BSRLM Conference Abstracts
University of Wales Trinity St David (UWTSD Business School, Swansea)

Saturday 9th June 2018

Alderton, Julie* & Pratt, Nick
University of Cambridge, Plymouth University

"Actually all we are trying to do is fill their gaps and help them learn."

This study sprang from an opportunity provided by the recent reform of assessment practices in England in which national curriculum levels for assessing pupil outcomes and progress were removed. Using data from a small-scale study we examine the ways in which primary teachers talk about their work at the classroom level and how they reorganise their practices in a manner constrained by a well-established accountability culture. We discuss our initial analysis, focusing on how teachers make use of particular language forms in their accounts of the ways in which they construct mathematics teaching and assessment. We take a sociological perspective, using the lens of Foucault's governmentality, working with the premise that assessment takes place in social practices as a technology of government and that the 'truth' about children's mathematical development is produced within power/knowledge relations (Foucault 1977, 1997). We identify a discourse of gaps used in teachers' descriptions of pupils' mathematical knowledge and learning. This notion of gaps is linked to teachers' use of commercially produced monitoring and tracking software packages which generate electronic grids of pupils with yearly objectives, producing a pictorial array of gaps that teachers must act on. We ask how these practices create particular truths about pupils, knowledge and learning and briefly discuss some of the potential effects of correlating mathematics learning with gaps in knowledge.

Key words: *assessment; accountability; governmentality*
Session type: *Research paper*
Duration: *30 minutes*

Andrews, Nick
University of Oxford

Are there mathematical differences in what is addressed through different modes of interaction?

This workshop will explore whether what is addressed in lessons through classwork is likely to be mathematically different to what is addressed through seatwork. Furthermore, is this a planning issue to which mathematics teachers might usefully attend?
The above questions arise from a study in which four series of lessons were analysed by treating each as a sequence of micro tasks. Focusing on the mode of interaction, each micro task in the study could be categorised either as classwork or seatwork. Micro tasks categorised as classwork featured whole-class teaching, typically teacher exposition or class discussion. Those categorised as seatwork featured learners working more independently of the teacher - possibly in a small group - typically on an exercise, problem or investigation. Focusing on the mathematics, a finding of this study was indeed that across each of the four lesson series what was addressed through classwork was different to what was addressed through seatwork.

Key words: *Instructional design; teaching styles; mathematics teaching; teacher learning.*

Session type: *Research workshop*
Duration: *30 minutes*

Barclay, Nancy*; Barnes, Alison*; Marks, Rachel* & Treacy, Páraic*
University of Brighton, University of Brighton, University of Brighton, University of Brighton

Reviewing 15 years of research in mathematics education: continuity, change and lessons for the future

BSRLM conferences offer a supportive atmosphere for new and established researchers to share research and explore pertinent issues. Post-conference proceedings provide an inclusive forum capturing the wide-ranging debates and ideas disseminated, representing a rich archive of change and development in mathematics education research. This presentation addresses work in progress on a commissioned review offering a critical reflection of BSRLM conference proceedings from the last 15 years. It aims to examine trends in research, highlight strengths, identify gaps and point to potential areas for future study.
The mixed-methods review will have two outcomes: i) a quantitative overview of the corpus of 783 papers published in this period and ii) a thematic report addressing trends in mathematics education research. In this presentation, we focus on the first of these. We present our coding system and methodological approach, highlighting the challenges of inter-coder reliability and working with a wide variety of papers in terms of content and style.
Early indications suggest a heavy focus on empirical studies, early support for seminal projects (e.g. ICCAMS and epiSTEMe), and a strong focus on specific themes including tools/technologies and policy. There are limited papers addressing EYFS and SEND. Positively, we note a discernible improvement in the quality of papers over the 15-year period and offer suggestions to strengthen the quality and consistency of future proceedings.

Key words: *systematic review; research methodology; research trends; publications; cross-phase*
Session type: *Research paper*
Duration: *30 minutes*

Bustang, Bustang
University of Leicester

Proportional reasoning and probability: What does the literature say about how these are related?

Since the seminal work of Piaget and Inhelder in 1975, a large body of research on people's conceptions and misconceptions about probability has been conducted (e.g. Fischbein, 1975; Fischbein and Schnarch, 1997; Green, 1983; Jones, Langrall & Mooney, 2007; Shaughnessy, 2003; Tversky and Kahneman, 1974; Way, 2003). However, little research has explored the role of proportional reasoning in the teaching and learning of probability concepts. Fischbein and Gazit (1984) found that lessons on probability had a negative effect on students' proportional reasoning and Van Dooren et al. (2003) showed that students' tendency to misapply proportional reasoning in solving probability problems led to misconceptions. In this presentation, I will summarise the literature that informs my design-research project, which aims to develop a convergence between proportional reasoning and probability that will help students improve their understanding of probability.

Key words: *probabilistic reasoning; proportion; probability misconceptions*
Session type: *Research paper*
Duration: *30 minutes*

Constantinides, George* & Neale, Charlotte*
Imperial College London, Langham Primary School

A Logical Perspective on Cuisenaire and Bar Modelling

We aim to use the tools of mathematics, specifically the ideas of formal logic, to rigorously study the class of mathematical sentences expressible, provable and disprovable with the use of Cuisenaire rods and bar models.
We will explain the ideas of formal languages in mathematics, and how both Cuisenaire rods and bar models can be understood within this context. We observe that, in our model, Cuisenaire rods impose syntactic restrictions on expressibility, making the notions of expressibility of a number sentence and truth of that number sentence coincide. In contrast, we explore two contrasting views of bar models – that only their adjacency that holds

meaning, versus that length carries meaning. We draw out the advantages and disadvantages of both these perspectives, and provide examples of 'rules of inference': statements about bar models which are sufficient to prove or disprove mathematical sentences expressed within these models. We draw conclusions on the potential and limits of these models, site them within the English National Curriculum and stages of child development, and suggest fruitful avenues to search for complementary Concrete Pictorial Abstract representations of mathematics. This work springs from a fruitful collaboration between mathematics and pedagogy. We therefore believe this session will be of broad interest across all key stages – and beyond – as a theoretical stimulus for deeply reflective practice and future research.

Key words: *CPA; Cuisenaire; Bar Model; Logic; Model Theory*
Session type: *Research paper*
Duration: *60 minutes*

Denny, Helen*; Moss, Nigel* & Joubert, Marie
University of Wales Trinity St David's; Welsh Government; Swansea University

Observations of primary mathematics classrooms in Chongqing, China

It is generally accepted that observing teaching in different contexts has considerable learning potential for teachers and researchers. They are able, for example, to consider the similarities and differences between their own contexts and the different contexts and this raises their awareness of their own practice which they might adapt and improve in the light of their observations. In March 2018 a group of eight teachers and three other education professionals from Wales visited Chongqing in China. The overarching purpose of the visit was to learn about approaches to teaching mathematics in primary schools with a view to developing practice in Welsh schools. The visit was organised by British Council China, in conjunction with Chongqing Municipal Education Commission. This presentation synthesises the key observations and findings of the eleven participants in terms of the organisation of schools and teaching and learning in mathematics in particular. It concludes with lessons learned for Wales.

Key words: *curriculum; China; primary; comparative*
Session type: *Research paper*
Duration: *30 minutes*

Gifford, Sue
University of Roehampton

Early years and primary mathematics working group

In our third session we aim to continue building our mini-data base of each others' research, with a particular focus on sharing research sources and theoretical approaches.
We will invite those present to talk for a few minutes (but only if you want to!) about your current research focus and to identify theory and research which you are finding useful. Please bring any key references with you (stick or paper) and we will add these to our informal data base.
We will also discuss any topical updates eg Education Endowment Fund, revisions to Early Learning Goals ….
All new-comers with a particular interest in early years and primary mathematics education are welcome.

Key words: *early years and primary mathematics education*
Session type: *Working group*
Duration: *60 minutes*

Goos, Merrilyn
University of Limerick

Writing for Publication in Mathematics Education Research Journals: Issues, Challenges, and Strategies

Conducting and disseminating mathematics education research is an international concern, with peer review

considered to be vital in assuring the academic quality of published journal articles. Getting published in good quality research journals also has real consequences for individual researchers in terms of obtaining an academic post, and tenure and promotion.
The aims of this workshop are to discuss journal editors' typical expectations for publishable manuscripts, engage participants in identifying challenges they face as authors, and suggest ways of overcoming these challenges. The presenter will share her experience as the Editor-in-Chief of Educational Studies in Mathematics, presenting data on manuscript submission and publication rates, but also opening up the often-invisible processes of reviewing, revising, and editorial decision-making. As well as uncovering some of the mechanics behind submission and review, the workshop will focus on how to address two key requirements for publishable manuscripts: (i) making an original and significant contribution to knowledge and (ii) being accessible and interesting to an international audience.

Key words: *publishing; dissemination; journal editing*
Session type: *Research workshop*
Duration: *60 minutes*

Hilton, Caroline
UCL Institute of Education

Can fingers help children develop a 'feel' for number?

The role of fingers in the development of early number skills has recently received significant interest in mathematics education, neuroscience and psychology. This study describes the findings of a longitudinal exploration of the mathematical development of children with Apert syndrome. Children with Apert syndrome are born with their fingers fused and although they have their fingers separated, they do not often use their fingers spontaneously to solve numerical problems. The children's working memory, approximate number system and finger gnosis were assessed alongside their development in mathematics. Through an exploration of the children's development in these areas over a 2 year period, the study provides new insights into the role of fingers in supporting understanding and skills in early number and arithmetic.

Key words: *Fingers and early number skills*
Session type: *Research paper*
Duration: *30 minutes*

Hodgen, Jeremy
UCL Institute of Education

What does research say about teaching mathematics and what are the implications for the research field?

I will present the findings of two literature reviews funded by the Education Endowment Foundation and the Nuffield Foundation. These focused on the synthesis of the meta-analyses and systematic reviews related to mathematics teaching and learning that have been conducted internationally over the past 40 years. I will discuss, and critique, this literature base. One outcome of this work has been the recently published guidance report, Improving Mathematics in Key Stages 2 and 3, published by the EEF. I will reflect critically on the process of producing this guidance and the implications for research.

Key words: *Research, literature reviews, meta-analyses*
Session type: *Plenary*
Duration: *60 minutes*

Ingram, Jenni & Andrews, Nick*
University of Oxford

Tensions and opportunities when working in a collaborative video group

In this session we will explore the tensions and opportunities that arose during a collaboration between mathematics teachers and researchers which took the form of both a research project and a professional learning

opportunity for all involved. Throughout the process there are choices and decisions that need to be made and the relationship between the research and professional practice can bring complexities to these choices that can both open up new possibilities and raise tensions between the two roles within the collaboration. This exploration includes considering the goals, processes and participants and the different roles each plays as the project evolves.

Key words: *collaborative research; video methodology; classroom interaction, Secondary*
Session type: *Research paper*
Duration: *60 minutes*

Joubert, Marie; Lyakhova, Sofia*; Moss, Nigel* & Griffiths, Michael*
Swansea University, Swansea University, Welsh Government, Welsh Government

Developing a new national curriculum in mathematics and numeracy: the case of Wales

New curricula get developed all over the world and for all sorts of reasons, but mainly it seems to be because the previous curriculum is somehow failing our young people. Designing a new curriculum is neither trivial nor easy, and a number of factors need to be considered, such as what the aims of the curriculum are, how the curriculum is designed (what is the process?), who will be involved in the process, and how skills and content are balanced. This presentation begins with an outline of the theoretical ideas behind current curriculum design and then turns to the case of the Welsh mathematics and numeracy areas of learning, using this case to explore some of the theory already discussed.

Key words: *Curriculum; Design; Stakeholders; Skills; Knowledge*
Session type: *Research paper*
Duration: *30 minutes*

Liu, Xiaowei
University of Bristol

A literature review on rigour

In this session, I will present a rigorous literature review on rigour within the realm of mathematical rigour. This review is the precursor to a comparative study across China and the UK, to test the hypothesis that there are significant differences in secondary school practice in relation to the development of mathematical rigour. The rationale for this research is that the UK government is importing the Shanghai mastery approach and textbooks to UK schools seeking to match the standards in top-performing East Asian countries in PISA global education league table, while the Chinese government is turning to the UK on how to encourage creativity in primary schools. A comparative study can contribute to a better understanding of differences in students' mathematical behaviours in the two countries, which may further to inform better practices. In the literature, there are a variety of phrases used in relation to rigour: 'mathematical rigour', 'rigorous mathematics' 'rigorous problem solving', 'rigorous mathematical thinking', 'rigorous proof', 'rigorous classroom', 'rigorous curriculum', 'rigorous learning'. There is no consistent definition, and rigour is not always clearly defined. I categorise the existing different definitions into several categories, which I will elaborate on during the seminar. Furthermore, I will devise a definition of rigour, which I can operationalise in my study. In the end, I would like to offer some differences in practice.

Key words: *mathematical rigour; rigorous curriculum; rigorous learning; rigorous classroom*
Session type: *Research paper*
Duration: *30 minutes*

Lyakhova, Sofya*; Wallis, Rachael* & Joubert, Marie
Swansea University, Welsh Government, Swansea University

The National Network for Excellence in Mathematics in Wales

The National Network for Excellence in Mathematics (NNEM) was established in July 2017 in Wales. This presentation begins with some background contextual information about education in Wales. It then turns to mathematics achievement in Wales, explaining the perceived need for a new curriculum and a National Network for Excellence to support the teaching and learning of mathematics in Wales.
The remainder of the presentation concerns the NNEM, and outlines some of the work achieved by the NNEM in the past year. In particular, it focuses on the work of the 'Evidence Eco-System' priority group of the NNEM and discusses in some detail the action research conducted by teachers in this group.

Key words: *Network of excellence; Wales; action research; evidence eco-system*
Session type: *Research paper*
Duration: *30 minutes*

Naik, Mamta
Manchester Metropolitan University

"I hate maths like, but I don't mind this …" Interrogating primary student teachers' relationship with mathematics in the university space

This presentation focuses on some initial exploratory research carried out for an assessment as part of an Ed Doc programme, with a view to where explorations can be taken next as I move towards the thesis phase. Working with primary student teachers of mathematics requires work on both their content and pedagogical subject knowledge (self- efficacy) as well as their confidence and motivation (self-concept). This all relies on developing a positive pedagogical relationship between tutor and students as well as between students and the subject of mathematics. With one group of students, I found myself struggling to form both a mathematical attachment with them and between the students and mathematics.
In initial explorations of this fascinating paradox of student teacher of primary mathematics rejecting the subject in the university space (as learner of mathematics), I have drawn upon Bibby's (2011) as well as Britzman's (2009) work on psychoanalytical explorations within the classroom. Both draw upon some Lacanian concepts within these explorations. This enabled me to perhaps gain some insight into what may be happening 'behind' or in the hidden spaces of the students (a research aspiration). I would like to explore further how these 'hidden' spaces and 'behind the facades' can be accessed in a formal teaching space.

Key words: *pedagogical relationship; rejection; student teacher; primary; psychoanalysis*
Session type: *Research paper*
Duration: *30 minutes*

Treacy, Páraic
University of Brighton

Integrating mathematics and science in secondary classrooms

Recent recommendations to improve mathematics teaching and learning in the UK have included calls to focus on students' problem-solving skills and an increase in the facilitation of meaningful application of mathematics to other disciplines. Integrating mathematics and science through transdisciplinary lessons can help address these recommendations as such lessons provide students with opportunities to organise knowledge into a connected conceptual framework which facilitates future retrieval and application. Within this session, I will outline the means by which these transdisciplinary lessons which integrate mathematics and science can be designed and delivered effectively within the current structures and confines of secondary education. Particular focus will be placed on the means by which these transdisciplinary lessons can complement single-subject lessons to enhance conceptual understanding and knowledge retention.

Key words: *Integration; transdisciplinary lessons; interleaving; rich tasks; applications of mathematics.*
Session type: *Research paper*
Duration: *30 minutes*

Tsikalaki, Eleni * & Misailidou, Christina
National and Kapodistrian University of Athens, National and Kapodistrian University of Athens

What do primary school teachers really think about mathematics?

We present selected results from a study on the Greek primary school teachers' attitudes and beliefs about mathematics. The study's sample consisted of ten teachers, five men and five women of varied teaching experience. Structured interview data were collected and analysed by using a grounded theory methodology. Contrary to previous findings, most of the teachers of our sample exhibited a positive attitude towards mathematics. This is an encouraging result since primary school teachers in Greece do not usually have a strong mathematical background from their secondary school years. Nevertheless, two participants admitted that, given the choice, they would not teach mathematics at all! This fact is alarming and should be given the appropriate attention.

Key words: *Primary school teachers, Attitude, Beliefs*
Session type: *Research paper*
Duration: *30 minutes*

Wake, Geoff* & Clark-Wilson, Alison*
University of Nottingham, London Knowledge Lab, UCL

'Building and Sustaining Active Research Collaborations with Teachers of Mathematics' Working Group

Recently, two important pieces of work have been published by the Education Endowment Foundation: Improving Mathematics in Key Stages 2 and 3
https://educationendowmentfoundation.org.uk/public/files/Publications/Campaigns/Maths/KS2_KS3_Maths_Guidance_2017.pdf
and the evidence review that underpinned this work
https://educationendowmentfoundation.org.uk/public/files/Publications/Campaigns/Maths/EEF_Maths_Evidence_Review.pdf
It is our intention in our continuing discussions around teacher/researcher collaborative activity to consider how we might respond in ways that best support effective responses in schools and classrooms to such work. How might teachers respond? Can we carry out collaborative research that can provide additional and practical

evidence? In doing so can we draw on newly emerging networks such as research schools and the Chartered College for Teaching?
Our discussions will focus on these (and no doubt other) questions.

Key words: *teacher/researcher collaboration, researching in classrooms, working with research evidence*

Session type: *Working group*
Duration: *60 minutes*

Wake, Geoff* & Hodgen, Jeremy*
University of Nottingham, UCL IoE

Mathematics in Vocational Education Systems: A Boundary Crossing Perspective
In this session results from an international comparison of vocational education systems and the role of mathematics in preparation for STEM careers are briefly presented. The comparison focuses on systems that are claimed to be particularly effective such as those in Germany and Korea. Although there seems no 'one answer' about how to design for effectiveness our data does highlight some distinctive features of the systems in terms of boundaries that are developed. These are both intentional and designed but also result from cultural ways of understanding education, vocational education and society more generally.

We consider and explore these boundaries together with notions of boundary crossing and boundary objects and this raises issues of use value and exchange value. Finally, we consider the case of England and point to how we might better design for mathematics in vocational education.

Key words: *curriculum; vocational maths; boundaries and boundary crossing; comparative education*
Session type: *Research paper*
Duration: *30 minutes*