BSRLM Day Conference 16th June 2007: Abstracts

Working Group

Developing a Framework for Researching Professional Development in Mathematics (NCETM / BSRLM Working Group)
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In 2006 the National Centre for Excellence in Teaching Mathematics (NCETM) was launched with the broad aim of enhancing mathematics teaching and learning, in schools, colleges, universities and other organisations, through high-quality continuing professional development. The aim of this workshop is for BSRLM members to provide critical feedback on a proposal for an NCETM commissioned research project that aims to investigate the interrelated factors that contribute to 'effective' continuing professional development in mathematics. The workshop will build on a previous NCETM/BSRLM workshop in which participants expressed the view that it is important that the NCETM funds a coherent programme of research related to professional development, and that this should be articulated with research funded by ESRC and other fund-raising bodies.

Research sessions

Fallacies in Mathematics
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This paper explores the application of recent work on fallacy theory to mathematics. Many alternative theories of fallacy have been suggested. One influential approach employs the concept of an 'argument scheme': a characteristic pattern under which many similar inferential steps may be subsumed. Fallacies may then be understood as argument schemes used incorrectly, or inappropriately. Most argument schemes common in informal reasoning are presumptive or defeasible. But deductive inferences can also be understood as argument schemes, and moreover, not all of the reasoning peculiar to mathematics is deductive. This paper argues that mathematical fallacies may be characterized in terms of argument schemes, suitably generalized to include the more complex inferential steps characteristic of mathematical reasoning. This generalization leads to an intriguing intersection with independently obtained accounts of mathematical reasoning.
(30 minutes)

Mathematical visual forms and learning geometry: Towards a systemic functional analysis
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Mathematics is a multimodal discourse in which mathematical texts use, at least, three different semiotic systems: natural language, algebraic notations and visual forms (diagrams and graphs). Beside the research that has been done in the natural language in

the mathematical texts (Morgan, 1995), there is a need to develop tools to describe the non-verbal features of mathematical texts (Morgan, 2006; O'Halloran, 2005). Based on Halliday's systemic functional grammar and multimodality approach (Kress & van Leeuwen, 1996), I present a preliminary-suggested descriptive framework for these visual forms. My intention is to use this framework in my PhD study which investigates the role of mathematical visual representations in the construction of mathematical meaning in learning geometry and what meanings students make with these representations when they encounter in problem solving. Two examples will be analysed based on this framework and the potential implications of this framework to mathematics learning will be discussed also.

(30 minutes)

Using dynamic geometry tools to introduce Calculus concepts: CalGeo and the case of derivative

Irene Biza and Theodossios Zachariades (University of Athens)
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CalGeo (Calculus+Geometry) is a three-year project supported by EU programme Comenius 2.1. Amongst the objectives of this project is the design of an in-service teacher education programme which employs dynamic geometry (DG) tools for teaching functions and Calculus in upper secondary education. In this session first we present a learning environment and its supporting material designed for the introduction to the notion of derivative at A level; and, secondly, we present its application in a real classroom situation. This environment uses a DG software called EucliDraw that offers a function editor / sketch environment as well as some tools appropriate for Calculus instruction. In this application we use the tangent line and the property of local straightness to introduce the formal definition of derivative. Several cases of differentiable and non-differentiable functions are discussed through their geometrical and symbolic representations.

(30 minutes)

The development of Mental Representations of Number

Giles Dickins (University of Sussex)
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New-born infants have been shown to have some understanding of very small whole numbers, and most children start their schooling with a more-or-less secure understanding of how to count. Even without instruction, they soon develop simple strategies for addition and subtraction of integers. Thereafter progress is much less secure, and, quite apart from the difficulties of recalling multiplication bonds or understanding fraction notation, a fully developed conceptual understanding of number grows very slowly and is often incomplete even in adulthood. (Why else do so many people prefer to describe multiplication by 1.5 as "adding 50%" – and then face such difficulty in accepting that "subtracting 50%" does not get one back to the start?) I am researching the links between written numbers and the relative magnitudes they represent, hoping to show that greater use of visual representations and physical size can help build more secure understanding of the continuous number line. The work of some cognitive psychologists suggests that we have some kind of "mental number line", and I shall present some of their findings, as well as debating their interpretation. I shall also report on my study of primary students' numerical

estimation and discuss ideas for follow-up work next year – which I hope colleagues will contribute to.
(1 hour)

Mathematical Education for Gifted in Egypt
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Mathematics and science gifted students are the hope of Egypt in its advancement in keeping pace with civilization and progress.This presentation takes a critical look at current educational practices for the mathematical education of gifted students in Egypt. It will include: historical developments in the education of gifted student in Egypt; Egyptian ministry of education policy for gifted students regarding the identification (selection) of gifted students, inclusion issue and the educational program; accelerated progression; enrichment activities and teacher education to meet the needs of gifted students.
(30 minutes)

'Maths in my way': Caribbean Students' Perspectives on the Social Role of Mathematics
Patricia George (University of Leeds)
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Increasingly mathematics is being recognised as neither culture nor value-free. This presentation will look at these features of the discipline of mathematics and the possible social implications as viewed by some Caribbean students. Wrapped up in these implications are issues to do with gender, ability grouping practices, and social class. These last two issues become played out in the ways 'school' is enacted. In addressing the three issues, questions are raised such as who mathematics is for, what mathematics is for whom, and for which group(s) of students mathematics may stand in the way. These issues and questions will be looked in a Caribbean context, but they arguably can have meaning in wider contexts. Ideas from Gates & Vistro-Yu's (2003) work *Is Mathematics for All?* along with the perspectives of some Caribbean writers will be used to discuss the data to be presented.
(30 minutes)

Paired Interviews in Mathematics Education
Hilary Evens (Open University) and Jenny Houssart (Institute of Education, London)
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In this session we will consider the advantages and disadvantages of carrying out interviews with pairs of children. Although the Mathematics Education literature contains examples of this method, there is relatively little detailed discussion of the rationale for its use. We will draw on examples from the literature and from our own task-based interviews with pairs of ten and eleven year-olds. We hope those attending the session will also contribute their own views and experiences on this issue.
(30 minutes)

Arithmetical Notating as a Diagrammatic Activity
Ian Jones (University of Warwick)
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I present data from the trialling of a software-based arithmetical notating task designed to foster engagement with the structure of equality statements. The design rationale is "diagrammatic activity" where arithmetic inscriptions onscreen are observed and manipulated according to operational rules. The data suggest that the children's readings of arithmetical notation were transformed from computation to pattern awareness and substitution making. This afforded the emergence of commutative and partitional meaning-making for $a+b=b+a$ and $c=a+$b syntaxes respectively.
(30 minutes)

Introducing more proof into a high stakes examination – towards a research agenda
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We are involved in a partnership with AQA to design, trial and pilot new AS/A2 modules which introduce greater 'stretch and challenge'. One aspect of this work is to include (more) 'multi-step' and proof questions into examinations. There are many challenges along the way, e.g. how can you do this without making GCE maths harder than it already is?! At this BSRLM meeting, however, we'd like to explore the potential research agenda and we'll probably restrict ourselves to proof for a tight focus on the day – but we are happy to extend this to problem solving if people attending the session want this. The research issues in this field are complex and interesting – it is much more than exploring students' and teachers' conceptions of proof: what do we mean by proof; how can you trial now for classroom practice of the future; the power of markschemes; interrelations between 'players' in GCE mathematics. We promise plenty of time for you to express your ideas.
(1 hour)

Mathematics teachers' and ICT: factors influencing perceptions and beliefs
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A case study of a mathematics teacher involved in an ICT INSET programme and an on-line discussion board is considered. The study had three phases with regard to the teacher:
(i) an assessment of needs and a mapping of prior beliefs and perceptions towards ICT; (ii) the INSET programme and participation in an on-line discussion board; (iii) an analysis of changes in beliefs/perceptions. This presentation will present findings from each stage and discuss how INSET may influence teachers' beliefs and perceptions.
(30 minutes)

Teachers' mathematical preparation in initial teacher education
Andreas Stylianides (University of Oxford) & Gabriel Stylianides (University of Pittsburgh)
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An emerging research discourse examines the *mathematical* knowledge that can enable teachers to support successful pupil learning of mathematics. In this session, we discuss how the developing research ideas about the nature of mathematical knowledge for teaching can inform the mathematical (rather than pedagogical) preparation of teachers in initial teacher education. Our discussion uses examples from a semester-long initial teacher education course in the United States that aimed to foster the development of primary school teacher trainees' mathematical knowledge for teaching. To develop the course we followed (over the last four years) iterated design-based research cycles of implementation, analysis, and modification, in an effort to better transform existing research ideas about the nature of mathematical knowledge for teaching into effective learning opportunities for teacher trainees. In the session, we will also engage the participants in a discussion of other possible approaches to promoting mathematical knowledge for teaching in initial teacher education and of possible differences between the American and English initial teacher education contexts.
(1 hour)

Can maths in a test be 'functional'?
John Threlfall (University of Leeds)
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The context for this session is the proposed revision to GCSE mathematics to include 'functional mathematics', and the work of the Pathways team at the University of Leeds (in conjunction with AQA) to develop an assessment of functional mathematics, which is to be piloted from September 2007. The session will present some thoughts about what it means for mathematics to be 'functional' – that is, to be helpful to individuals in their everyday lives and work – and the limitations of 'word problems' for either developing or assessing the competence of pupils in 'functional mathematics', asking what might be done in the constrained context of a timed paper and pencil assessment to deal with the issues. One or two examples of proposed questions will be examined and considered.
(30 minutes)