# BSRLM Autumn 2021 Abstracts: Day Conference

## Saturday 6th November 2021

British Society for Research into Learning Mathematics

## Plenary

**Anne Watson**

**Professor Emeritus**

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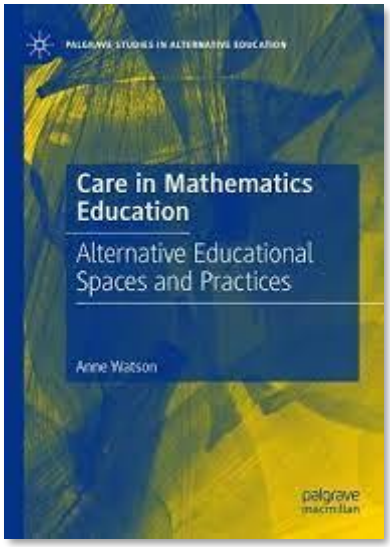
### *Care in Mathematics Education*

*I shall present the main ideas in my recent book, Care in Mathematics Education, in which I develop a picture of how teachers care for the learning of mathematics, conjoining care for learners with care for mathematics. Cognitive care contrasts with cognitive control. To understand more about this, I sought information about mathematics teaching practices in a variety of educational spaces.*



# Research papers, workshops and working groups

**Algharbie, Turkie (University of Exeter)** [PRESENTATION]

***The use of visual representations (VRs) in Saudi mathematics Textbooks for pupils with MLD***

The aim of this study is to examine mathematics textbooks and their instructional emphasis with VRs in mathematics for pupils with MLD in 4th, 5th and 6th grade in Saudi Arabia (SA). In order to investigate the use of mathematics textbooks a total of 12 mathematics teachers and 9 pupils with mild learning disability (MLD) have also been interviewed using semi-structured interview. I also observed nine self-contained classrooms (SCC). In this presentation, I will report parts of my findings, in particular in the following points: (a) although the mathematics teachers hold conceptions about VRs, Concrete-Pictorial-Abstract (CPA) model of VR and the roles they serve in problem solving, they lack depth understanding of their pedagogical values, and are narrow in their perspective; (b) Social culture plays a huge role in teaching and learning mathematics using VR in mathematics lessons; (c) Pupils with MLD find mathematics textbooks interesting in learning mathematics; d) Saudi mathematics textbooks have been found to adopt a more abstract of VRs than concrete and pictorial; and(e) The low cognitive level of pupils with MLD might play a major role in the limited effectiveness of the CPA method in teaching and learning mathematics. The findings of this study are useful: the use of VRs in mathematics textbooks also for teachers, but these representations must be appropriate for the culture content and also for the cognitive level of pupils with MLD.

**Almulhim, Maryam (University of Exeter)** [PRESENTATION]

***Teaching mathematics through reading mathematics stories interactively for kindergarteners: Small-scale intervention study in the context of Saudi Arabia***

Consolidation of mathematics education (ME) should begin in the earlier stages of education, at kindergarten. However, several opportunities to teach and learn mathematics during daytime activities are commonly missed. One of these activities is story time: as most pre-school provision creates specific times for storytelling, recounting mathematical stories (MSs) within this time might help pupils to improve their mathematical knowledge and skills. Stories during these sessions are usually read with whole group, and this is often done without associated activities. However, stories can be read interactively, which is expected to maximize their benefits. Alongside the recognition of the importance of learning mathematics at kindergarten, the content of ME must also be given due consideration. Two concepts are considered crucial to improving pupils' achievements: number sense (NS) and mathematical thinking (MT). This study aims to examine the effect of MSs on the development of NS and MT by adopting authentic interactive reading scenarios, and to explore the contribution of interactive reading in that development. To achieve that, a quasi-mixed methods small-scale intervention study will be applied. A non-equivalent quasi-experimental design involving comparison and intervention groups will thus be adopted to allow NS to be measured based on obtaining data from pre- and post-tests. MT and the contribution of interactive reading will be studied through intervention observation.

**Brady, Corey; Ramírez, Paola González** **[WORKSHOP]**

***Real-world modeling situations: complicated or complex?***

Educational research and teaching praxis in mathematical modeling depend on tasks that offer learners opportunities to engage in modeling. Moreover, the design of such tasks assumes and cultivates particular perspectives on the nature and purpose of modeling in mathematics education. In this workshop we will focus on one aspect of task design, involving the choice of types of real-world situations to expose learners to and prepare them to handle. Specifically, we consider the question of pursuing Complicated or Complex situations in modeling activities. Complicated situations may require students to employ advanced techniques or concepts; or they may demand subtlety in their application of these conceptual tools. Nonetheless, these situations can be described with the traditional tools of algebra, geometry, trigonometry, statistics, or calculus in a satisfactory manner, sufficient for the purposes of the modeling problem. Complex situations may involve feedback loops, tipping points, or other emergent behaviors. Such settings may challenge learners to make tradeoffs; to maximize or minimize focal quantities; or to operationalize key constructs. Thus they demand a toolkit that is built upon the foundations of traditional school mathematics but that assembles these building blocks into complex systems. Introducing and discussing examples of each, we will engage the group in asking, "What role (if any) does modeling Complexity have in our students' mathematics education?"

**Brougham, Rachel* (Edge Hill University)**
**Nicholson, Laura; Kaye, Linda; Laing, Gordon** **[PRESENTATION]**

***Enjoyment and Anxiety in Further Education Mathematics: Investigating the Role of Constructivist Learning in Creating Positive Learning Experiences for Adult Students***

This mixed-methods research project aims to explore the links between adult students' perceptions of cognitive constructivist principles in learning and their achievement emotions in Further Education (FE) mathematics. In a previous study, associations were quantitatively identified between perceptions of four constructivist-informed classroom practices, students' appraisals of control and value, enjoyment and anxiety towards learning mathematics in FE. Building on this, the current study aimed to qualitatively explain our quantitative results and provide further insights into adults' learning experiences via one-to-one interviews with students and teachers in FE. Qualitative findings demonstrate ways in which constructivist learning may create positive emotional experiences for these students. Recommendations for facilitating constructivist learning in emotionally sound ways are discussed.

**Cave, Peter** **[PRESENTATION]**

***Focused discussion and fluency practice in first and second grade elementary mathematics classrooms in Japan***

This presentation reports some findings from an observational study of teaching in first and second grade elementary maths classrooms in regular public elementary schools in Japan, carried out between February and July 2018. To date, research on elementary maths teaching in Japan has highlighted its focus on children's conceptual understanding and its emphasis on problem-solving, especially through class discussion of a limited number of problems in each lesson. However, many of the studies reported in English-language literature were undertaken either in laboratory schools or in Japanese schools overseas, rather than regular public schools. This study broadly corroborated the features found in previous research, but also found that fluency practice was strongly incorporated into maths teaching, either within lessons or as homework. The presentation gives illustrations both of classroom discussion and of the various forms that fluency practice took. It suggests that future research should pay more attention to the roles played by fluency practice in elementary maths education in Japan.

**Clark-Wilson, Alison; Crisan, Cosette; Bretscher, Nicola; Geraniou, Eirini** **[WORKING GROUP]**

***Learning from the pandemic: Capitalising on opportunities and overcoming challenges for mathematics teaching and learning practices with and through technology***

This Working Group will meet for the third and final time to work on the case studies that were presented during the March 2021* and June 2021** meetings. We'll aim to draw some conclusions with respect to how practitioners responded to teaching mathematics online and the evolution of their related practices. The group's work has been framed by the following three pedagogic activities, which have now been shown to be particularly challenging: - Introducing and developing understanding of new mathematical topics; - Managing interaction and communication in mathematics; - Assessing mathematics - both formatively and summatively. In this final session, we will endeavour to conclude some of the theoretical and methodological challenges faced by the mathematics education field when the prevailing boundaries of the classroom shifted; alongside the changed nature of the interactions between the humans (teachers and students) and the chosen technologies. *https://bsrlm.org.uk/bsrlm-cp-41-1-06/; **https://bsrlm.org.uk/bsrlm-cp-41-2-05/ .

**Golding, Jennie* (UCL Institute of Education)** **[PRESENTATION]**
**Hill, Mark J.; Custodio, Irene; Grima, Grace**

***Gender, self-perception, and mathematics: The 2020 England, Wales, and Northern Ireland PISA Field Trial***

Concerns around discrepancies in mathematics participation by gender are longstanding in many jurisdictions. Normatively, those are a question of social justice: if females are being disproportionately excluded for conscious or unconscious reasons at any level of the curriculum system, those should be addressed. Economically, disincentives for female engagement might also impinge on both personal and national thriving. While more females than males took pre-university STEM A-Levels in recent years in England, Wales and Northern Ireland, issues remain specifically with mathematics. This paper draws on the 2020 PISA Field Trial data to outline some areas of concern as perceived by 15-year-olds in England, Wales, and Northern Ireland in early 2020. We first identify key issues recognised in previous literature, and then locate those within the 2020 dataset. By exposing the continuation and extent of these challenges in mathematics, the paper has potential also to identify opportunities to address them.

**Gripton, Catherine (University of Nottingham)** **[PRESENTATION]**

***Teachers developing patterning in their classrooms***

Attention to pattern and structure is fundamental to mathematical learning and attainment, particularly in early childhood. Following a critical realist notion of powerful knowledge, pattern teaching has the potential to empower young children to notice patterns, mathematise their everyday experiences and engage in mathematical sense-making. This session reports on a study which investigated how to harness this potential. It reports on participatory research with ten teachers of three to five year old children in England as they developed pattern teaching in their settings. Findings indicate that teacher knowledge, pedagogic interactions and pattern-rich environments (all underpinned by an appropriate developmental progression and extended to form a setting-wide shared approach) supported the development of patterning praxis. These offer potential priorities for teachers of young children who similarly seek to develop mathematical patterning in their classrooms.

**Hatisaru, Vesife* (University of Tasmania)** **[PRESENTATION]**
**Oates, Greg**

***Developing Proficiency with Algebra in Teacher Working Groups***

Algebra learning plays an important role for students both in school and college level studies. Students' algebra learning outcomes are, nevertheless, sometimes poor in both national and international assessments. For instance, in Australia, only 15% of the Year 9 Victorian students gave the correct answer to the question: 2 x (2x - 3) + 2 +? = 7x - 4 (Sullivan, 2011). Research studies show that students' algebra learning outcomes can be enhanced through effective forms of instruction that attend to algebraic proficiency, but also suggest that teachers need to be supported in developing such effective instructional practices. In this study, we established a teacher working group in which participant teachers solved and discussed algebraic problems to develop a deeper understanding of algebraic processes and solution strategies. Here we present the very first results indicating the need in this field.

**Hooper, Owen* (University of East Anglia)** **[PRESENTATION]**
**Nardi, Elena**

***Do old habits die hard? How university mathematics teaching may have risen to the challenges presented by the move to an online learning environment***

We report from a Masters dissertation research project that investigated how university mathematics teaching (UMT) in a British University adapted to the challenges presented by the move to an online learning environment as a result of COVID-19. Six interviews were conducted with teaching staff who provided first-hand accounts of how UMT adjusted to the new normal. To identify shifts in the lecturers' teaching practices, we deployed a commognitive lens (Sfard, 2008): four characteristics of mathematical discourse (word use, visual mediators, endorsed narratives and routines) were drawn upon to code the interview datasets with the aim to distinguish - but also consider in tandem - shifts in the lecturers' mathematical and pedagogical discourses. Two themes emerged from the analysis: the Faceless Audience; and, Coping without the chalk and blackboard. We exemplify how the interviewed lecturers reported the ways in which, in the midst of the pandemic emergency and at quite short notice, coped with finding innovative and productive new ways to deliver UMT in an online learning environment. Routines that developed rapidly included using multiple choice questions and emoticons as a barometer for student understanding, replacing previous reliance on facial expressions and nods of heads. We conclude with reflections - and a call for further research - on whether these urgently implemented innovations are here to stay or old UMT habits will prove too hard to die, and return.

**Hyde, Rosalyn; Archer, Rosa; Bamber, Sally** **[PRESENTATION]**

***Understandings and perceptions of mastery approaches to mathematics: The case of beginning secondary teachers***

This study reports on the perceptions and understanding of beginning teachers regarding mastery approaches to secondary mathematics teaching and the alignment of their beliefs and practice. We draw on qualitative data from six semi- structured interviews designed to interrogate and capture teachers' understanding of the features of mastery learning within their own practice. The interviews used vignettes, defined as "written ... stimuli … reflecting realistic and identifiable settings that resonate with participants for the purpose of provoking responses, including … beliefs, perceptions" (Skilling & Styliandes 2020, 542-3). The analytical framework drew on Guskey's (2015) interpretation of Bloom's theory of mastery learning together with features of mastery learning in mathematics from Drury (2018) and Boylan (2018). Whilst capturing the full complexity of beginning teachers' perception and understanding is beyond the scope of this study, the data provides insight into these teachers' experiences at a time when mastery learning discourse is prominent (Boylan 2018). The study exposes differences in their interpretation of the principles of mastery learning well as tensions that arise between beginning teachers' beliefs, practice, professional knowledge and sense of agency in their developing classroom roles. We further found that some beginning teachers found it challenging to talk about pedagogy and evidence of continuing misconceptions about teaching and mastery approaches.

**Ineson, Gwen; Gifford, Sue; Marks, Rachel** **[WORKING GROUP]**

***Early Years and Primary Mathematics (EYPM) Working Group - 12th meeting***

This will be the twelfth meeting of the Early Years and Primary Mathematics (EYPM) Working Group. It will be an informal meeting where we will be considering the implications for early years and primary mathematics research, in the light of the Ofsted Mathematics Research Review. We will share some of the excellent responses to the Review that various mathematics organisations have put together, and we will also consider some of the research that is drawn on in the Review, in relation to the teaching and learning of early mathematics, as a starting point to our discussions. Feedback from previous working group meetings has been that participants value the opportunity for informal discussion about EYPM research-related matters, so our intention is to include small and full group discussion about these topics. We look forward to welcoming both previous and new attendees to our meeting.

**Joubert, Marie*** **(University of Nottingham)** **[PRESENTATION]**
**Wake, Geoff; Dalby, Diane; Noyes, Andrew; Adkins, Michael**

***A randomised control trial in FE maths: designing the 'medicine'***

The University of Nottingham is running a randomised control trial (RCT) of an approach to teaching for mastery in GCSE maths in FE. This is informed by five research-based principles, based on research, and developed by stakeholders in the sector. Medical RCTs that research the efficacy of interventions, such as vaccines, use controlled and standardised doses of carefully designed medicines which are given to those in the intervention group. Those in the control group get a placebo. In the socially complex context of teaching mathematics, our RCT's equivalent of the medicine is a set of carefully designed lessons exemplifying the teaching for mastery principles and a programme of professional development. The trial involves three groups: one receives the full package of lessons and professional development, the second receives all the lessons but only part of the professional development programme and the third continues with business as usual. Our focus in this presentation is the design of the intervention illustrating how the lessons have been designed to exemplify the five principles of teaching for mastery and how the professional development has been designed to prepare the teachers to teach them.

**Kimber, Elizabeth (The Open University)** **[PRESENTATION]**

***Linguistic and paralinguistic features of teachers' discourse in online teaching videos about graphs***

Learning can be conceived as a change in students' discourse, but what discursive tools does teaching make available to them? Teachers' own use language and gesture when introducing ideas or presenting worked examples is one such tool. I will report analysis of online teaching videos about functions, graphs and change for pre- and early calculus courses. These videos can be viewed as multimodal texts in which teachers combine language, diagrams, symbolism and gesture. The analysis uses approaches from Systemic Functional Linguistics to explore the ideational, interpersonal and textual metafunctions of teachers' language and gestures as they construct graphical concepts. The teaching videos have allowed us to explore teachers' language and gestures in planned environments as part of a larger study involving analysis of online and classroom video.

**Macey, Darren; Rycroft-Smith, Lucy** **[WORKSHOP]**

***The personal politics of research methodologies***

Engaging in research, in particular choosing methodologies, is a deeply personal act that reveals truths about the inner and outer world of the researcher even as the researcher seeks to reveal new truths about the world. While epistemological beliefs are commonly revealed by researchers, in our work developing our methodological approaches we have identified multiple dimensions through which as researchers we enact and reproduce beliefs, social relationships, and hierarchies of power. The choices we make are not merely instrumental or practical, but rooted in our alignments, our identities, and our research communities. Just as they can locate us as servants to a hegemonic paradigm or as agents of change and subverters of norms, they can locate us at the centre or the core of communities, or on the boundaries of them. In this session we explore some of the multitude of spectra on which we position ourselves and our research and the potential implications of those choices.

**Makramalla, Mariam (New Giza University)** **[PRESENTATION]**

***Resisting Problem Solving: Voices of educators and caregivers***

Despite the fact, that amongst most scholarly bodies, there is an agreement about the importance of integrating problem solving as a substantial part of the mathematics classroom, there still seems to be resistance from educators favouring a rather more traditional and procedural approach in teaching mathematics. In this session, I utilise data collected as part of my recent doctoral study to report on some of the main reasons why teachers would opt to implement a more traditional classroom experience in mathematics education. Underpinned by the Goodson Change Framework, I discuss the societal role of caregivers in influencing teachers' resistance to adopting problem solving in the classroom.

**McGill, Shauna* (Ulster University)** **[PRESENTATION]**
**Harbison, Lorraine**

***Integrating Children's Literature in Numeracy Education (InCLINE Project)***

A cross-border qualitative exploratory study of preservice teachers' integrating literature in primary mathematics lessons. The study facilitated workshop training for both PGCE and BEd primary teachers from both the North and South of Ireland. Addressing the barriers to integrating literature in mathematical learning as signposted by Prendergast et al. (2018), the project explored a range of mathematical concepts and how they can be represented in children's literature. The study concluded by formulating guidance principles for adopting and selecting literature to support the teaching and learning various mathematical concepts. A central outcome of the exploratory study examined the focus of mathematical language and development of discourse based pedagogical practice.

**Misailidou, Christina* (National and Kapodistrian University of Athens)** **[PRESENTATION]**
**Spanoudi, Anastasia**

***Measuring primary school teachers' attitudes towards problem solving in real-word contexts: Development of the appropriate instrument***

Successful problem solving is an essential aspect of learning mathematics. Nevertheless, according to research studies, pupils as well as student-teachers often fail to discern the real-world context of a problem and, as a result, they fail to solve it. The study presented here, extends the results already reported in the literature, by measuring the primary school teachers' attitudes towards problem solving in real-word contexts. Constructing the necessary instrument for this purpose was challenging. An extensive review of the literature resulted in a two-part questionnaire. The first part contains questions that call for the teachers' opinions and ideas on teaching problem solving. The second part contains two categories of problems that must be solved: 'standard items' that require just the application of an algorithm for their solution and 'problematic items' that require an investigation of their real world context.

**Mohanty, Karmel (Institute of Education, University College London)** **[PRESENTATION]**

***Deaf experiences in the mathematics classroom***

Despite the fact that hearing loss is not itself a cause of mathematical difficulty, deaf pupils are at significant risk of underachievement in mathematics. The limited research we have on deafness and mathematics education rarely covers both topics, and has not been able to explain why, or offer solutions. This presentation shares the findings of a study investigating the experiences of deaf pupils and staff in the mathematics classroom through interviews with 19 deaf and hearing teachers and support/peripatetic staff, some with deaf children of their own, and all with experience working with deaf pupils. This project found that pedagogical and school practices that benefit deaf pupils and staff are likely to also benefit their hearing peers. Inclusive classrooms, therefore, should not be an addition to regular practice but central to how we run our schools and colleges. Many participants talked about the potential of mathematics to be particularly accessible to deaf pupils through its use of numbers, symbols and clear strategies and processes, but that this does not simply make mathematics easier for all deaf pupils. Instead, deaf pupils are more likely to be (and feel) successful when teachers explicitly teach mathematical language and approaches to solving worded problems. Deaf pupils also learn content more clearly and successfully when their teachers work with support staff in key ways including co-planning mathematics lessons to make their classrooms more inclusive.

**Neate, Andrew; Lyakhova, Sofya; Dorris, Rachel** **[PRESENTATION]**

***Understanding secondary school student engagement with an online enrichment programme***

This study investigates a series of Royal Institution (Ri) Mathematics Masterclasses that took place online in Spring 2021. These are enrichment classes would normally have taken place in person in a classroom or university lecture hall setting, but this was not possible due to the pandemic. Instead they were held as live online sessions and after each class students were provided with follow up materials for asynchronous study. We investigate, through interviews with students, what they found helpful to improve their understanding in the online sessions and how they accessed and used the additional materials provided after the classes. This continues work presented at the BSRLM June 2021.

**Njaru Mbogo, Harrison* (University of Nairobi)** **[PRESENTATION]**
**Ciamwari, Gatumu Jane; Rachel, Kangethe-Kamau; Murray, Cathryn; Njeri, Juliet Mwasya; Mwangi, Thiongo, John**

***Mathematical pedagogical and classroom climate simulation methods as an antidote to low mathematics attainment and positive mathematics disposition: Is this supported by multiple intelligence theory and practice?***

An antidote to the problem of low mathematics attainment and positive mathematics disposition is using multifaceted none routine mathematics pedagogical and classroom climate simulation methods delineated into children's intelligence preference (capacity). This involves using the concept of multiple intelligence theory and practice in presenting mathematics concepts in the classroom. Here, it is argued as to how mathematics pedagogical and classroom climate simulation methods may be integrated into multiple intelligence theory and practice to offer emotionally rich mathematics enhancing learning environment that may aid positive mathematics outcomes, positive adaptive mathematics stance, and improved daily mathematics classroom instructional practice. There are connections to an individual's intelligence preference (capacity) and self-mathematical efficacy. Robust research evidence has indeed indicated that children enjoy and persist in learning mathematics when mathematics learning concepts are contextualized into their intelligence preference. Intelligence preference-based mathematics learning gives children gifted in areas other than logical-mathematical intelligence an opportunity to fully utilize their minds in learning mathematics.

**Rumbelow, Michael (University of Bristol)** **[PRESENTATION]**

***Counters or lengths? Developing an AI-based app that recognises and responds to arrangements of block manipulatives, to support 're-worlding'***

It is common practice in many primary schools in England following 'mastery' approaches to use interlocking cubes to model objects in word problems, for example 5 oranges may be represented by 5 cubes. By naming it as an orange, in some sense the cube temporarily 'becomes' an orange in the mathematical dialogue or 'language game'. And the affordances of cubes enable them to be lined up in a row which has a length. In modelling another word problem a cube may become a child, or an hour, or a vote. Friedrich Froebel (1782-1852) in his Kindergarten centralised block play, and children's storying of their block constructions to create 'worlds'. And the mathematics educator Caleb Gattegno (1911-1988) also used Cuisenaire rods, originally designed to model mathematical objects, to support story-telling in his 'Silent Way' approach to language learning. In this session I look at how children transform the meaning of blocks through actions and language. I demonstrate a prototype app in development at the University of Bristol which uses AI to recognise arrangements of Cuisenaire rods and responds with preset sounds and images. In particular I focus on a short video from a recent trial of the app with year 1s in a primary school, which I suggest offers tentative evidence of a transformation or 're-worlding' of rods, from counters to lengths.

**Saralar-Aras, Ipek*** **(Ministry of National Education, Turkey)** **[PRESENTATION]**
**Sari, Mehmet Hayri**

***Distance Education as Perceived by In-service Teachers during the Covid-19 Pandemic***

It is often argued that teachers are one of the most important factors in teaching. Teachers' experiences of education are, inevitably, important so that one can design studies to meet their needs when necessary. With the Covid-19 pandemic, crisis-prompt distance education has started. This abstract is prepared to present preliminary findings of a case study, which aimed at learning about 12 in-service teachers' (6 females, 6 males) experiences with distance education during the Covid-19 pandemic. The study group was selected using a criteria sampling method. Various positions of teachers and varying levels of professional experience were used to develop the criteria (such as 1-10 years and 11-20 years). Open-ended semi-structured interviews, which took 30 minutes to 40 minutes to complete, were employed. Then, the content analysis approach was used to evaluate the data. The data revealed four major trends concerning teachers' experiences of distance education during the pandemic: the need for guidance and support, planning online materials and teaching with them, technical issues, and the use of technological tools. Because the majority of the findings were contextual, we suggest schools should give some school-based training sessions to assist teachers and parents in this process. Moreover, university teacher training departments may give comprehensive pedagogical knowledge support, particularly to pre-service teachers who will be the teachers of the future.

**Sharpe, Fiona** **(University of Bristol)** **[PRESENTATION]**

***Can teachers imagine teaching differently?***

Responding to a call for the aesthetic and sensual in mathematics (de Freitas & Sinclair, 2013) and in-the-moment awareness of our virtual nature (Varela, 1999), my research involves facilitating experiential workshops for teachers. In this longitudinal project teachers reflect on experiences of learning and teaching mathematics - giving voice to some interesting ambiguities and contradictions. To investigate further, I am drawing on Leatham's (2006) idea of teachers as sensible systems, whereby inconsistencies between beliefs and actions indicate a possibility for looking more deeply. Therefore, I am returning to a previously carried out case study in which the role of imagination and the possibility of what mathematics could look like, came to the fore. Images of mathematics held by students and teachers are complex, with varying attributable characteristics. Affective factors, such as beliefs and attitudes, have been found to be significant in influencing outcomes. This study examined the images of mathematics held by three adolescents and their teacher in a Steiner school. The Steiner-Waldorf curriculum approaches mathematics through cognitive, emotional, physical and spiritual aspects. The findings indicate that despite seeming ambiguities and contradictions, a relationship to mathematics, as expressed in the curriculum, is common to teacher and students. Relating this finding to my current longitudinal research, I ask can teachers imagine teaching differently?

**Siddiqa, Mariam (Staffordshire University)** **[PRESENTATION]**

***Resit Maths Learners' perceived apprehensions that impact their engagements and motivations with compulsory Maths course***

The learners of Further Education (FE) colleges must need to re-sit English and Mathematics exams alongside their vocational course if they have not achieved it at school, under the new government policies (Coughlan, 2013). However, in the light of the researcher's own experience that these compulsory subjects especially Maths is considered an unnecessary burden, unachievable, confusing and irrelevant to daily life by most of the learners (Markovits et al, 2017). Negative feeling towards learning and achieving Maths is emerging as a social trend in the UK, for example, it is not surprising in public that people are not good in Maths and finding it hard to handle (Kowsun, 2008). There is a gap in FE sector research on these issues of Mathematics re-sit learners' apprehensions and teaching and learning approaches to improve the situation (Andrew et al., 2020).

**Stacey, Jennifer (Sheffield Hallam University / Chestefield College)** **[PRESENTATION]**

***Doctoral research on adults (19+) studying GCSE Mathematics in Further Education (FE) colleges in England: The importance of the pilot study***

Adults who re-engage with mathematics after a break can do so for many reasons, including career changes which can expand opportunities and enhance earnings. Success in mathematics, combined with Access to HE courses, can lead to professional training as nurses, teachers or social workers. In turn this can ensure more secure employment, potentially reducing adults' economic vulnerability. In England in June 2020, over 30 000 learners of 19 years or more were enrolled for the Level 2 GCSE examination in mathematics. This is a marker exam for many universities, as a grade 4 or better can be an entrance requirement. Many of these learners may have left school at 16 years old with a range of Level 2 qualifications, and some may not have English as their first language or have been educated in the UK. Previous practitioner- based research with adults revealed levels of anxiety about both mathematics and examinations. This has led to the current doctoral research, which is a mixed method investigation to gather learners' confidence and anxiety levels, using a questionnaire based on a number of pre-existing surveys. Using thematic analysis learners' perceptions will be compared to examination performances to evaluate for correlative links, via learner characteristics, such as age, gender and first language. This presentation is about both importance of the results of the pilot study and the impact of the pandemic on the main investigation.

**Tiflis, Ozdemir*** **(Brunel University London- Samsun University)** **[PRESENTATION]**
**Yilmaz Ebru-Busra**

***Investigation of Difficulties Encountered by Mathematics Teachers in Online Education***

The aim of this research is to examine the difficulties that mathematics teachers encounter in providing online education. This research aimed to reveal after the transition to online education in the Covid-19 process the difficulties experienced by teachers in teaching online and what caused these difficulties. The case study method, one of the qualitative research designs, was used because it was aimed to reveal an existing problem in various aspects. The participants of the research are eight volunteer mathematics teachers from Turkey selected by the non-random sampling method. In line with the purpose of the study, a semi-structured interview form was prepared and applied to teachers in order to reveal the difficulties encountered by teachers and the reasons for these difficulties. As a result of the research, it was concluded that the teachers' views about the difficulties they experienced in the online education process were mainly due to the camera and microphone being turned off, the inability to interact with the students, and the inability to provide a suitable lesson environment for students.

**Wenderlich, Maja** **(The Maria Grzegorzewska Univeristy)** **[PRESENTATION]**

***Introducing children to the world of geometry. Advantages of shaping intuition and outlines of concepts***

The analysis of psychomotor development shows that children create their first geometric intuitions from manipulative and spatial experiences. Tactile experiences of the shape of solids are important and talking about them and determining the location of three-dimensional objects in the environment. Then slowly - using educational support - they transform these intuitions into outlines of geometric concepts. Meanwhile, introducing children to the world of geometry in the Polish education system begins with plane geometry. In this presentation, I will discuss the dangers of this kind of regulation.

**Zembat, Ismail* (University of Glasgow)** **[PRESENTATION]**
**Seyit Ali Yasa; Mustafa Aslan**

***Qualified mathematics teachers' knowledge of place value concept***

Place value is an important concept that cut across primary and secondary curriculum universally. Teachers need to understand this concept in more advanced ways than their students to teach it effectively. Knowing about the nature of teachers' understanding of place value is essential as it may give educators opportunities to develop well-designed professional development programmes. However, qualified teachers' knowledge of place value has not been extensively investigated in the mathematics education research arena. We propose sharing the initial results of a research study about 40 qualified teachers' knowledge of place value using the Mathematical Knowledge for Teaching framework as a guide for this research session. The teachers who took part in the study have a range of experience (3-45 years) and currently teach grades 1-8 (age 6-14) in the central region of Turkey. We collected the data via videotaping of one-on-one semi-structured interviews. We gave the participants five different scenarios about alternative student solutions in the context of arithmetic operations and asked them to analyse those. We are in the process of qualitatively analysing the data. Our initial observations suggest that teachers with weak and procedurally oriented knowledge are inclined to draw on pedagogical content knowledge when they feel insecure about analysing the given scenarios with specialised content knowledge.

**Zhang, Ying* (University of Cambridge)** **[PRESENTATION]**

***Chinese Teachers' Views on Implementing Problem-based Learning in the Chinese Mathematics Classroom***

Chinese students attained high achievement in maths competition but low attitudes toward mathematics, this might due to the fact that Chinese secondary schools still mainly use conventional teaching (CT) and teachers still dominate the classrooms. This study is located within a case study methodology and draws on in-depth focus group from three Chinese secondary schools to investigate teachers' impressions of the implementation of Problem-based learning (PBL) in Chinese mathematics classrooms. The data were collected from teachers' focus group, researcher memos, and school context, and thematic analysis was adopted. The findings indicated that PBL approach was relatively accepted by the participants, who believed that PBL could improve students' problem-solving skills and mathematical interest. Participants considered exclusively using PBL would not be ideal, but advocated for combining PBL with CT for the best learning outcome. Main concerns shared by all cases regarding such implementation are class management, teachers' stress, students' adaptability, and time management. I also found that there is already one Chinese secondary school successfully implementing PBL in their maths classrooms for several years. Such a qualitative analysis of teachers' response provided insights into Chinese teachers' thinking and Chinese mathematics education. Recommendations for future research are provided at the end of the article.