

BSRLM Autumn 2020 abstracts

Plenary talk

Mathematics Education in Scotland

Pamela DiNardo (Education Scotland) will share the aspirations of Curriculum for Excellence and The National Improvement Framework and explore what they mean in practice for mathematics education in Scotland. She will provide insights into Scotland's collective and connected approach to system improvement. Sue Pope (SQA) will share the pathways for accreditation in Scotland. We will also mention the OECD review of Scotland's Curriculum for Excellence and Scotland's qualifications. We welcome questions from participants about the distinctive approach to (mathematics) education in Scotland.

Research papers and workshops

Agostino, Luca*

Laboratoire LaMME - Université d'Evry

Pedagogical walls: an effective pedagogical activity to foster the oral competence in Math classes. Mathematical speech is, still, a not wide-spread skill in classes, in fact mathematics is often seen as a "written" topic. Nevertheless teachers focusing on this competence observe important improvements in students comprehension and efficiency during written assessments. In this context, the question "How to effectively work the oral practice in Mathematics?" is imposed. During this session we will present a pedagogical activity named "Pedagogical Walls" which allows to foster oral skills in mathematics classes. Participants will live this activity and a didactical analysis will be collaboratively realized. Finally, first results of observations in french classes will be shown and commented. (*Workshop*)

Awortwe, Peter Kwamina* & Wake, Geoffrey*

University of Nottingham

Understanding the content, pedagogical and technological knowledge of Beginning Teachers using technology in relation to geometric constructions using dynamic software

This study aims to understand beginning teachers' knowledge of mathematics, the use of technology, and pedagogy appropriate to learning how to work with students making geometric constructions using dynamic geometry. The eventual aim is to understand how we might improve initial teacher education in this area.

The global COVID-19 pandemic has added both challenges and opportunities for the study particularly in exploring how remote working might enrich the research.

The two research questions focused on how exploratory tasks might support beginning teachers to learn appropriate content, pedagogical and technological knowledge to teach geometric constructions with technology, and in what ways beginning teachers perceive and understand knowledge for teaching in such a technology-focused context? Methodologically, design-based research was adopted with the researcher being both the initiator and designer of the tasks. The pilot study was conducted remotely through the use of the Microsoft Teams with video recordings made of all the activities the beginning teachers investigated and discussed remotely.

In this presentation, initial findings will be presented and discussed together with a discussion of research methodologies appropriate to researching knowledge for teaching in a global pandemic.

Barmby, Patrick*; Foster, Colin*; Jones, Ian*; Kelley, Joel; Milinkovic, Jasmina

No More Marking, Loughborough University, Loughborough University, University of Cambridge, University of Belgrade, Serbia

Using a comparative judgement approach to assess the problem-solving skills of primary school pupils

Comparative judgement has been put forward as a way of assessing more open responses to mathematical questions, for example in problem solving. This paper describes a small-scale study involving a comparative judgement assessment of the problem-solving skills of 17 pupils from one primary school in England, with judgments provided by 10 teachers. The Scale Separation Reliability was 0.87, showing a high degree of accuracy in differentiating between the quality of responses. Examples of responses showed a valid progression in the problem-solving skills shown.

Questionnaire responses from the teacher judges support the potential of the process to inform teachers and pupils of the range of approaches that can be used in such a task. In addition, through the built-in moderation process, comparative judgement can provide formative support in aligning teachers' views of problem solving.

Black, Laura*; Coles, Alf*; Ingram, Jenni*; Smith, Kyla*

University of Manchester; University of Bristol; University of Oxford; University of Oxford

Writing and reviewing for "Research in Mathematics Education"

This session is particularly aimed at Early Career Researchers. The editorial team will introduce BSRLM's journal "Research in Mathematics Education" (RME) and its aims, and offer some reflections on recent submissions to RME. We will distill and offer advice on features of successful articles. We will be inviting attendees to engage in reviewing for RME and will discuss qualities of good reviews. There will be a space for discussion and questions. (*Workshop*)

Bustang, Bustang*; Foster, Colin; & Morsanyi, Kinga

Loughborough University

Misconceptions of Probability: Susceptibility to The Representativeness Heuristic and Equiprobability Bias Among Secondary School Students and In-Service Mathematics Teachers in Indonesia

Although a large body of research on individual's probabilistic misconceptions has been conducted since the seminal work of Kahneman and Tversky (e.g. Kahneman, Slovic, & Tversky, 1982), Shaughnessy (1992) and Jones et al. (2007) pointed out the limited amount of probability research outside of western countries and questioned whether the same misconceptions appear across many different cultures or whether the culture of students and teachers might affect their probabilistic reasoning. In this presentation, I will discuss some results from my doctoral study that investigated the confidence and competence of Indonesian eighth-grade secondary school students (N = 160, Male = 69) and in-service secondary school mathematics teachers (N = 64, Male = 22) when dealing with various probability problems. Both students and teachers completed a multiple-choice probability questionnaire, provided justifications for their responses and indicated their confidence. The results indicated that the typical misconceptions of probability were present in both teachers and their students, and both groups showed overconfidence in their responses. Although teachers were less susceptible to misconceptions in general, they were more susceptible to some biases related to equiprobability than their students.

Crisan, Cosette

UCL Institute of Education, University College London

Making mathematics the focus of mentor-mentee conversations

This paper describes the design of a short professional development course for prospective mentors of mathematics teachers. A case vignette approach that promoted the use of topic specific mathematics education research was employed, as a means of supporting the course participants critically reflect on, and make explicit their own teaching practices. We present and discuss the various components of the course, and account for how such a design served the purpose of causing the participants to be introspective of their ability to provide explanations and examples in mentor-mentee discussions that place the teaching of specific mathematics topics at the heart of mentor-mentees conversations.

Golding, Jennie*; Barrow, Ellen; Grima, Grace

UCL, Pearson, Pearson

A pandemic summer: Impact on teaching and learning for mastery in Power Maths primary schools

We report on findings from a 2019-2021 study of use and impact of Power Maths, which serendipitously was able to access primary mathematics teachers' responses to the 'pandemic summer'. Power Maths is a 'mastery'-oriented primary (R-year 6) resource. We are following 42 classes of 2019-20 Power Maths-using year 1,3 and 5 children and their teachers over two years, monitoring teacher/pupil use and impact on children's mathematics. Initial findings suggest good progress towards widely-enjoyed, 'mastery learning' in many study classes, though key recommended features of 'mastery teaching', such as whole-class teaching, remain challenging in this early use.

Summer 2020 study data from 36 class teacher surveys and 21 maths coordinator interviews or surveys enabled us to understand aspects of teachers' responses to mathematics teaching and learning over the pandemic period. Teachers reported particular challenges in addressing new areas requiring challenging conceptual development, and broad inability to effectively develop children's mathematical language or reasoning, or to monitor deep progress in their mathematics learning. However, some children's mathematics learning benefited from small group in-school provision, and others' from more contextualised and less time-constrained work at home. Further, children returning to school often showed initially slow, but accelerating, recovery from confidence and learning loss.

Goodwin, Sian*; Iannone, Paola*; Tanswell, Fenner

Loughborough University

What do mathematicians really mean by 'diagram'?

Much of the thinking we do about mathematics is visual. Throughout history, mathematics has been presented alongside, or in the form of, diagrams. At university, professors have continued to use a 'chalk and talk' approach to teaching, writing on the chalkboard as they explain their lectures, while students copy down whatever they are seeing.

Diagrams can help to explain, prove, or prove some mathematics statements. But what do we really mean by 'diagram'? How do mathematicians define a 'diagram'? Can we investigate perceptions of something that is so universally understood, and find a definition for it?

Obtaining a specific definition of a diagram in mathematics may be useful to understand the connection between mathematics education research and practice. Defining a diagram could pave the way to providing students with a better experience of university-level mathematics.

In this session, I will present findings a survey completed by mathematicians from across Europe. I will illustrate the results, comparing participants' responses and how this comparison will help to find features that are associated with diagrams across participants responses, moving us towards a greater understanding of how, when and why diagrams might be useful within for mathematics learning at university level.

Gripton, Catherine

University of Nottingham

Pattern as powerful knowledge? The story of pattern in the early years curriculum in England
Pattern and structure are fundamental to mathematical learning. Drawing upon a critical realist interpretation of powerful knowledge, I argue that pattern is powerful knowledge for the young child, supporting early algebraic thinking and providing a firm foundation for future mathematical learning across the mathematics curriculum. This understanding of pattern is applied to a review of national level curriculum documentation for birth to five years in England. Findings of this analysis suggest that pattern, whilst included in statutory curriculum requirements, has been consistently marginalised adopting a narrow conception of pattern which is far from that of powerful knowledge. Implications for current and future early years curriculum revisions are explored within an argument that recognition of the potential power of pattern would position it as a fundamental quality of mathematics (rather than a topic) which underpins all areas of early mathematics within a more socially just curriculum entitlement.

Hatisaru Vesife

University of Tasmania

The Analogies in the Writing of Secondary Mathematics Teachers about the Concept of Function: An Application of the Structure-mapping Theory

This study examines the analogies made by 42 secondary mathematics teachers when they write about the concept of function: how students would (anticipating) and should (desired) define and exemplify the function; and what questions the teachers would ask to assess students' understanding of the function (assessing). The argument of the study is that the descriptions present in the writing of this sort provide information about how the teachers view and construct functions. Using examples from an extensive set of responses from the teachers, the article presents the major analogies found in the writing of the teachers and examines ways in which these are structurally mapped in the concept of the function by applying the structure-mapping theory (Gentner, 1983). Among the analogies discussed are a 'child-mother' (the biological link between a child and mother – every child has exactly one mother) and 'machine/factory' analogies. Of interest is the similarity between the analogies formed by the teachers. At the close, the article makes the case for using the tool 'analogy' in research on teachers' knowledge for teaching.

Hatisaru Vesife

University of Tasmania

Using Drawings to Investigate the Image of Mathematics

The use of drawings in education as a measure of students' perceptions of teaching and learning mathematics has been found to be valid, reliable, and useful (e.g. Laine, Ahtee, & Näveri, 2020). Throughout the years, drawings have been widely used to elicit data from students relating to their views about mathematics (Rock & Show, 2000), mathematicians (Hatisaru, in press; Picker & Berry, 2001), mathematics teaching (Hatisaru, under review), perceptions of assessment practices in mathematics classrooms (Remesal, 2009), and the types of work experienced in mathematics

lessons (Pehkonen, Ahtee, & Laine, 2016).

The focus of the workshop is the elaboration of the drawing method. In the workshop, I present the Draw a Mathematics Classroom instrument and its associated rubrics and outline the key elements (e.g. content analysis in an inductive or deductive approach, reliability checks), strengths, and limitations of using drawing instruments to explicate individuals' thinking and perceptions. I share data analysis processes and present data from Turkish lower secondary students' (aged 12 to 15 years old) depictions of a mathematics classroom (Hatisaru, 2020). Finally, workshop participants reflect upon ways in which using the drawing approach may be useful in their own research.
(Workshop)

Hodgen, Jeremy.* & Jacques, Laurie.*

University College London, Institute of Education

The nature of mathematical interactions in Y7 during remote teaching as a result of school closures in response to the 2020 Coronavirus Pandemic in England: Stories from Heads of Maths

When schools closed to the majority of pupils in March 2020 in response to the Coronavirus pandemic, the immediate challenge for teachers was how best to enable pupils' learning to continue. With our ongoing research into attainment grouping in mathematics on hold, we were keen to understand how Y7 mathematics teachers in our study schools were adapting their practices for remote teaching. We conducted semi-structured interviews with 17 Heads of Maths about their Y7 remote teaching provision. One key finding was that during lockdown, Y7 pupils had very limited opportunities to engage in meaningful mathematical interactions.

In this presentation, we reflect on the literature around interactions in distance learning as well as Schoenfeld's Teaching for Robust Understanding (TRU) framework to consider the nature of the restricted pupil experience as reported by the Heads of Mathematics that we interviewed. We also discuss this finding in relation to grouping practices and in particular in relation to the perceived impact on low attaining pupils.

Kinnear, George*; Sangwin, Chris; Jones, Ian*

University of Edinburgh, University of Edinburgh, Loughborough University

Towards a shared research agenda for computer-aided assessment of university mathematics

We have recently formed a working group to develop a shared research agenda for computer-aided assessment of university mathematics. Such an agenda will help to establish a programme of research aligned with practical concerns, which would contribute to both theoretical and practical development. To do this we are following the methods used by Alcock et al. (2016).

Our group draws from the community of mathematics education researchers and university teachers interested in this topic. So far, we have generated a set of research questions, and refined this into a list of 52 questions organised into 5 broad categories.

We are now reaching out to the wider community at various conferences to seek input on the developing agenda. In this talk, we will give an outline of the project and show how you can get involved.

Kinnear, George*; Foster, Colin*

University of Edinburgh, Loughborough University

Lecturers' use of questions in undergraduate mathematics lectures

Mathematics lecturers frequently ask questions in their lectures, and these questions presumably play an important role in students' thinking about and learning of the lecture content. Previous research (Paoletti et al., Educational Studies in Mathematics, 98, 1-17, 2018) studying 11 university mathematics lecturers in the US produced a coding scheme to categorize the types of questions asked. We will report on work to replicate and develop the use of this coding scheme within a UK

university context, across 24 lecturers and 136 lectures within 16 different advanced mathematics courses (a total of 2460 questions). We found that Paoletti et al.'s coding scheme was easily implemented, and the categories were readily distinguished, although we found it necessary to add an additional category to accommodate questions where students were invited to generate examples. We explore reasons for this, and for variations in the prevalence of the different categories in terms of possible differences in lecturing style between the US and the UK.

Lee, Stephen*, Rainbow, Tom, Van Saarloos, Catherine & Landon, Rebecca

Mathematics in Education and Industry, Mathematics in Education and Industry, Mathematics in Education and Industry, Tribal

Teacher engagement with online professional development – a case study of a 'Core Maths Festival'.

The government funded Advanced Mathematics Support Programme (AMSP) seeks to improve the quality of mathematics teaching. One way it does this is by providing professional development (PD), often at low or no direct cost to teachers. The AMSP's PD offer is extensive in both content and delivery style, varying from 'in-person', to 'online', to a 'blended' approach. With COVID-19 resulting in no in-person events for most of 2020, the AMSP used its prior expertise with online PD to develop an online 'Core Maths Festival' (CMF), which ran between May and July 2020.

The CMF consisted of 22 online sessions (most being 90 minutes in length). Across the sessions there were 3622 participants, with 1177 distinct teachers from 794 distinct state schools/colleges applying to attend. The average number of sessions attended by individual teachers was 4.

This paper uses the CMF as a case study to explore teacher engagement with online PD. It gives background to the still relatively new Core Maths qualifications, and why such PD is needed. It also provides analysis on the uptake of Core Maths in institutions from which the teachers originate, and feedback from over 850 participants is presented.

Lord, Ems

University of Cambridge

Going deeper: Exploring ways to achieve greater depth in the mathematics classroom

Ongoing DfE initiatives for the teaching and learning of mathematics in schools encourage teachers to consider whether their students achieve 'mastery at greater depth.' As a result, schools are searching for suitable classroom resources. In a project funded by the Faculty of Education at the University of Cambridge, the university's outreach mathematics team NRICH worked with schools in Tower Hamlets, London, to explore ways to adapt existing rich mathematical resources to enable them to teach 'at greater depth.' The planned project included a year-long series of PD events for teachers, gap tasks and a case study with several of the participating schools. Although the project was disrupted by the recent school closures, this session will explore the emerging findings which indicate ways that schools might consider adapting their use of existing resources to enable their students to work 'at greater depth.'

Lyakhova Sofya and Oakes Dominic

Swansea University

From emergency remote teaching to quality remote teaching: a case study of Covid-19 FMSPW high school mathematics outreach.

Entirely asynchronous mode of studying may not be a preferred option for mathematics outreach. However, emergency school closures set constraints different from those contributing to good quality remote teaching. The study considers a case of FMSPW mathematics outreach programmes that offered video materials to students aged 16+ during the school closures in spring/summer 2020 in Wales. Survey and interviews with participants are analysed against international trends in Covid-

19 school education, research on blended learning and FMSPW 10-year experience of offering remote courses in Further Mathematics in Wales. The project is ongoing, and the findings will contribute to re-cycling of the materials produced during Covid-19.

Macey, Darren

Cambridge Mathematics

Characterising teachers' and expert statisticians' internal representations of the concept of statistical distribution

In this session I will discuss the findings of a multiple-case study exploring how secondary school teachers and expert statisticians based in England understand the concept of statistical distribution. In the study, an analysis of semi-structured interviews was used to generate maps of the concept images of the participants and the key features and themes arising from these were compared and contrasted. The findings suggest that while the conceptual components of these maps are similar for both participant groups, the expert statisticians concept images are more coherent with more developed organising structures based in their professional experience. The teachers on the other hand structured their knowledge by relating concepts to familiar assessment items. Implications of these findings will be shared and some recommendations for both professional development and future research made.

Makramalla, Mariam

University of Cambridge

A contextualised socio-political perspective on mathematics education in modern Egypt

In this session, I will shed light on socio-political dimensions that have, over the years, influenced the schooling enterprise in modern Egypt. I discuss the implications of these on the implementation policy of the national Egyptian mathematics curriculum, as it stands now. In particular, I will make use of the Goodson Change Model, as a theoretical lens to plot socio-cultural and socio-political power dynamics that influence the way mathematical problem solving is implemented within the mathematics classroom, governed by the national curriculum schooling context. I present the findings of an extended mathematics teacher focus group session, held at a middle class national curriculum Egyptian school. The findings were mapped against a pre-existing conceptual template about mathematical problem solving classroom implementation. Findings indicate a collective teacher preference to utilise mathematical problem solving tasks as a teaching tool to introduce a yet unfamiliar mathematical concept to the students. In other words, the problem solving task resolution is perceived as teacher responsibility. This findings have relevant implications for ongoing teacher professional development in the Egyptian context.

Mashiyane, Nokuthula Nardi, Elena

University of East Anglia

Exploring primary school teachers' narratives about mathematical ability through a MathTASK activity

We report from a research study conducted in the UK which explored primary school teachers' narratives about mathematical ability using semi-structured interviews after engaging participants in situation-specific activities from the MathTASK programme (mathtasks). The data from the written responses and follow up interviews is then analysed according to Nardi, Biza & Zachariades' classification of teacher warrants which considers the complex set of considerations that teachers take into account when they determine their actions. In the session, we will first introduce a mathtask (called "Fractions" in which four students grapple with the question "How do I know which

fraction is bigger?” as they work through fraction activities) especially designed to elicit teachers talk about mathematical ability and trigger discussion of whether, how and why they group students. We then discuss the written response to the task and their reflection in the interview that followed of one teacher. Our analysis shows a prevalence of both personal and professional empirical considerations for the decisions and claims teachers make about their classroom practice. We illustrate the possible influence of ability narratives and how these become part of teacher decision making. We also expose the influence of external, public narratives of mathematical ability as innate that may perpetuate deeply-ingrained teacher classroom discourse and practice. Our analysis further indicates that the depth of engagement and genuine discussion that was triggered by the math task contributed to the methodological strength of this study.

Mbogo Harrison Njaru *; Professor Ciumwari Gatumu Jane; Thiongo Mwang Johni

The University of Nairobi; The University of Nairobi; The University of Nairobi

Mathematical pedagogy and classroom climate simulation methods antidote to low mathematics attainment: Is this supported by multiple intelligence (MI) theory and practice?

The antidote to the problem of low mathematics attainment is using multifaceted mathematical none routine pedagogical and classroom climate simulation methods. This involves using the concept of multiple intelligence (MI) theory and practice in presenting mathematics concepts in the classroom. Here, it is argued how mathematical pedagogy and classroom climate simulation methods can be integrated into MI theory and practice to aid positive mathematics outcomes, and improved daily mathematics classroom instructional practice. There are connections to individual's intelligence preference (capacity) and motivation in learning mathematics. Robust research evidence has indeed indicated that children enjoy learning mathematics when mathematics learning concepts are delineated into their intelligence preference in the classroom. Presenting mathematics concepts using intelligence preference in the classroom leads to enhancing motivation to learn mathematics to children gifted in areas other than logical-mathematical intelligence preference.

Mbogo Harrison Njaru

Building Mathematical Resilience: A Case Study of Grade Three Children Experiencing Mathematics Anxiety in Kenya

Although over 60 years of international literature confirm that mathematics anxiety is an issue in children performance in mathematics; it is difficult to find empirical evidence on building mathematical resilience in young children in Kenya. It has been established that successful mathematics outcomes are hindered due to children's mathematical anxiety experienced in the classroom. In response to this global issue, it has been identified in the literature that mathematical resilience is required to achieve positive mathematics outcomes. The use of positive adaptive stance enhancing teaching approaches plays a role in building mathematical resilience leading to the reduction of mathematics anxiety. This paper investigates literature from a number of sources that recognize that although research is ongoing in this area, mathematics anxiety continues to be a prominent issue with school age children. In particular, it is evident from the literature that grade three children have mathematics anxiety that impacts on their school performance. In fact, the literature reveals the existence of mathematics anxiety in children as young as six years of age. Literature regarding mathematics attainment in Kenya reveals that 61% of grade three children are identified as being unable to compute grade two level mathematics tasks. Further literature evidence reveals that 50% of grade three children's learning has fallen below 250 mean score points that are officially stipulated as the mathematics curricular attainment requirement in Kenya. It is suggested in the literature that the low mathematics attainments could be due to mathematics anxiety, a lack of positive adaptive measures, and lack of development of mathematical resilience

when teaching mathematics in the classroom. Interestingly, it is difficult to find empirical evidence on building mathematical resilience among grade three children either globally or in Kenya. This is despite the literature evidence that at grade three level mathematical competences for undertaking advanced mathematics are developed. This paper will identify the literature outcomes, gaps, and further research to investigate mathematics anxiety in grade three children and measures to mediate the current situation in Kenya.

Mendick, Heather★, Berge, Maria, Ottemo, Andreas & Silfver, Eva

Freelance, Umeå University, University of Gothenburg, Umeå University

Popular culture geeks, suffering, revenge and mathematics

From 'The Big Bang Theory' to 'Stranger Things', geek characters are increasingly central to contemporary popular culture. They may be primarily into science or technology but this is always grounded in extraordinary mathematical skills. As Tony Stark says in 'Iron Man' "If my math is right, and it always is...". Popular culture provides narratives through which we imagine ourselves, other people and what is possible. Geek narratives do this for the 'mathematically able' and 'unable' - providing stories about who can occupy these positions and how their lives will play out. Suffering - in the form of bullying and abuse by the more popular crowd - is fundamental to geek narratives, as is the revenge executed as payback. In this session, we analyse geek suffering and revenge through two contrasting examples: Facebook-founder Mark Zuckerberg in the film 'The Social Network' and economics-genius Betty Aurora Rincón in the television series 'Betty en NY'.

Redmond Ben *, Dr Jennie Golding*, Dr Grace Grima

Pearson, UCL Institute of Education, Pearson

Covid 19: Impacts on teaching, learning and progression for A Levels in Mathematics

We report on ways that teaching and learning for mathematics A Levels have been disrupted by Covid 19. These are discussed in the context of teacher and student accounts of the aspirational and time-pressured nature of these reformed qualifications.

The depth and breadth of engagement with mathematics achieved by year 12 and 13 students during lockdown will be explored, as well as the preparedness of 2019-20 year 11 students for progression into A level. These year 13 students' progression to HE, and other implications, will also be considered.

Our findings derive from the third year of a four-year study (2017/18 to 2020/21) exploring enactment and impact of reformed Mathematics and Further Mathematics A Levels, and efficacy of associated Pearson resources and assessments. Research tools were adapted to collect information about emerging impacts of home learning and the cancellation of examinations during Summer 2020.

Given the timing of this data collection (March to July 2020), we present a snapshot of teachers and students looking to the future in a time of uncertainty and rapid change. The study continues into 2021 and will monitor the complex, evolving impact of Covid 19 in the context of mathematics A Levels.

Rycroft-Smith, Lucy

University of Cambridge

Evaluating research summary materials for mathematics teachers using comparative judgement

In this study the method of comparative judgement (CJ) was used to ask a group of mathematics teachers and a group of mathematics education researchers to rank 20 different educational research summaries for teachers, and then to consider which features and factors made these successful at communicating the research to teachers. This session looks at the similarities and differences across the two groups.

Saralar-Aras, Ipek and Tiflis, Ozdemir*

Ministry of Turkish National Education, Brunel University London

A Literature Review on Technology Use of British and Chinese Pre-Service Mathematics Teachers

The potential of educational technologies for student understanding and motivation in teaching mathematics is stressed by many researchers (Koehler & Mishra, 2009; Niess, 2008; Polly & Orrill, 2016). Studies argue that maths teachers' beliefs on this potential have an effect on their teaching methods and thus their beliefs influence whether and how they integrate technologies into their lessons (Ernest, 1989; Saralar, 2016). These beliefs might conceivably be connected to previous experiences and culturally embedded (e.g., Correa et al., 2008; Stipek et al., 2001). For example, Correa et al. (2018) found that Chinese and American teachers have a distinct way of thinking about their students' learning of mathematical topics. Recently, with the teacher exchange project, England recruited a large number of Chinese mathematics teachers to work in public primary and secondary schools and English-China mathematics teacher exchange extended to for at least two further years, to 2020 (Liang, 2018; National Centre for Excellence in Teaching of Mathematics (NCETM), 2018). Considering the cultural differences, it is important to discuss the beliefs of Chinese and British teachers on technology integration. "There is no one best way to integrate technology into the curriculum. Rather, integration efforts should be creatively designed or structured for particular subject matter ideas in specific classroom contexts" (Koehler & Mishra, 2009, p. 62). Therefore, the aim of this study is to investigate similarities and differences between Chinese and English mathematics teachers' perceptions of and beliefs regarding technology integration into their lessons. In this paper, we present our literature review findings which created the basis of our study for revealing the differences in the perspectives of British maths teachers and Chinese maths teachers, in terms of technology use.

Skilling, Karen *

University of Oxford

Using vignettes to investigate preservice mathematics teachers' beliefs

Vignettes are short stories or classroom scenarios that can be represented in written, cartoon or video formats, to which participants respond. In education research, they are an effective tool for representing aspects of teacher practices, beliefs and understandings about cognitive and pedagogical aspects related to mathematics learning and teaching. At the same time, vignettes can be representative of theory and provide important methods for eliciting data for research in mathematics education to elicit teachers' responses by probing for reactions and encouraging discussions to gain insights to participants' knowledge, beliefs, emotions, judgments, attitudes and values about particular phenomenon. In this session, I will report how vignettes are being used in one mathematics teacher training course in the UK and their contribution to the CoReflect@maths project, an Erasmus+ Strategic Partnership representing six institutions across four countries: Czech Republic, Germany, Spain and the United Kingdom.

Tiflis, Ozdemir*

Brunel University London

How do students' errors and their causes help us to develop teaching approaches for ratio and proportion?

The identification of students' errors made when attempting ratio and proportion problems and the causes of these errors are especially important for low attainment students. The purpose of this study is to develop an understanding about the errors made by resit GCSE students in England and vocational school students in Turkey and to investigate the causes of these errors to provide insight

about the difficulties that students encounter. For this purpose, an error analysis model and a diagnostic test consisting of 33 questions in total were developed. Percentage and frequency descriptive statistics were used to analyse the data collected. As a result of the study, it was determined that while understanding errors and mathematisation errors were the most common type of errors among Turkish students, the most common errors made by British students include mathematisation errors and processing skills errors. Moreover, “building inappropriate strategies”, “confusing strategy with strategies else”, and “inability to reason proportionally” were the most common causes of these students’ errors. It is suggested that these results can be used in developing new teaching approaches to eliminate the difficulties experienced by the students in learning about ratio and proportion.

Townsend, Vivien

Manchester Metropolitan University
Reconceptualising the 'good' mathematics teacher

What does it mean to be a good teacher of mathematics? Is it about ... adopting a particular pedagogy? ... student results? ... having a quiet classroom? ...

In this presentation, I will draw on my doctoral research in which I observed and spoke with three Year 6 teachers. The year group is significant as Year 6 students’ scores in national tests contribute to high-stakes accountability processes. I will share some of the beliefs I held prior to conducting my research, and will reflect on how I came to unfairly judge my participant teachers.

Engaging with Bakhtin’s work on dialogism led me to take a more sympathetic view of the three teachers which accounted for their personal histories and local contexts. Understanding the researcher as ‘other’, I came to see how the teachers authored themselves as good as they addressed me: they showed me in their lessons, and in interviews, they told me how they orchestrated different discourses about teaching.

I conclude by reflecting that I learned much more about the teachers once I stopped being evaluative and trying to fit them into existing frameworks, and started to become aware of how they authored themselves as ‘good’.

Wenderlich Maja

The Maria Grzegorzewska Univeristy, Warsaw, Poland

Crystallizing experiences in developing mathematical skills of the Polish winners of IMO international Olympiads

I study crystallizing experiences that have spiked the interest in mathematics, that is, experiences that "engage in a meaningful and unforgettable meeting of people with extraordinary talent or potential abilities with the material of a given field in which this talent can be manifested" (Walters, Gardner 1986). I am interested in the Polish winners of international mathematical Olympiads organized during the years 1959-2019. The history of mathematics shows that ground-breaking mathematical discoveries were made by young people (at the turn of adolescence and early adulthood). Examples are the achievements of Evarist Galois, Srinivas Aiyangar Ramanujan, Terence Tao. This, according to M. Spitzer (2012) and D. A. Kramer (2003), has a biological basis in reasoning strategy. However, some imperative for the development of talent had to appear. I plan to undertake qualitative research. The aim of the project is to capture crystallizing experiences that were related to orientating the minds of the people towards mathematics.

Yardley, Fiona* & Cooper, Charlotte*

Canterbury Christ Church University; Canterbury Christ Church University

Training Teachers of Mathematics virtually: opportunities and threats

We reflect on our experiences working with 35 Teach First Trainees in June and July 2020 in an entirely online environment. Trainees had no opportunity to spend any time in a classroom or with young people prior to or during the programme, before commencing on an 80% timetable in September. We have still not met any of the trainees face to face. We describe and reflect on the changes we made to our pedagogy, especially changes which produced unexpectedly rich and sophisticated discourse, as well as the challenges. Having presented our own observations of the opportunities and threats of online initial teacher education we wish to engage delegates in professional discussion about online initial teacher education in mathematics. Our objectives are twofold: to enable the sharing of experiences and strategies for online ITE, and to gather further data for our research into the generation of rich discourse in ITE in general. Workshop

Zhang, Kim

University of Warwick

Culture and Conflicts: Examining England and China's Secondary Mathematics

Teaching through Teacher Questioning around Errors

This article reports the findings of a cross-cultural study of teachers' questioning surrounding student errors in mathematics lessons in England and China. The questioning behaviour of 12 Chinese and 11 English lower secondary school mathematics teachers was studied through the qualitative analysis of audio-taped classroom observations and individual post-observation interviews. Results indicated that Chinese teachers were more open to student errors than their English counterparts. They created a positive error culture where they and their students viewed errors as a stepping stone for public discussion, and even intentionally posed questions that allowed errors to surface. They also directly evaluated student responses. The English teachers by contrast mitigated these responses and adopted a rather private student-focused questioning strategy to try to understand the student reasoning behind errors

Working groups

Angier, Corinne* & Wright, Pete

University of Stirling and UCL Institute of Education

What opportunities and constraints are experienced by those committed to teaching for social justice in English compared with Scottish classrooms?

The Critical maths Education CME Working Group (launched in November 2015) is open to all and aims to promote research that brings about positive social change through mathematics education. CME aims to identify and challenge ways in which mathematics is commonly used to maintain the status quo and reproduce inequities in society. It proposes an alternative and empowering conceptualisation of mathematics, which enables people to better understand their social, political and economic situations, and to advocate and bring about changes leading to a more just and equitable society.

This workshop will begin with brief presentations of work in England and Scotland followed by discussion of questions such as:

- How does the policy climate in which a maths teacher works impact on their classroom practice in relation to social justice?

- To what extent do differences in within the professional standards documents for England and Scotland impact on practice?
- What are the implications of the various levels of deregulation of schools in England compare with Local authority run schools in Scotland?
- Is it appropriate or even realistic to ask teachers to be neutral when teaching maths in controversial contexts?

Gifford, Sue*; Ineson, Gwen* and Marks, Rachel

University of Roehampton, Brunel University, University of Brighton

Early Years and Primary Mathematics' (EYPM) Working Group

This will be the ninth meeting of the Early Years and Primary Mathematics (EYPM) Working Group.

This will be an informal meeting where we will be:

- Sharing updates since our last meeting in March 2020, particularly in light of the challenges presented by the ongoing Covid-19 pandemic
- Discussing the new Early Years Framework and New Development Matters documents (see: <https://www.gov.uk/government/publications/early-adopter-schools-eyfs-framework>) and the place of spatial reasoning in Early Years mathematics
- Reporting on an upcoming research project on the use of textbooks in primary mathematics, and eliciting feedback on experiences and areas of interest for us to explore.

We look forward to welcoming both previous and new attendees to our meeting.

Wake, Geoff* & Foster, Colin*

University of Nottingham, Loughborough University

Didactics Working Group

This meeting of the working group will continue to explore “didactical” devices and their use. Given current circumstances the intention is to focus on devices that might provide insights into mathematical structure and support curriculum connections using the dynamic affordances of technology. We will consider how these may be used at distance and what we might learn from classroom-based pedagogies that could support their effective use in new, and emergent, remote teaching environments.