

BSRLM Abstracts, University of Leicester, 8 November 2014

Plenary Presentation

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Unravelling Mathematical Difficulties for Children in Foster Care

Children in public care are amongst the most vulnerable children in the education system, and their attainment in mathematics is often low. I will examine some of the reasons for this, and discuss the cases of Skye (aged 7) and Kyle (aged 9), to illustrate what can go wrong, and how it could be put right.

Both children were 'bottom of the bottom group' in their class for mathematics, and used contrasting tactics to survive each lesson. Many of the issues considered are relevant for any child who is facing difficulties in mathematics.

Research presentations

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To what extent do gestures, facial expressions and intonation affect classroom interaction?

Classroom communication is important for dialogue between teachers and students. It is vital for classroom interaction that teachers become aware of how they communicate with students while teaching. To support student participation and talk in the classroom, teachers need to be aware of verbal and non-verbal communication. My research involves professional development workshops to develop Saudi mathematics teachers' perceptions about dialogic teaching. The participants were three male primary mathematics teachers in third, fifth and sixth-grade classrooms. Classroom observations and video recordings used to collect data about the teachers, focused especially on the communicative strategies they use in the classroom. This session presents data on teachers' awareness concerning non-verbal communication such as gestures, facial expressions and intonation which might affect teacher-pupil classroom dialogue.

Borthwick, Alison & Harcourt-Heath, Micky

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Calculating: How have Year 5 children's strategies changed over time?

We report on longitudinal research into the calculation strategies used by Year 5 children between 2006 and 2014. We consider not only whether increasing proportions of children are successful with their calculations but also examine the range of strategies used and whether these have changed over time. Each of the five data sets across the nine years has included approximately 1000 children from the same group of 22 schools spread across one large UK County. There will be an opportunity to view the latest set of data from 2014 and also to look at examples of children's work. We will conclude by considering the strategies that might continue to move children's capabilities further forward.

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The role of prospective teachers' mathematical knowledge to identify primary students' understanding: the process of unitising

This study analyses the role of prospective teachers' mathematical knowledge in identifying students' understanding related to the idea of unitising (as a component of proportional reasoning). 92 prospective teachers analysed primary students' answers to 12 school problems about different components of proportional reasoning. Three answers of the primary school students to these problems were selected to show different characteristics of the development of proportional

reasoning. The focus of this paper is on one problem that could be solved by a unitising process. The prospective teachers' analysis was focused by four questions about teaching and learning (a: about mathematics elements in the school problems; b: about the evidence of understanding; c and d: how to modify the school problem to support students' conceptual understanding). Results suggest that the way in which prospective teachers understood the unitising process influenced what they considered to be the learning objective, how they recognised and interpreted evidence of primary students' understanding and how they modified the school problems to help primary students develop the unitising process.

Burroughs, Beth

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A Mathematical Minute: An Informal Mathematics Education Project

Mathematics as a discipline suffers from a public relations problem. Often mathematics is thought of as either memorised facts in arithmetic or as formulas and manipulations in algebra. Neither of these is very interesting as an end in itself. Many teachers report that it is parents' preconceptions about what mathematics is that makes them resistant to curriculum changes in their children's schools. Thus, there is the need for the mathematical community to define what is important in mathematics, rather than relying on individuals' often decades-old classroom experiences to define important mathematics by default.

I will describe a proposed project: *A Mathematical Minute* that will create radio spots for dissemination to the general public, and the project will contribute to the research base in informal mathematics education by asking "Does listening to short radio spots on a regular basis change individuals' perception of the discipline of mathematics?" Participants will be invited to contribute ideas about both the research design and about the mathematical topics that could be featured in short radio spots.

Butler, Douglas

TSM Workshops and Autograph

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Is the switch to HTML working?

In order to provide mathematical software on mobile devices, most software authors are being forced to re-write in HTML, supported by javascript. This session will look at some major titles that have made the switch, including Geogebra and Autograph, and will discuss if this is a forwards or a backwards step.

There is little doubt that mathematics software will always work best when written in the native language of the operating system. So to satisfy the needs of IOS, Android, Windows, Mac and Linux would require seven completely separate code bases, which is economically impossible. Writing in HTML is the only sensible solution, but this is far less powerful, and open to all the vagaries of the many different browsers. On the other hand, the touch interface does introduce some exciting new approaches to the way dynamic objects can be handled.

Freeman, Nisih

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Does the Japanese abacus improve underachieving children's performance in mathematics?

I report the results of a pilot study carried out over a period of 10 weeks, looking at the benefits of using the Japanese abacus as part of an intervention programme on a small group of underperforming Year 1 children in a UK school. The study investigates the rate of progress of children who have participated in the abacus sessions against a control group. We used standardised tests at pre- and post-intervention stages which examine a number of features of the children's performance, including computational skills, oral counting, identification of numbers, object counting and language. The results show that children who participated in the abacus sessions have progressed at an average rate of 40% against the control group of 8%. The intervention group displayed a particularly strong improvement in their computational skills. Given these preliminary results, further research is required to investigate the extent to which the Japanese abacus can benefit a larger sample of underachieving children in the UK. It is therefore

recommended that a more extensive study is undertaken to measure the impact of using the Japanese abacus in raising KS1 children's numeracy levels.

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10 000 Hedgehogs: practical activities to explore numbers and number patterns

We will introduce a Nuffield project, *Making Numbers*, which aims to produce a guide about the use of manipulatives in primary schools. It includes a 10 minute stroll to Rose Griffith's *10 000 Hedgehogs* exhibition in the New Walk Museum and Art Gallery. We will watch an animation film and engage with the hedgehogs to consider their potential for exploring mathematical ideas and patterns. We will also include discussions about the research background to the project, issues about the use of manipulatives in schools and the role of exhibitions as teacher CPD. (Participants will get a recipe for making hedgehogs.)

Harth, Helen
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The use of tasks in the teaching of statistics at university

Statistics education has focused on the design of tasks that teachers use in instruction, but there have been few empirical studies seeking to characterise the teaching process using tasks. In this session, I seek to characterise the role of tasks in teaching and learning statistics on tertiary level non-specialist modules. Taking a grounded theory approach to frame my qualitative enquiry, I seek to answer the question: how do lecturers use tasks on statistical modules and why. In particular, I pay particular attention to the number and nature of tasks lecturers use in their teaching (e.g. type of task, presupposed prior knowledge/skill, targeted statistical content, enacted statistical content, how much time is devoted to each task). I illustrate this grounded theory approach using teaching episodes from two tertiary level statistical modules in a UK university. This analysis provided a way to provide a tentative characterisation of the complexity in the teaching and learning of statistics on these modules.

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Shanghai mathematics exchange - views, plans and discussion

Two recent government initiatives in mathematics education are the proposal for English teachers of mathematics to learn from their Shanghai counterparts and the creation of 'Maths Hubs' (which will organise England-Shanghai exchanges). This session will provide three perspectives on the Shanghai initiative:

- * Tony Staneff will talk about approaches being developed at the White Rose Maths Hub (including what Maths Hubs are and 'mastery pedagogy');
- * Fiona Shen will talk about her experience as a school student in Shanghai and contrast these with her experience as a UK teacher of mathematics;
- * Jeremy Hodgen will comment from a 'research perspective' drawing on a number of recent comparative studies.

The floor will then be open for discussion – what might be learnt from Shanghai mathematics teaching?

Juwe, Sylvester Chukwuemeka
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A comparative study of mathematics education beliefs amongst mathematics curriculum leaders in English and Nigerian schools

The discussion of beliefs is ubiquitous to discussion pertaining to mathematics education because of their importance in individuals' behaviour. The beliefs of mathematics curriculum leaders in England and Nigeria, however, have received limited research attention despite their relevance to

school mathematics. I highlight parts of a study that comparatively evaluated the espoused mathematics education beliefs of mathematics curriculum leaders in Nigeria and England, as comparative studies are noted for making implicit assumptions explicit. To infer their beliefs, ten mathematics curriculum leaders from Nigeria and eight from England were interviewed using a semi-structured schedule. These responses were analysed using percentages, agreement rates, deductive and inductive thematic analysis. Consistent with national cultural expectations, the English curriculum leaders demonstrated a slightly higher proportion of constructivist beliefs than those from Nigeria. The inductive analysis of the semi-structured interviews made disparities more apparent as both set of leaders had a different set of emerging beliefs. The results of this study, in agreement with those of other studies, suggest that mathematics education beliefs appear to resonate with cultural assumptions. They further revealed that certain cultures might encourage individuals' holding contrasting beliefs, giving rise to teachers acting in ways contrary to their beliefs.

Kennedy, Jo

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Investigating secondary mathematics student teachers' development of mathematical understanding

My research investigates how students on a Subject Knowledge Enhancement (SKE) course at Manchester Metropolitan University engage in discussions about basic calculation processes. The theoretical foundation is Skemp's (1976) notions of procedural and conceptual understanding and related research.

Through a series of whole class deliberations, informal questioning and semi-structured interviews, my study discovers and attempts to explain shifts in mathematical thinking. The debate considers how the groups' development of a deeper view of mathematical procedures can enhance learning and it seeks to explore an emerging insight into how our learning as children affects our perception of knowledge and understanding as adults (Costello, 1991).

My findings suggest that through revisiting school mathematics from an advanced perspective, the students actually gain much more than merely competence in mathematical procedures. They suggest that the students appear to develop a deeper understanding and appreciation of the underlying mathematical concepts. This relational learning enhances their own conceptual mathematical knowledge and subsequently strengthens their pedagogical awareness.

Livesey, Rosemary & Rempe-Gillen, Emma

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Researching the development of pre-service primary school teachers

Recent government initiatives and school inspection reports have placed school-based training in the spotlight and the in-school mentoring of pre-service teachers has become a focus for improvement (e.g. Jones 2013 and DfE 2013). Research in the field of pre-service teachers' teaching mathematics in primary school is our focus and we will explore ways in which this important time in the development of a primary school teacher can be researched. In particular, we will centre our attention on the post-lesson discussions between mentors and pre-service teachers since these are often the predominant form of interaction that a student teacher has in order to improve his/her teaching. Typically post-lesson discussions do not draw attention to subject specific targets for the pre-service teacher (Ofsted, 2012 and Thwaites et al., 2005) despite the expectation that in-school mentors do this. We will discuss how this can be researched in order to promote the development of pre-service primary school teachers of mathematics.

Mali, Angeliki; Biza, Irene & Jaworski, Barbara

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Lecturers' use of graphical representations in university mathematics tutoring

University mathematics teaching is of major significance in mathematics education, where central aspects are how students learn mathematics and ways of enabling those students to learn

mathematics. However, a systematic literature review (Speer, Smith and Horvath, 2010) reveals a limited number of studies based on systematic data collection and analysis for university mathematics teaching. The aim of this presentation is to report early findings from undergraduate mathematics teaching in the tutorial setting. Tutorials are 50 minute weekly sessions and a group includes 5 to 8 first year undergraduate mathematics students. Observation notes were kept and the sessions were audio-recorded and transcribed. The study distills characteristics of two tutors' mathematics teaching and through interviews, their underlying considerations. One tutor has a doctorate and conducts research in mathematics and the other tutor has a doctorate and conducts research in mathematics education. The characteristics emerge as codes through a grounded analytical approach. Analysis of a teaching episode from each tutor illuminates the lecturers' use of graphical representations regarding different teaching approaches for students' meaning making and links the lecturers' teaching practices to knowledge from their own research.

Ormesher, Caroline

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We need to talk about mathematics: analysing conversations of PGCE primary mathematics specialists

I am in the early stages of doctoral study and am researching what PGCE primary mathematics specialists talk about when they talk about mathematics. I have made a collection of conversations over the past year and some of the audio data indicates that these student teachers see 'maths talk' as a valuable part of their development in beginning to establish a deep understanding of the mathematics that they teach, what Ma (2010) might call 'a profound understanding of fundamental mathematics'. However some feel that they have different types of conversations about mathematics at school and at University. As we move towards PGCE courses which are primarily school based I question what this holds for the types of 'maths talk' that student teachers will have opportunities to engage in.

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Using ICT in the mathematics education of Mexican adults who haven't completed basic education

I describe a study into the role of ICT in the mathematics education of Mexican adults who have not completed their basic education. Most of these adults live in rural communities and in poor zones in the cities. The aim of the study is to improve numeracy teaching with ICT for this specific population, analysing the characteristics of didactical and technological material that is appropriate to them. Having analysed the mathematical pre-conceptions of the population, a didactical proposal was developed based on Pick's Theorem, as an alternative for calculating irregular areas. In addition, ad hoc software (webpage-app) was designed to ease the transition between mathematical pre-conceptions and school mathematics concepts. The main design decisions and some of the preliminary results will be presented.

Palmer, Pauline

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Exploring synergies between the teaching of mathematics and modern foreign languages

I present my work to date on an intervention with a group of students following a mathematics specialism unit, as part of their BA in primary education. The intervention began with workshops run by student volunteers, a visiting lecturer from Spain, a MFL colleague and me, which provided an opportunity for colleagues, students and school partners to explore potential synergies between mathematics and MFL teaching. The aim of subsequent work with the student group, was to focus on learning mathematical concepts, using Spanish as the language for teaching in order to answer the question: To what extent does the use of a different language medium support the development of understanding of mathematical concepts?

Following the workshops, I taught a session in Spanish involving measurement and scaling. The students were invited to engage with the tasks using Spanish if they could. Following the session there was a discussion with the students about the strategies used, the place of resources and

gesture in supporting the talk, and the value of combining subjects in this way. The students were also asked to evaluate the session via questionnaires. Attendees will be invited to discuss my findings and the implications for further research and development.

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The design and phase 1 implementation of the Citizen Maths MOOC: Powerful ideas in action for Level 2 adults

Citizen Maths (<https://citizenmaths.com>) is funded by UFI to develop a free MOOC for citizens who feel they would like a better appreciation of mathematics, a very large population. It is aimed at Level 2 and assumes knowledge of lower levels of GCSE. Once developed the course will run without direct tutor support.

For citizens who have not benefitted in the past from conventional approaches to teaching mathematics, our approach is to offer a series of activities based around powerful mathematical ideas. Phase 1 has focussed on 'proportion', experienced through the actions of mixing, comparing, scaling, sharing and trading off. Programming with Scratch and other computer-based tools, such as Geogebra, are deployed throughout the course. No previous experience of the tools is required. Phase 1 of the project has been running since mid-September.

We will explain the underlying philosophy of *powerful ideas in action* in more detail. We will also present some early findings from the initial impact study of Phase 1. Finally, we will look forward to Phase 2 to discuss further powerful ideas and how they might be brought into action.

Skyrme, Sue; Gay, Sarah-Jane & De Geest, Els

National Numeracy

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"It's a massive confidence boost having your mum or your dad there" – discovering attitudes and barriers to parental engagement in mathematics with school-aged students

It has long been recognised that parental engagement has a large and positive impact on children's learning (Desforges and Abouchaar, 2003). But how can we tap into this powerful resource when it comes to the nation's favourite 'love-to-hate' subject – mathematics? While general parental engagement faces large barriers itself – time restraints, parents' own experiences of school, confidence etc. – parental engagement in mathematics seems to face a whole host of additional barriers including the low level of mathematics skills and high level of mathematics anxiety existing in the UK adult population. Keen to transform negative attitudes towards mathematics in the UK and give parents/carers the confidence to support their children's education through mathematical conversations and activities, National Numeracy launched a research project into parental engagement in mathematics. Focusing on areas of deprivation, National Numeracy explored attitudes, experiences and concerns of parents/carers, teachers and students (both primary and secondary). In this session we discuss the key barriers and recommendations that emerged from this research.

Smith, Cathy

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Time and maturity in students' accounts of choosing Further Mathematics

Interviews with year 13 mathematics students have shown that they had different reasons for choosing Further Mathematics A-level than they did for Mathematics. The discourses associated with Further Mathematics sustain two tensions: the first is between the two neoliberal imperatives of getting ahead in time and remaining authentic. The second related tension is that students can demonstrate maturity both by choosing Further Mathematics and then by giving it up. In the session I draw on Lesko's work on adolescence and student data to show how these tensions inscribe Further Mathematics as risky so that students are positioned as making the rational and authentic choice in giving it up.

Trakulphadetkrai, Natthapoj Vincent

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Primary School Teachers' Beliefs about the Intergration of Children's Literature in Mathematics Teaching and Learning: Cross Validation by Systematic Triangulation

Children's literature can be beneficial in mathematics learning as it provides a meaningful, familiar and engaging context in which children explore and develop mathematical knowledge and skills. Yet, such resource seems to be associated mainly with the EYFS setting, and appears to be underused in KS1 and particularly KS2 classrooms. I will present initial findings of a small-scale pilot study which sets out to explore primary school teachers' beliefs about the integration of children's literature in mathematics teaching and learning in England. The focus on teachers' beliefs is crucial as any attempt to change teachers' practice must begin with an understanding of their beliefs and conceptions. This research is part of a comparative study that explores the beliefs of teachers in England and Finland about the integration of children's literature into the mathematics curriculum. Participants will be invited to participate in the cross validation of my coding of the open-ended survey data.

Zerafa, Esmeralda

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An intervention study with children having mathematics learning difficulties with and without comorbid reading difficulties

I present the methods I have used to collect data for my PhD study. The study focuses on finding effective strategies for helping children struggling with mathematics. The project was carried out with boys in Grade 5 (9 - 10 years old) who attend Church schools in Malta. To identify the learners for the main part of the study a battery of assessments were used including standardised tests for numeracy and reading. As Malta does not have local standardised tests, the tests used were first translated to Maltese and eventually read out in both languages. Moreover the norms for the tests were calculated after tests were done in local classrooms. After thorough assessment, three children were identified as having mathematics learning difficulties only and three with comorbid difficulties in mathematics and reading. The selected participants then followed an intervention programme based on the Catch Up Numeracy intervention programme. The data collected is being analysed using a Vygotskian perspective, including the Zone of Proximal Development (ZPD) and its relevance in helping children's learning. The notion of cultural tools and their meaning will be explained.

Working Groups

Alcock, Lara; **Evans**, Jeff; **Inglis**, Matt; **Hodgen**, Jeremy; **Monaghan**, John; **Noyes**, Andy & **Pope**, Sue

Using statistics in mathematics education research

This working group continues sessions held over the last two years, on a variety of themes ranging across experimental designs, surveys in international performance comparisons, and the use of secondary data (National Pupil Database, in a discussion of Andy Noyes's paper in RME 14,3). This conference session will focus on a more general discussion of problems with using secondary data, and also the very relevant issue of what sorts of studies are "replicable", i.e. have findings which may be reproduced in a range of contexts. We hope this short description will show that the paper raises many issues relevant to today's methodological challenges.

The session will begin with a discussion, led by Matthew Inglis and Jeff Evans, of a paper by Robert Hanson, "Evidence and Procedure Characteristics of 'Reliable' Propositions in Social science", *Amer Jnl of Sociology*, LXIII (1958), 358-363. Most University libraries will have electronic (and other) access to this paper; if you are unable to access in this way, you may approach Jeff Evans for a copy (e-mail address above).

The second part of the session will discuss the direction for future meetings, both at BSRLM conferences and possibly in other fora.

Clarke, Nichola

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Environmental Sustainability in Mathematics Education Working Group

In the first section of the meeting, we review recent literature, including Coles, Barwell, Cotton, Winter and Brown (2013) *Teaching Secondary Education as if the Planet Matters* London: Routledge.

In the second part, we will discuss what beginning teachers might learn about teaching sustainability issues through mathematics lessons, and share and develop resources for use in initial teacher education contexts.

Clark-Wilson, Alison

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BSRLM and BERA: Maximising the opportunities for our affiliation

The BSRLM affiliation with BERA, through which the BERA special interest group (SIG) on mathematics education is convened, brings with it the opportunity to share research and project outcomes that are regularly seen at BSRLM day conferences with the wider education community.

Although ensuring the mathematics education community's presence at the annual BERA conference is an important part of this affiliation, BSRLM also has a small budget with which to convene other activities, events and publications. This working group is being convened to explore how BSRLM might strengthen its affiliation with BERA through future activities, publications and events.

Coles, Alf

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Mathematics Education and the Analysis of Language

The aim of the group is to offer participants an opportunity to dwell in the moment of interaction with language data. We share approaches to the analysis of transcripts of classroom talk and raise awareness of issues. The group has not met since March 2013 so attendance at previous working group sessions is not necessary.

In this session, participants will engage in a methodology for studying language that derives from the research paradigm of enactivism. Whereas many approaches to language are deliberately silent about issues of learning (this would be true of, for example, discursive psychology, systemic functional linguistics and linguistic ethnography) an enactive methodology is different. Through a focus on pattern and distinctions, there is an attempt to say something about learning over time.

After a brief presentation to set up the key elements of the approach, participants will work in groups on a selection of data and then compare their resulting analyses. This will lead to a broader discussion of how the study of language is able to shed light on learning.