Presentation
Elements of pattern - Sue Gifford and Helen Thouless

This session presents results from preliminary case study research into developing pattern awareness with children aged 3 to 5, following the research of Mulligan et al. (2009). Pattern in this context is considered as regularity between elements in an arrangement of items. Children’s diverse responses to pattern replication tasks reveal the complexity and challenge of pattern elements that are pertinent to young children. These provide insights into children’s thinking processes when making sense of patterns, in terms of visual, kinaesthetic and conceptual regularity. Implications are discussed in relation to the significance of pattern awareness for pre-algebraic thinking.

EYFS, Initial Teacher Education, KS1, Teacher Professional Development

Passionate about patterns - Sue Gifford and Helen Thouless

This workshop explores the development of pattern awareness in the early childhood context and is based on collaborative work with teachers of three to five year olds, following research by Papic et al. (2011) who found that teaching pattern awareness with pre-schoolers improved their number understanding. We will consider a trajectory for teaching pattern in the early years, teachers’ adaptations of this trajectory to their specific contexts and children’s responses to the patterning activities. We will invite participants to engage in some practical activities and discuss how the teaching of pattern might be developed in relation to pre-algebraic thinking.

EYFS, Initial Teacher Education, KS1, Teacher Professional Development

*H7 - Experiences of a pair of mathematicians teaching in a primary school - Richard Thomas

Two research mathematicians volunteer as teaching assistants, and develop a hunch about why only two children in each class like mathematics. We then start running a mathematics lesson for an hour a week, for all ages and abilities. We don’t teach anything; we just set conceptual problems. We’d like to explain our observations and experiences, why we set each child their own different problem, and why we think there’s a problem with fractions.

KS1, KS2
A Study into Links Between Performance and Mathematical Resilience in Year 1 Children - Katie Baker

The presentation will describe initial findings of a study of links between attitudes to mathematics and mathematics performance in Year 1 children over the 2017-2018 academic year. The research uses a scale developed by the researcher to measure Mathematical Resilience (MR) in 5 and 6 year olds. Piloting of the scale in 2016-2017 found that pupils who were Exceeding Expectations had significantly higher MR ($F(3,217)=4.86, p = .003, \omega = .25$) and belief in Growth ($F(3,217)=5.513, p = .001, \omega = .24$) than other groups and the current research explores these findings further.

EYFS, Initial Teacher Education, KS1, Research Presentation, Talk, Teacher Professional Development, University

Catch Up Numeracy: An Intervention for Children Struggling with Mathematics - Ann Dowker and Graham Sigley

The Catch Up Numeracy intervention, launched by the educational charity Catch-Up, is an individualised intervention for primary school children with mathematical difficulties. It is delivered by teaching assistants in two fifteen-minute individual sessions per week and addresses 10 key components of numeracy: (1) Counting verbally; (2) Counting objects; (3) Reading and writing numbers; (4) Hundreds, tens and units; (5) Estimation; (6) Word problems; (7) Translation; (8) Remembered facts; (9) Derived facts and (10) Ordinal numbers. Studies show that children receiving the intervention made Number Age gains of more than twice that expected on the basis of changes in chronological age.

KS1, KS2, University

*H8 - Teaching problem solving in the new A-level - Nikki Gupta

The new A-level has meant we have all had to revamp our ways of teaching to incorporate mathematical argument, modelling and problem solving. 'Problem solving' as a term is vague. It is best described as knowing what to do when a method is not obvious. Nikki, the cofounder of MarkIt has been researching the new specification, creating hundreds of exam-style questions tested in classrooms by thousands of students. We will discuss how students can develop a problem solving mindset, to feel stronger even given the lack of predictability of the new exam style.

Post-16, Teacher Professional Development

Common mistakes students make at A-level - Nikki Gupta

Mistakes create opportunities; for independent learning, for developing a 'give it a go' attitude and for us as educators to provide understanding through targeted feedback. We have built a website around these, designing scaffolded A-level questions for students that give immediate feedback only for mistakes. After three years, reviewing data from 10,000 users, we have collated the most common types of mistakes students make at A-level and aligned to the Overarching Themes in the new specification. Are they able to choose the right method? Are they able to correctly identify false arguments?

Post-16, Teacher Professional Development, Research Presentation
The Cambridge Maths Framework is intended to be a web-based digital map of school mathematics, based on evidence and research emphasising the connectedness of mathematics. It consists of different layers, users can navigate and analyse for a variety of purposes, including: supporting curriculum development, improving subject/pedagogical knowledge, aiding coherent lesson/scheme design. During this session some of the functionality of the framework will be demonstrated and we will discuss: the ethos behind the Framework’s development; whether it captures the aspects of mathematics that a curriculum should attend to; what additional functionality would be useful; and how attendees might envisage using the framework.

EYFS, Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16
Discussion Group
Teacher Professional Development, University

Using NRICH tasks to develop resilient problem solvers - Alison Kiddle and Charlie Gilderdale

With the new national curriculum, GCSE and A levels, and the demand from universities and employers for resourceful and independent problem solvers, developing our students' problem solving skills is more important than ever. In this workshop for secondary teachers, we will draw on NRICH’s 21 years of experience (nrich.maths.org), share some new resources, and consider teaching strategies that allow us to embed problem solving into a busy curriculum.

Initial Teacher Education, KS3, KS4, Teacher Professional Development
Workshop

Puzzling Problems for the Classroom - Tom Cowan, Barbara Allen, Charlotte Webb, Angela McConnell and Jeffrey Goodwin

The session will discuss mathematical problems that we have used in the classroom and we will consider how we can develop these tasks to promote not only skills and procedures but also reasoning and problem solving. There will be opportunity to work on mathematics tasks during the session, as well as time for sharing ideas and discussion about how similar tasks can be implemented in the classroom. This session is suitable for both primary and secondary practitioners. It is aimed at those who like to challenge their own way of thinking.

KS2, KS3, KS4, Teacher Professional Development
Workshop

Problem Solving in GCSE, Core Maths and A level - Mick Blaylock and David Burghes

Problem solving is central to GCSE, Core Maths and A level. This interactive session will consider teaching for problem solving. It starts with an opportunity to tackle some problems (hopefully unfamiliar) and to reflect on strategies and the experience. We will move on to consider relevant research from Poincare, Polya (heuristic strategies), and Schoenfeld (Tactical and Strategic approaches) covering teaching by, for and through problem solving. Questions from each exam will be considered against the assessment aims relating to problem solving. Similarities and differences will be explored along with implications for teaching, such as the importance of Problem Posing.

KS4, Post-16, Teacher Professional Development, University
Workshop
**H15 - GCSE resit - the good news - Peter Whitehead**

Contrary to the popular press narrative, most FE students welcome the chance to resit and get a C at GCSE resit. This evidence will challenge the conventional wisdom that most GCSE resit students are against the resit policy.

*Post-16 Research Presentation, Workshop*

**GCSE resit - the role of parents - Peter Whitehead**

This session will look at two interventions that have looked at the level of support that parents and learning supporters can give to students doing GCSE resit within FE.

*Post-16 Research Presentation, Workshop*

**GCSE resit - a contextualised approach using #MathArt - Peter Whitehead**

Engaging GCSE resit students using sacred geometry and art history. When GCSE resit students are presented with contextualised work that stretches both their maths and vocational skills, their engagements with all elements of their vocational programmes improves.

*Post-16 Discussion Group, Research Presentation*

**H16 - Including disabled learners in school mathematics - Lulu Healy, Irene Biza, Érika Silos de Castro and Elena Nardi**

This workshop will focus on the ongoing work in Brazil and the UK of the CAPTeaM project, dedicated to challenging ableist perspectives in mathematics education. Participants will explore activities aimed to motivate (1) investigations of the mathematical potential of different tools of the body such as using the hands or ears as tools for seeing, or visual rather than verbal tools for remembering (2) reflections on how to attune mathematics teaching to student diversity and (3) the questioning of classroom practices that disable certain groups of mathematics learners and, especially, the notion of the 'normal' mathematics classroom/student.

*KS1, KS2, KS3, KS4, Teacher Professional Development Workshop*

**H17 - Lyness sequences - Stan Dolan and Jonny Griffiths**

Each of the sequences \(2, 3, 2, 1, \ldots; 4, 1, \frac{1}{2}, \frac{3}{2}, \ldots; -2, -3, 1, -\frac{2}{3}, \ldots\) satisfy the rule that every number is 1 less than the product of the numbers on each side: \(a, ab - 1, b\). If you continue these sequences, what happens?

Through the use of simple spreadsheet activities, we will explore the delightful properties of sequences such as these. The mathematician and mathematics educator, Robert Lyness, proposed a famous conjecture concerning these sequences 70 years ago, a conjecture that has only recently been settled. Please bring a laptop running a spreadsheet program like Excel

*KS4, Post-16, Teacher Professional Development, University Talk, Workshop*
H18 - Teaching through variation: the key to mastery of mathematics - Debbie Morgan, NCETM

This session will draw on recent experience of teaching mathematics in China, research around this topic and its practical application by teachers in England. It will demonstrate in practical ways how the theory of variation develops deep learning in mathematics which leads to sustained outcomes and the ability to solve problems.

Teacher Professional Development  
Research Presentation, Talk, Workshop

H19 - Literacy for Life, developing the literacy skills that pupils need to be successful in mathematics - David Dowling & Catharine Driver, National Literacy Trust

Developing pupils' literacy skills can significantly improve the way that they engage with learning across the curriculum and this is particularly relevant in mathematics. There is perhaps something unique about the literacy skills that are required to support learning and understanding within mathematics. This session will give an overview of the importance of developing literacy in schools and will report back on a project that involved a group of secondary mathematics departments that aimed to incorporate subject specific literacy development in the mathematics classroom.

KS2, KS3, KS4  
Presentation, workshop

H20 - Making Sense of Integration Visually: Mapping Diagrams for Calculus - Martin Flashman

Understanding and evaluating integrals are important challenges of the calculus. Mapping diagrams, frequently coupled with tables, are a valuable alternative to graphs for visualising functions and integration. The session will start with the basics of mapping diagrams to visualise linear functions, the differential, and Euler's numerical method for solving differential equations. Participants will take a hands on mapping diagram tour using GeoGebra through visualisations of integration theory and practice, concluding with visualisations to make sense of the Fundamental Theorems of Calculus.

KS4, Post-16, Teacher Professional Development, University  
Demonstration, Talk, Workshop

*H21 - Stickability - getting students to remember - Hinal Bhudia

Do you ever find that your students just don't remember what you taught last month, last week or even yesterday?

In this session, Hinal will review research and provide practical tips and ideas on what she has tried and tested in her own classroom and in her department to make Mathematics 'stick' so students remember concepts.

KS3, KS4, KS5  
Talk
Whispering away maths anxiety - **Henri Plag**

This session introduces the adaptation of horse whispering strategies to help eliminate maths anxiety. Maths anxiety negatively affects progress, particularly in Y7 students. The approach will show how strategies relating to horse whispering, can be used to facilitate students’ personal learning awareness. It is based on Steve Chinn’s work on short term and working memory. Combining this with ‘Growth mindset’ strategies (Carole Dweck), helping students to reflect more accurately on their ability and attainment. The aim of the exercise was to improve metacognition and self-regulation, as defined by the Education Endowment Foundation, leading to accelerated progress.

**KS3**

Supporting low attaining students through secondary school mathematics - **Graham Walton**

As primary students following the ‘Mastery curriculum’ move to secondary, the range of prior attainments seems to be becoming more polarised. This session aims at addressing how secondary practioners can adopt a support model for those students who haven’t yet ‘mastered’ mathematics.

*Initial Teacher Education, KS3, KS4, Teacher Professional Development*

**H22 - Dynamic digital technologies for dynamic mathematics: implications for teachers' knowledge and practice - Alison Clark-Wilson and Celia Hoyles**

We report the findings of a 2.5 year project, funded by the Nuffield Foundation, which concluded that the process of integrating dynamic technology necessitates teachers developing their own fluency with the technology so they themselves relearn the mathematics with the technology. Along the way, new pedagogies emerge that support subsequent classroom work. The session will share key findings from the project. The follow-on workshop will provide an opportunity to work on dynamic digital activities from the project.

*Initial Teacher Education, KS3, KS4, Teacher Professional Development*

**Dynamic digital technologies for dynamic mathematics: Hands-on with the Cornerstone Maths activities - Kate Gladstone-Smith and Phil MacDivitt**

The Cornerstone Maths KS3 curriculum units embed dynamic digital technologies for ‘hard-to-teach’ topics at KS3. In this workshop, you will be introduced to ‘landmark activities’ from the curriculum units that are the focus for teachers’ professional learning and classroom work. Please bring a wifi enabled tablet/laptop to this session with the Google Chrome browser installed. The presenters will also share strategies for supporting school-based PD to scale and sustain the use of dynamic digital technologies in mathematics departments.

*KS3, Teacher Professional Development*
H23 - Building Mathematical Resilience - Clare Lee and Sue Johnston-Wilder

Learners with mathematical resilience have a positive attitude to mathematics that enables them to persevere with mathematics even when it gets difficult. Mathematical resilience is not something you have or don’t have - it can be grown. In this workshop we consider ways that work with learners of all ages to overcome any anxieties or avoidance that have become established and to learn mathematics with resilience. Students who learn how to successfully marshal cognitive resources and build approaches that limit mathematics-related anxiety responses can become mathematically competent individuals, who willingly engage in mathematics in their future career or life choices.

KS1, KS2, KS3, KS4, Post-16 Workshop

H24 - Gattegno (30th anniversary): The tens chart - Tom Francome and Luke Richards

Gattegno’s tens chart is a tool devised to assist children in learning the number system. This active session will involve participants using some of Gattegno’s principles of working with learners’ awarenesses in order to learn a lot from a little. We will explore how the tens chart might afford learners an opportunity to gain mastery of the number system building a firm foundation for future work.

Initial Teacher Education, KS1, KS2, KS3 Workshop

H25 - Lazy teaching with active learners - John Suffolk

We will look at how we can use our learners as teaching aids, giving them a lot of fun in the classroom and teachers much less to prepare before class; session participants - expect to be active! Activities come from many key stages: they include making areas to find formulas, experiencing being prime numbers, making plane figures to find angle sum formulas, drawing distance time graphs using learners walking without either rulers or watches, bowls for the blind to introduce polar coordinates, quadratic and cubic graphs and loci. Participants will be encouraged to try out their own ideas.

KS1, KS2, KS3 Discussion Group, Workshop

H26 - Sims for Maths - Sami Salah

The importance and benefits of using simulation applications in teaching mathematics.

KS1, KS2, KS3, KS4, Post-16, Teacher Professional Development Demonstration
H27 - What's the same? Areas of agreement in mathematics education research and practice - Helen Drury

Whether we're teachers, researchers, policy makers or campaigners, we all advocate some teaching approaches over others. As we debate and discuss, it's tempting to focus on the difference between various approaches - but what about the similarities? This session seeks to put the spotlight on the teaching practices and techniques - such as talk and multiple representations - which we agree are having impact in the classroom. Together we will share feedback, present evidence and identify commonalities. 'Mastery' may have become the umbrella term for grouping best practice in mathematics education - but today let's forget the name and simply discuss what works.

*EYFS, Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16, Teacher Professional Development, University*

H28 - The Pedagogy of NRICH - Liz Woodham or Frances Watson or Alison Borthwick

We believe rich mathematical teaching is more than just knowing what to teach. It is also about the art of teaching mathematics. There are many strands to effective mathematics teaching but at NRICH our pedagogical approach is grounded in encouraging children to be curious, collaborative, thoughtful and determined. We know that carefully constructed mathematical pedagogy can afford children the opportunity to develop understanding, reason, make sense, notice patterns and play around with different approaches that support their mathematical thinking. This workshop explores some of the primary tasks and solutions that show why NRICH is the home of rich mathematics.

*KS1, KS2, Teacher Professional Development*  
*Workshop*

H30 - The essence of mathematics - through elementary problems - Tony Gardiner

How can one help good A level students, or undergraduates, to appreciate the essence of mathematics without expecting them first to grapple with higher mathematics? This collection of 300 problems (with full solutions), produced by the presenter and Alexandre Borovik, offers a possible answer, providing enlightenment for bright 16 year olds, A level students aiming to apply to good universities, undergraduates, and experienced teachers.

*KS4, Post-16, University*  
*Workshop*
H • Session • Thursday 14:00-15:30

H31 - Archimedes' best ideas - Paul Stephenson

A carousel of a dozen experiments designed to be done by 15 pairs of able Y8/9s over a Saturday morning. You can find a 500-word summary on the conference site and detailed specifications for each station at www.magicmathworks.org/masterclasses.

KS3, KS4, Teacher Professional Development

H32 - Using Cuisenaire from early years to adult - Helen Williams, Simon Gregg and Mike Ollerton

An active workshop to explore some uses of Cuisenaire as a powerful resource. *This session is linked to I22. It is not necessary to attend I22 in order to sign-up for this session

EYFS, Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16, Teacher Professional Development

*H34 - Addressing low attainment in the middle years: A multiplicative reasoning intervention study - Hamsa Venkat

Low attainment in primary mathematics in South Africa is commonly described as related to unwieldy counting strategies underlain by a lack of fluency and number-sense related flexibility. In this context, we report on a four-lesson intervention involving Grades 4-6 cohorts in ten schools. We worked with middle years' teachers to develop sense-making of problem situations and the use of key multiplicative models (double number lines and t-tables) to support moves into more effective and efficient problem-solving. Results indicate small gains in performance across pre- and post-tests, accompanied by broad shifts to the use of more efficient working.

KS2, Teacher Professional Development

Addressing low attainment in the middle years: The design and implementation of a focused intervention - Mike Askew

Paper reports on the theory behind, design of, and implementation of a four-lesson intervention involving Grades 4 - 6 in ten South African primary schools focusing on multiplicative reasoning. Drawing on Vergnaud’s theory of conceptual fields together with the Dutch Realistic Mathematics Education research and Askew’s Big Books of Word Problems, the intervention was structured around teaching multiplicative reasoning through carefully designed example spaces of problems and key representations, particularly the t-table. As well as reporting on the intervention design we examine differences in teachers’ interpretation and implementation of the lessons as revealed through analysis of video tapes of selected lessons.

KS2, Teacher Professional Development

Research Presentation
I1 - ICT Strand 09: Autograph for KS5 - Douglas Butler

Improve your skills! This session will concentrate on using Autograph to help students understand many of the topics in Core Maths and A level through visualisations. These will include the study of vectors in 2D and 3D, and topics in calculus, parametric and polar plotting, and differential equations. The session will continue with ideas for using Autograph in problem-solving and handling large data. Finally, we will look at the study of complex numbers as dynamic objects in the Argand diagram, including de Moivre’s Theorem. Delegates should bring a laptop, mouse and power lead. Software will be provided.

Post-16, Teacher Professional Development Discussion Group, Workshop

I2 - Primary pre-service teachers: reasoning and generalisation - Julie Alderton, Gina Donaldson, Gwen Ineson, Tim Rowland, Charis Voutsina and Kirsty Wilson

Reasoning is one of the main aims of the National Curriculum, but our experiences within initial teacher education suggest that pre-service teachers would benefit from opportunities to explore mathematical reasoning that includes generalisation. In this session we will introduce two problems that we have worked on with primary student teachers in four English universities. We will invite the group to work on the problems, and explore possible alternative approaches. Then we will present and discuss indicative examples of our student teachers' approaches to the problems - inductive/recursive and functional - and how they reasoned to achieve a generalisation. We will conclude by sharing our thoughts about the importance of including problems of this kind in primary initial teacher education programmes.

Initial Teacher Education, KS1, KS2 Research Presentation, Workshop

I3 - The Answers Aren't Important - Ed Southall

Exploring the depths of discussion and understanding in classrooms when we focus primarily on processes rather than answers when teaching.

KS2, KS3, KS4 Talk, Workshop
I5 - Learning algebra in a digital age - Chris Sangwin

This talk will review contemporary digital tools for learning algebra online. Using carefully selected, and historically important, algebra problems this review will provide an opportunity to reflect on the purpose of algebra, what we need to learn for the 21st century and how contemporary digital tools support or hinder students' learning.

KS3, KS4, Post-16, Teacher Professional Development, University  

*I6 - What do prospective mathematics teachers notice in a lesson on patterns? Hatice Akkoç, Hande Gülbagci-Dede, Sibel Yesildere-Imre, Zuhal Yılmaz, and Betul Yazıcı

The aim of this study is to investigate what prospective mathematics teachers notice in a lesson on patterns. Twenty prospective teachers watched videos of two lessons on patterns taught by two different teachers using the same textbook. Using an observation form, participants identified three most important events, explained why they considered them as important and described strengths and weaknesses of the lessons. Content analysis of data indicated various categories of important events reported by participants such as assessing prior knowledge and effective questioning. These categories were also compared to expert opinion on important events.

Initial Teacher Education  

Development of Noticing Skills of Prospective Mathematics Teachers: A Focus on Students' Difficulties with the Function Concept - Hande Gülbagci-Dede and Hatice Akkoç

The aim of this study is to investigate the development of prospective mathematics teachers' (PMTs) noticing skills. Participants are fourteen upper secondary PMTs who were enrolled in a teacher preparation program. A course module was designed to develop pedagogical content knowledge and noticing skills concerning students' difficulties with the function concept. Participants watched videos of function lessons and used an observation form to describe three important events of the lessons before and after the module. Analysis of observation forms revealed that PMTs' noticing skills improved in making connections between classroom situations and pedagogical principles, and reasoning about classroom events.

Initial Teacher Education  

I7 - Revealing Mathematics - David Bedford and Ben Sparks

Ben and David will present some of their favourite bits of mathematics, which all have a nice reveal or aha! moment. Expect some classics and some new mysteries.

KS4, Post-16  

Talk
I • Session • Friday 9:00-10:00

*18 - Why do students construct a joint solution to non-routine unstructured problem that is no better than their original individual solutions? - Sheila Evans

When students collaborate after tackling a problem individually, the solutions vary in quality and strategy. Working together on a joint solution to the same problem can facilitate the productive resolution of differences but not invariably, as pairs do not always construct a better solution. Further, this joint solution may be derived mainly from one, or both students' initial attempts, or they may produce a distinctly different solution. This talk will explore the relationships, in terms of strategy and quality, between students' initial and joint solution to unstructured non-routine problems to answer the question of when collaborative construction yields positive results.

KS2, KS3

The Thinking Project - Creating Positive Thinking in Post 16 Mathematics - Helen Johnson

A study into the efficacy of a process called 'The Thinking Project', developed in the USA by Rachel Pickett and Linda Dellet. The Thinking Project is based on The Work of Byron Katie, based in Cognitive Behavioural Therapy and mindfulness. Hattie’s research demonstrates that meta-cognitive strategies score highly for teacher effect. Students learn to identify and question thoughts, and to see situations through multiple perspectives, to engage with their inner and outer worlds with more honesty and resilience. My research is a trial of this resource, in an effort to create positive thinking in Post 16 mathematics.

Post-16

I9 - The connectedness of mathematics - Vinay Kathotia

In his work, Elementary mathematics from an advanced standpoint, Felix Klein (1924) described 'different processes of growth' in mathematics, including 'Plan B' where the 'ideal is the comprehension of the sum total of mathematical science as a great connected whole'. Since then, numerous researchers (including Piaget, Skemp, and Hiebert) have used the metaphor of connections and connectedness to help represent mathematical knowledge and mathematical understanding. We will look at these and more recent attempts at clarifying and leveraging the connected nature of mathematics.

Initial Teacher Education, Teacher Professional Development, University

Research Presentation
*I10 - Transforming aspirations of mathematics teachers into strategies in context - Irene Biza with Victor Giraldo, Lina Kayali, Jack Keeler, Bruna Mustafa, Elena Nardi, Rebecca Potiphar, Angeliki Stylianidou, Athina Thoma and George Thoma

We present outputs from the MathTASK, a collaborative research and development programme in the UK, Brazil and Greece. In MathTASK we design situation-specific tasks (Tasks) and use them to explore, challenge and change in- and pre-service secondary mathematics teachers' pedagogical and mathematical discourses. We will outline two theoretical constructs that have emerged from data analysis: a Toulmin and Freeman informed classification of warrants; and, a set of four characteristics (specificity, consistency, reification of mathematics and mathematics education discourses).

Teacher Professional Development  
Research Presentation

Teachers' use of resources for mathematics teaching - the case of teaching trigonometry - Lina Kayali and Irene Biza

My study is on the use of technology, specifically mathematics-education software, by secondary mathematics teachers. It presents some of the data collected with the aim of investigating teachers' use of mathematics-education software: how are certain settings used, and what are the reasons behind such use? The findings will be discussed by drawing on the documentational approach and the teaching triad. While the documentational approach outlines the set of resources being integrated to achieve a specific goal, the teaching triad offers a lens to observe teachers' considerations when implementing an activity in a mathematics lesson.

Post-16  
Research Presentation

*I11 - Talk me through it: Promoting dialogue in mathematics teaching through peer-facilitated professional development - Elisa Calcagni

In this talk I will describe a professional development program for mathematics teachers implemented in three public primary schools in Chile, employing classroom video. The program aimed to promote whole-class dialogue by promoting ground rules for talk, and better-quality invitations and opportunities for students to engage in oral mathematics discourse. The design involved groups of 4, 5 and 9 participants, with peer-facilitated communities of learners to foster sustainability and scalability. Results will include an overview of the implementation process, and evidence of teacher change employing interviews and pre-post classroom videos as well as video-observation interviews.

Teacher Professional Development  
Talk
11 Session • Friday 9:00-10:00

Transition from Instrumental Genesis to Anthropological Moments of Didactics in the Teaching and Learning of Mathematics in Basic Schools - Clement Ali, Ernest Kofi Davis and Douglas Darko Agyei

We report on mixed methods research that explores teachers' approaches to developing discussion in mathematics classrooms. We have evidence of how teachers can successfully transition from instrumental teaching (that can be understood using the theory of instrumental genesis) to purposeful discourse in the classroom (that can be understood using anthropological models). As a result, we recommend approaches for teachers to develop efficient and effective classroom mathematics discourse.

Initial Teacher Education, Teacher Professional Development

112 - Problem Solving - Bridging the gap between theory and practice - Sukhjeet Singh

Looking at practical techniques for implementing problem solving in the classroom and within a scheme of work. Aimed at KS3, KS4 and A-Level.

KS3, KS4, Post-16

113 - Recruiting and training Mathematics teachers in challenging times - Julia Brown and Barbara Rodgers

In this session we will share our experiences of two DfE backed projects set up to help recruit qualified and trainee teachers of Mathematics and Physics. The first, Quantum Scholars, is one of two ‘test and learn’ projects to recruit overseas-trained teachers with QTS equivalence, to come and teach in England. The second is the development of a National SCITT to recruit and train teachers across the state and private sectors. Integral to both projects is high quality CPD focussing on subject specific pedagogy. Join us to learn more and find out how you can be involved.

Initial Teacher Education, Teacher Professional Development

114 - The challenges and delights of an Honours course on problem solving and enquiry in primary school mathematics - Susan McLarty

I will share some of the challenges of course design on a final year ITE option course for primary student teachers, and some delights of their engagement with it. One challenge is balancing elements of pedagogy, practical work and theory. Another is students’ own understandings and expectations in mathematics. Shifts in student confidence in ‘teaching’ problem solving over the course of 10 weeks are amongst the delights. Others will be shared through examples of student work. Time will be included for discussion.

Initial Teacher Education
Pre-service teachers' perceptions of compressed knowledge theory - Amanda Wilkinson

This discussion session will be prompted by research into pre-service teachers' perception of theory during their training. Discussions will begin broadly around theory before focusing specifically on the idea of compressed knowledge in mathematics.

Initial Teacher Education Discussion Group, Research Presentation

I15 - Talk for mathematics - Sarah Morgan

The importance of talking! Great questions to encourage reasoning and some great talk for teaching mathematics activities and games

KS2, KS3 Workshop

I16 - The new contender: Shanghai Maths in Key Stages 1 and 2 - Amanda Simpson

Teaching for mastery has, so far, been based largely on Singapore-based pedagogy and curriculum. Shanghai Maths has much in common with this, not least a focus on whole-class teaching and the importance of high quality textbooks and teacher-led learning. This session explores how mathematics education principles from Shanghai, incorporating conceptual and procedural variation, are relevant in UK classrooms. 'South-East Asian' no longer means Singaporean when it comes to approaches to mathematics teaching in primary schools; there is now an alternative.

KS1, KS2 Talk

I17 - Evaluating Qualification Reform - Alison Tonkin

Summer 2017 saw the first award of the reformed GCSE mathematics qualifications. In addition, the reformed AS and A levels in mathematics and further mathematics are being delivered for the first time from September 2017. As the qualifications regulator, we are committed to the oversight of the introduction of these qualifications and evaluating their impact. The session will not be about us talking at length about the reforms. We will provide some input and then raise a series of questions to stimulate conversation. Then it's over to attendees to give us invaluable feedback to inform our evaluation of the reforms.

KS4, Post-16, Teacher Professional Development Discussion Group

I18 - Rising to the reasoning & problem solving challenges of the new curriculum and GCSE - Rob Tait, NCETM

Implementing an improvement program to address the teaching & learning challenges of reasoning & problem solving in the new curriculum and GCSE. Reflecting on the impact of classroom approaches to strengthen reasoning & problem solving in all lessons.

Teacher Professional Development Research Presentation, Talk, Workshop
I19 - Teaching Calculus with Graphing Technology - CASIO CG20/50 - Akpan Okono

Hands on practical activities on how to use the Casio CG20/50 to teach calculus. The activities will focus on differentiation and integration including finding the area under a curve.

Post-16  Demonstration

I20 - Learning fractions through visual representations: a Ph.D. research with low-achieving secondary students - Leonardo Barichello

Three low sets of secondary students were taught addition and subtraction of fractions through visual representations, more specifically, with the rectangular area model. After observation of several lessons for these groups, twelve lesson plans were designed in accordance with the current practices in the school. Data was collected during these lessons in the form of worksheets, field notes and through audio-recorded talks between researcher and students. In this session, I will present an overview of the lesson plans, discuss how students were able to reason mathematically based on the visual representations and some strengths and weaknesses of the approach.

KS3  Research Presentation

I21 - Discrete mathematics with cows - Kitty Meeks

One of my current research projects is about understanding how a disease can spread through a network, specifically when livestock are moved from one farm to another, and I have found that talking about this application makes it much easier to explain concepts in discrete mathematics to non-mathematicians. Inspired by this experience, I have devised a range of interactive games and activities, for all age groups, that introduce some key ideas in discrete mathematics through farm-based examples. In this session I will demonstrate several of these activities.

KS1, KS2, KS3, KS4, Post-16, University  Demonstration

I22 - Using Cuisenaire from early years to adult - Helen Williams, Simon Gregg and Mike Ollerton

An active workshop to explore some uses of Cuisenaire as a powerful resource. *This session is linked to H32. It is not necessary to attend H32 in order to sign-up for this session

EYFS, Initial Teacher Education, KS1, KS2, KS3, KS4, Post-16  Workshop

Teacher Professional Development
I23 - Students' Mathematical Digital Competencies - Eirini Geraniou and Uffe Thomas Jankvist

New digital trends have found a place in the mathematics classroom and there is a potentially 'hidden' demand for students to acquire both digital and mathematical competencies. Current frameworks often talk about one or the other. In this session we propose a combined framework for mathematical digital competencies, and showcase applications through a few case studies of students interacting with digital technologies for mathematical learning. We will pose a number of questions for discussing the potential value of such a framework for the mathematics education community, i.e. researchers, mathematics educators and practitioners.

KS3, KS4

Discussion Group

I24 - Thinking Beyond Numbers - Perpetua Ratcliffe

This session is aimed at developing a deeper understanding of mathematics in our everyday lives. You will access/have exposure to Secondary Teaching-and-Learning Strategies that will assist teachers in developing students' views beyond numbers. The focus is on number patterns, philosophy and natural sciences. This session will encourage educators of mathematics to view mathematics as a holistic subject. A brief history of mathematics, mathematicians and philosophers will be used in demonstrating how mathematics shape our natural world. Some of the ideas from this session are aimed at answering some of fundamental questions students always ask, Why do we need to know this?

KS3, KS4, Post-16

Talk

I26 - Collaborating between primary, secondary and higher education: The case of a project on fractions - Clare Hill and Christian Bokhove

Our presentation will focus on the collaboration of three primary schools, Twynham School and the University of Southampton to jointly develop multiplicative reasoning skills and deeper understanding of fractions with primary colleagues through the process of lesson study. By combining expertise on teaching fractions from primary, secondary and higher education, we gained insight in the way fractions were taught at primary, but also how such a collaboration could influence teacher practice within the primary school classroom in terms of both pedagogy and subject knowledge. We will report on both the substantive (fractions) and social (collaboration) findings.

KS2, KS3

Research Presentation, Talk
I27 - Mathematics teachers' decisions - Andres Pinzon and Pedro Gomez

Decision-making is a central activity of the teaching process. The teacher makes decisions while planning, implementing and evaluating curriculum. In each of these phases, s/he uses different resources. We present a conceptualization of mathematics teachers' decisions. The model focuses on the implementation phase, and organises and integrates some of the notions proposed in the literature, such as situation, purpose, resources, options, and sequence of actions of the selected option. We consider possible methodological and practical implications of the model.

Teacher Professional Development  Research Presentation

I29 - Recalling Multiplication Facts and Developing Mathematical Thinking - Charlotte Wilkinson

Recall of multiplication facts is not a measure of mathematical success. Recall of facts is essential for number sense, making estimates and checking you or your technology has reached a reasonable solution. This workshop looks at creating a balance between learning to recall facts and developing multiplicative thinking. To develop proportional thinking students must have developed an understanding of multiplicative comparisons. To develop algebraic thinking students must have generalised the properties of multiplication. There is far more to primary multiplication than learning 'tables'.

Initial Teacher Education, KS1, KS2, Teacher Professional Development  Workshop

I30 - Helping children master fractions in Primary mathematics - practical strategies for identifying key misconceptions and for challenging these - Marc North

In this session participants will investigate key misconceptions and misunderstandings that Primary school children encounter when working with fractions. We will also look at practical materials and resources for challenging these and for developing deeper conceptual understanding of fractional quantities and representations.

KS1, KS2  Workshop
I31 - Worksheet-Making Extravaganza - Naveen Rizvi

What do we want from a worksheet? Challenge? Smooth difficulty progression? Scaffolded problems? Classic mistake problems to analyse? Super Scary problems? Is it rocket science? Will it take me forever? Answer: No. This workshop will specifically work on supporting teachers to make their own high quality worksheets on a selection of number and algebra topics. What do I mean by high quality? High quality in the sense that you can successfully get pupils attempting a large range of difficult possible problem types all testing a pupil’s knowledge of the concept that has been taught. Teachers will be able to leave the session knowing different strategies to reinvent basic problem types to make the testing experience for pupils deliberate, challenging and successful. More importantly, the strategies require minimal effort but are high impact in terms of pupil learning. For further information, see the following blog post: http://conceptionofthegood.co.uk/?p=122

KS2, KS3, KS4, Post-16, Teacher Professional Development

I32 - Mathematics in Further Education Colleges: the effects of policy and practice on students’ mathematics trajectories - Diane Dalby and Andy Noyes

In this session we will present early findings from the Nuffield-funded project Mathematics in Further Education Colleges (MiFEC), which addresses the critically important issue of how to improve the quality of post-16 mathematics education in colleges. The project takes a multi-scale view of this complex system, employing a mixed-methods research design to investigate the interlinking factors that shape the mathematics learning experiences and trajectories of young people on vocational and technical pathways. Trends in student progression from recent datasets are examined in relation to policy enactment and institutional practices, with a particular emphasis on students with low attainment at GCSE.

Post-16 Research Presentation

I33 - Environments for teachers' own development - Anna Kristjansdottir

From teacher-courses to changes in classrooms one may find 'stumbling stones'. Not visible, however serious, reacting to unexpected actions in class and changing collaboration with your own students. Sharing with other teachers in a dedicated environment is valuable. Four examples are presented, from Iceland and Norway: including work with children in teacher-courses; a web-based course on problem solving joined by one class with each teacher; simple videoconferencing equipment linked three classes -joint sessions were led by some of the teachers; collaborating colleges and communities, involving all mathematics teachers for building up schools own 'bank of knowledge' in their websites.

Teacher Professional Development Talk
I • Session • Friday 9:00-10:00

*I34 - Talk in mathematics: exploring students’ mathematical language use in lessons - Jenni Ingram, Nick Andrews and Andrea Pitt

Talk in Mathematics is a collaborative project with two mathematics departments investigating ways of enabling students to develop their mathematical talk during lessons. We will focus in this interactive session on three aspects of classroom interaction that received particular attention during the project: mathematical explanations; silence and wait time; and mathematical language. We will discuss the opportunities and challenges that arose from teachers working on each aspect in different contexts and explore with you the wider implications these have for teaching and learning of mathematics.

KS3, KS4, Post-16, Teacher Professional Development.                  Research Presentation, Workshop

What Are You Waiting For? - Michelle Falcinelli

Typically, mathematics teachers wait just a few seconds before selecting a student to call on to answer a question. What happens when we wait ten or twenty seconds or more to solicit an answer? This session addresses the need to lengthen the time we give to students to think about and process responses to questions asked. Just like dishes that taste better the longer they cook, student responses to questions and problems are better when we insist on longer processing time. Come see how to build waiting time into your lessons to elicit better than ever results from students.

KS1, KS2, KS3                  Discussion Group, Workshop
J1 -ICT Strand 10: Tablets in the Classroom - Douglas Butler (Bring and share session)

Improve your skills and share! Join this session to learn and share ideas about using tablets in the classroom. We will first look at the user interfaces of the two main players (IOS and Android), then look at the best of the apps that are currently available for mathematics: calculating, courses, graphing (including Desmos and the web version of Geogebra), statistics and general mathematics tools. Tools that allow collaboration and sharing will be discussed. Bring your own discoveries along and share. Delegates should bring any device with a sensibly sized screen.

KS3, KS4, Post-16, Teacher Professional Development Discussion Group, Workshop

J2 - Further Pure with Technology - Tom Button

Further Pure with Technology is an A level Further Mathematics option in which mathematical software is used in the teaching, learning and assessment. It includes graphing, solving differential equations and programming. This session will describe the innovative approach to using technology in the learning and assessment of mathematics in FPT as well as looking at some classroom materials. Delegates are requested to bring a laptop with a graphing package and Computer Algebra System (CAS), such as GeoGebra, to the session.

Post-16 Workshop

*J3 - Lesson study, professional development courses, and the development of mathematical and pedagogical understanding - Sian Morgan and David Swanson

This session focuses on lesson study (LS) and the connections between the development of the mathematical understanding of students and the pedagogical understanding of teachers, within varied aspects of the LS process, from a Vygotskian perspective. In particular, we discuss longer term professional development (PD) programs which include a central role for LS. When teachers come together in PD days, new problems of communicating and reasoning arise which can go beyond the discussions of individual LS groups. We conclude by arguing that the problem solving versus transmission debate is as important for PD as it is for the mathematics classroom.

Initial Teacher Education, KS2, KS3, KS4, Post-16 Research Presentation Teacher Professional Development
Lesson Study in Initial Teacher Education: can the experience mediate student-teachers' pedagogic beliefs and practices? - Rosa Archer

We explore the parallels between learning teaching and learning mathematics by considering how LS can be used to support professional development in Initial Teacher Education. We hypothesise that the collaborative nature of LS allows student teachers to reflect on their pedagogical intentions. We argue that student teachers begin to appreciate dialogic teaching and learning by experiencing it in their own learning through constructing their pedagogical intentions in lesson study. We are interested in exploring how the development of such values is reflected in their own beliefs and practice in the classroom, and if such values are sustained through teaching practice.

Initial Teacher Education, Discussion Group, Research Presentation
Teacher Professional Development

J4 - Conwayana - Jim Simons

John Horton Conway was recently elected to Honorary Membership of the Mathematical Association, so here is a celebration of his mathematics: not the hard stuff, but recreational mathematics, mixed with biography. I shall discuss games like phutball, the game of life, ways of calculating the odds in coin-tossing games, how the number 71 relates to the 'look and say' sequence and the Doomsday algorithm for finding the day of the week of any date in any year. Very little of the content requires mathematics beyond GCSE.

Post-16 Talk

J5 - Does a 'Building Houses with Side Views' tool improve Mental Rotation Skills in year 7 pupils? - Christian Bokhove and Edward Redhead

Prior research indicates that spatial skills, such as Mental Rotation Skills (MRS), are a strong predictor for mathematics achievement, and that they can be trained. This paper reports an experiment in June 2017 with almost 80 year seven pupils from an independent school in the south of England. Participants were randomly assigned to two conditions. Both groups were given standardised pre- and post-tests for MRS. The intervention group trained on a tablet with a MRS tool called 'Building Houses with Side Views'. The paper formulates conclusions on the training of MRS. The findings are discussed.

KS3, KS4 Research Presentation

J6 - How can you support your students prepare for university entrance exams? - Claire Metcalfe

In this session we will discuss what STEP is, why universities ask for it, the new specifications for 2018 and how to help students prepare. We will explore the various resources available, including the (free) STEP Support Programme developed by Cambridge University and NRICH. We will consider how these resources can help build confidence in advanced problem solving skills and encourage students to study mathematics at a higher level. This session will be led by the Senior Educational Resource Developer for the STEP support programme and there will be the opportunity to ask questions about any aspect of STEP.

Post-16 Workshop
J7 - STIMULUS - enrichment and opening doors - Jacqui Watkins

Teacher recruitment is a growing concern for many schools, especially in mathematics. In this talk, Jacqui Watkins shares her insights from leading the STIMULUS programme that places STEM subject students - both graduate and undergraduate - in volunteer placements within schools in Cambridge. In 2016, over 25% of the 'final year' students participating in the project enrolled on teacher training programmes. Jacqui will share how this highly effective local project is organised, and discuss the benefits of participation for both the student volunteers and their placement schools.

Initial Teacher Education, University

J8 - Redressing the Balance: assessing primary mathematics through observation and journalling - Gawain Little, Clare Whyles, Jo Horn and Steph Gillroy-Lowe

Presentation and discussion of a piece of action research by four teachers into the use of observation and journalling as an alternative to testing for assessing mathematics at primary school.

KS1, KS2


Experience and research in mathematics education leads us to understand that motivating people to learn mathematics can be difficult. So why would adults who do not need to learn mathematics for their jobs choose to learn the topic in the workplace? This research focuses on learners who are overcoming many barriers to study in classes organised and funded by their trade union. The adults are aiming to gain a formal qualification, using less formal learning approaches, in a non-traditional context and this research offers teachers in more conventional education settings an opportunity to learn about successful alternative practice.

* This Adult Learning session is linked to A9,D9 G26. Sessions can be attended separately or in conjunction

Family mathematics - supporting adults' and children's learning - Jackie Ashton

A study was carried out in 2011 (ALM 18) that looked at what motivates participants to join family mathematics courses. This small scale study on a group of adults attending a family mathematics course will update and provide comparisons with those previous findings. I will be using learner journals to identify what type of support participants on the family mathematics course give to their children at home and what they feel is most effective in terms of their child's increased confidence, improved attitude and engagement and improved understanding of mathematics.

* This Adult Learning session is linked to A9,D9 G26. Sessions can be attended separately or in conjunction
**J10 - Which is bigger out of the giants? - Zoltan Retkes**

Which is bigger $9^{10}$ or $10^9$, $99^{100}$ or $100^{99}$? Work out which is greater: $999^{1000}$ or $1000^{999}$.

I met this question in Cambridge and I knew the answer. In spite of this fact, I revisited my approach and invented several non-analytical proofs. It turned out that this simple problem interconnects several main branches of mathematics: enumeration of digits, geometry of the hypercube, code theory, binary matrixes and graph transformations. I will give an insight into this research demonstrating that no problem can be too simple to be underestimated.

*Initial Teacher Education, Post-16, Teacher Professional Development, University*

**J11 - Assessing Student Teachers' Reasoning with Fractions - Pablo Mayorga**

This talk will present the pilot study carried out to adapt the psychometric survey developed by the project Diagnosing Teachers' Multiplicative Reasoning (DTMR) to the English context. I will briefly discuss the background to the DTMR project in the USA and how this has informed the current project at the University of Roehampton. Participants will have the opportunity to look in detail at some example questions from the adapted survey. I will present some of the preliminary findings from a sample of student teachers that took the adapted survey.

*Initial Teacher Education, KS1, KS2*

**J12 - Engaging Students using Audio Feedback - Florian Bouyer**

In this session, I will talk about my experience of helping pure mathematics university students to engage with the feedback they receive from problem sheets. In addition to their written feedback, I trialled audio feedback, which was well received by students.

*University*
Measuring learning from two-stage collaborative exams in mathematics - George Kinnear

In a two-stage exam, students complete the exam individually before working in small groups to answer the exam questions again. This format exploits students' desire to know the correct answers immediately after they have sat the exam, and provides some immediate feedback. But do they help students to learn? We will survey relevant literature and report on a study where students completed an individual 'third stage' a few days later so that the possible effect of the group stage on their learning could be evaluated.

J13 - Teaching Linear Programming using Lego: Making a Real Difference with Operational Research - Sophie Parker

Explore how The OR Society's 'O.R. in Schools' educational outreach program broadens young people's horizons by demonstrating exciting, real world applications and possible careers using some of the mathematics they're learning in the classroom. This session will explore one of the initiative's most popular activities (Linear Programming with Lego) and will demonstrate how to incorporate them into mathematics lessons across different ages and ability levels.

J14 - The Importance of the 'Who' and 'What' of Deciphering Word Problems in KS1 and KS2 - Jean Knapp

This practical session looks at the importance of 'Who' and 'What' as clues to deciphering mathematical word problems (typical of Mastery approaches with Bar Models). Word Problems cover a large percentage of our taught and tested Curriculum. Perhaps the importance of 'who' and 'what' is in the mathematical language implied. This session looks at practical approaches to exploring mathematical vocabulary with children to support uncovering the story and the mathematics behind a word problem.

J15 - 50 Mathematical Things To Do Outside Before You Are 6 - Juliet Robertson

Young children learn best through play. There is also considerable evidence that suggests that learning outside through real experiences is highly effective. In this practical workshop, we explore the development of mathematical understanding through fun, play-based challenges and a child-centred approach. Whether a child needs to run around or has a passionate interest in dinosaurs, we explore how to integrate mathematical learning into their interests. All or part of this workshop may take place outside.
J • Session • Friday 10:10-11:10

**J16 - Fluency, problem solving and reasoning for the 2014 curriculum: how are they being embedded, and what difference does that make to students? - Jennie Golding, Grace Grima, and the Pearson Research and Efficacy team**

We discuss initial findings from our two-year study of KS 1-4 classes, focusing on processes of teacher development in relation to curriculum and assessment change; effective, replicable means, including provision of resources, to support teachers in making deep change aligned with valued curriculum goals, and impediments to that; the ways in which curriculum enactment, assessment, and use of resources impact on young people’s inclination, ability and enjoyment to function mathematically and on their mathematical and wider progression 5-16 and beyond.

*Research Presentation*

**J17 - Supporting new and non-specialist mathematics teachers - Jemma Sherwood**

Many of us have both new and non-specialist teachers in our departments and know how hard it is to develop pedagogy and subject knowledge on a busy timetable. This session will explore how we can support our less-experienced colleagues to develop into skilled practitioners.

*KS3, KS4, Post-16, Teacher Professional Development Talk*

**J18 - Leading Maths PD – What are the skills and knowledge required? - John Westwell, NCETM**

Session looking at the revised NCETM PD Lead programme

*Teacher Professional Development Research Presentation, Talk, Workshop*

**J19 - Bar Modeling and Autism - Sufficient or Necessary in Problem Solving? - Shaun Thompson**

My EdD research uses qualitative comparative analysis (QCA), as an evolving research design, to investigate whether the bar model method is necessary or sufficient for the development of problem solving skills for pupils with autism. As the primary school curriculum evolves, and the government draws on international best practice, the bar modelling approach is becoming a more prominent tool in the teaching of mathematics. Coupled with the rise in numbers of students with autism in mainstream primary schools, the question is: Is this approach sufficient, or indeed necessary, to support autistic pupils to solve mathematical word problems?

*KS2 Research Presentation*

**Maths Anxiety in Primary Classrooms - Heidi Kirkland**

This session will focus on my research for my PhD in Education at the University of Leicester. Current research into Maths Anxiety will be identified and the impact this has on primary school children. My pilot will be discussed and my research so far. Discussion will then form of how it is best to intervene in the primary classrooms and share best practice.

*KS1, KS2 Discussion Group, Talk*
J20 - Lessons to learn from how students performed in the 2017 GCSE (9-1) Mathematics assessment - Neil Ogden

In this session we will look at student responses from the 2017 GCSE (9-1) Mathematics assessment. Common mistakes and misconceptions within working will be identified and methods to address them in lessons discussed. We will make a particular focus on new content questions at both tiers, along with mathematical reasoning and problem solving questions (those assessing AO2 and AO3). This will be done through looking at responses to the OCR question papers, though the material covered and discussions would be useful to teachers of any GCSE (9-1) Mathematics qualification.

J21 - Core Maths: the story thus far and planning for 2018 implementation - Mick Blaylock, Paul Glaister and others

Core Maths: Who is it for? How to get started? What are the differences between the qualifications? What about UCAS points and university recognition? These questions and more will be considered in evaluating where we are up to in implementing Core Maths with specific consideration of the recommendations of the Adrian Smith report. It will include lessons learnt from the early adopters of Core Maths and the first two years of examination results. An interactive workshop with experienced teachers, this will be helpful for those already teaching Core Maths as well as for those introducing Core Maths from September 2018.

J22 - MathSOL: Teaching Mathematics to Speakers of Other Languages - Paul Landers

How teaching ESOL students mathematics at FE level (Functional Skills in particular) needs special consideration from teachers. A demonstration of how mathematics feels to an ESOL student and how we as professionals must try to differentiate especially in relation to materials in order to maintain student interest and ensure we are meeting the specific needs of ESOL students in a mathematics setting.

J23 - Mentoring teacher trainees of mathematics for ESL learners in post-compulsory education: reflections and challenges - Kevin Norley

Through adopting an auto-ethnographic methodology, this research paper reflects on the experiences and challenges brought about by subject-specific mentoring within a distinctive learning environment, namely mathematics for English as a second language (ESL) classes for 16 to 18-year-olds, within a college of further education in England, with the purpose of increasing the store of knowledge on mentoring mentees who are specialists in mathematics. Amongst its conclusions, the author argues that through a mentor demonstrating specific numeracy methods and techniques to mentees, and making them aware of language issues, mentees are more able to develop their learners' numeracy and language skills.
J24 - A beginner’s guide to Grid Algebra and GeoGebra - Alison Parish

Getting started with a piece of software can be daunting for those who are not confident users of digital technologies. This session looks at two pieces of software I have used with children from KS1 upwards; ATM’s Grid Algebra was used to encourage KS1 children to look for patterns in the multiplication table, moving on to algebra in KS3 and KS4. GeoGebra encouraged young children to talk about geometry using mathematical vocabulary while allowing older pupils to explore more complex mathematics. This session looks at how you can begin to use these two programs with confidence with pupils.

Initial Teacher Education, KS1, KS2, KS3, Teacher Professional Development

J25 - Curriculum backwards and forwards: shifting the focus from endpoints to journeys in mathematics curriculum development - Ellen Jameson

Every curriculum makes different trade-offs in depth, breadth, sequencing, and flexibility according to different sets of constraints. A curriculum may also be enacted differently by schools and teachers in various local contexts. At each level, it can be hard to know after the fact which decisions have been made and why - both for an outside observer and for those who are part of the process. This discussion will involve the goals and design of a set of tools for exploration, comparison, and research reference in the design of curricula, resources, and activities as part of the Cambridge Mathematics Framework.

KS1, KS2, KS3, KS4, Post-16, Teacher Professional Development

Discussion Group, Talk

J26 - Multiple representations in teaching and learning mathematics: challenges and opportunities - Marie Joubert

This workshop begins by exploring in detail a classroom activity in which students match different representations of functions (equation, table of values, rule in words, graph and name). Two further activities are introduced. Participants then discuss how and why these might be activities worth trying in their classrooms, focusing on questions such as ‘What are they learning?’ and ‘How are they learning?’. Finally they discuss challenges associated with running such activities in their classrooms: challenges ranging from practical issues such as producing sets of small cards to match to pedagogical questions such as ensuring student engagement in a wrap-up discussion.

KS4, Post-16

Workshop

*J27 - Using ESOL skills to improve mathematics teaching - Peter Whitehead

The language requirements within Levels 1/2 functional skills and mathematics GCSE are so demanding for low-level learners that the language skills delivered by ESOL teachers are key to the progression of these learners.

Post-16

Research Presentation
Functional skills - deconstructing the context and problem-solving - Peter Whitehead

16-18 students cannot recognise the context of many functional skills questions. This workshop explores a range of techniques for deconstructing exam questions and associated problem-solving techniques.

Post-16 Workshop

J28 - Mathemathinking - Mary Fiore

Thinking is integral to the teaching and learning of mathematics. When we use the word think - what do we intend for our students to do? When students hear the word think - how do they interpret it? Without having made sense of the notion of thinking, the assessment of students' mathematical thinking becomes a daunting task. It is only when students make their mathematical thinking visible that teachers can assess their students' understanding, provide feedback, and consequently improve student learning. Participants will explore learning experiences that allow for students to make sense of mathematics concepts and foster mathematical thinking.

KS1, KS2, KS3, KS4, Teacher Professional Development Workshop

J29 - It's a Kind of Magic - David Crawford

In this session I will present some mathematical magic tricks (both numerical and card tricks) that could be used in the classroom to both generate interest and to provide a context for algebraic proof. Bring a pen and paper and be prepared to join in.

KS3, KS4 Talk

J30 - Inspirational off-the-shelf Masterclasses: just add enthusiasm! - Samantha Durbin and Alison Eves

If you are looking to inspire and excite pupils, opening their eyes to the wonder, beauty, endless possibilities and uses of mathematics, look no further! The Royal Institution eagerly invites you to sample activities from our stimulating extra-curricular ready-to-go Primary Masterclasses, designed to be run in a series of six workshops with pupils from local primary schools. Take the samples home for your own pupils or get involved further - we offer the enthusiastic-but-busy teacher ongoing support, ideas and full workshop resources to run your own Ri Masterclass series and help make your school a centre of mathematical excellence and excitement.

KS2, KS3 Demonstration, Workshop
J31 - Developing Confidence in Problem Solving - Cheryl Hall

During this talk I will consider how regular, meaningful exposure to problem solving activities in the classroom and beyond can have a positive impact on logical reasoning skills and consequently improve pupil attainment at GCSE. I will discuss the factors that have an impact when a pupil is beginning to apply his/her knowledge in a problem solving context: How are they able to make sense of the information and provide a mathematical framework? What are we able to do as practitioners to encourage this movement and what strategies can we adopt to embed these skills to encourage lifelong learning?

Teacher Professional Development

J32 - Investigating Mathematical Attainment and Progress - Jeremy Hodgen and Colin Foster

Evidence continues to highlight the problem of low attainment in secondary mathematics. Over the last two years, the Investigating Mathematical Attainment and Progress: The Low Attainment in Year 9 Project has been exploring what low-attaining secondary students know about number, multiplicative reasoning and algebra. In this session we will relate our findings to the literature and explore possible classroom strategies and interventions to address low attainment in mathematics. This project is a collaboration between the UCL Institute of Education, the University of Nottingham, Durham University and King’s College, London.

KS3

Research Presentation

J34 - How do online professional learning courses compare with face-to-face? Reflection from a national provider - Sharon Tripconey and Sue de Pomerai

Professional learning courses that develop teachers’ mathematics subject knowledge and pedagogy can take different forms. An online course, albeit synchronous or asynchronous, can provide teachers with access to support for their professional learning but how does this mode of learning compare with face-to-face provision? MEI is highly experienced in developing professional learning courses and annually provides over 5000 teacher days of training through the FMSP, both online and face-to-face. We have a policy of monitoring and evaluating practice on an on-going basis. In this session the advantages and limitations of online learning and face-to-face learning will be discussed.

Post-16, Teacher Professional Development

Discussion Group, Research Presentation