

## Session abstracts, alphabetically by (sur)name of leader

### Janet Ainley

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#### *The Williams Review of mathematics teaching in primary schools and early years settings*

The Williams Review has the remit to consider and make recommendations in the following areas:

- What is the most effective pedagogy of maths teaching in primary schools and early years settings?
- What range of provision best supports children across the full ability range, including the most gifted?
- (Including specifically making recommendations to inform the development of an early (age 5 to 7) intervention programme for children who are failing to master the basics of numeracy – "Every Child Counts".)
- What conceptual and subject knowledge of mathematics should be expected of primary school teachers and early years practitioners, and how should initial teaching training and continuing professional development be improved to secure that knowledge?
- What is the most effective design and sequencing of the mathematics curriculum?
- How should parents and families best be helped to support young children's mathematical development?

An extensive consultation is currently in progress. In this session I will give some information about how the Review Panel is operating, but most of the time will be given to discussion which can feed into that consultation.

### Hatice Akkoç, Fatih Özmantar and Sibel Yeşildere

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#### *Prospective mathematics teachers' pedagogical content knowledge of definite integral: the problem of limit process*

This study investigates prospective mathematics teachers' pedagogical content knowledge (PCK) of definite integral. Considering the notion of PCK as described by Shulman (1986, 1987), we will investigate prospective mathematics teachers' knowledge of student difficulties in relation to the limit process to define definite integral. For that purpose, four prospective mathematics teachers' were observed during their micro-teaching and were interviewed afterwards. Micro-teaching videos, interview transcripts, prospective teachers' lesson plans and teaching notes were analysed. In this presentation, we will discuss how prospective teachers addressed student difficulties for the limit process when constructing the area under a curve from the sum of rectangular areas and consider the implications in terms of PCK.

### Jenni Back & Tony Beauchamp

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#### *Improving learning in mathematics at Key Stage 2*

This session will describe the findings from a pilot study trialling activities for children in Y5 based on the principles outlined in Malcolm Swan's cpd courses for teachers in FE and adult education settings. The study sought to assess the feasibility of developing a course for primary school teachers based on the same model for professional development and the purpose was to trial model activities with a group of Y5 children over the course of an academic year. We shall present some initial findings and examples and describe the development of the resources for a further NCETM funded research project on which we have just embarked trialling the cpd materials with a group of primary school teachers.

### Alf Coles

#### *Mathematics education - 'a field in disarray'?: the story of a search for a methodology*

In this session I will briefly review some recent reviews of mathematics education research, which seem at first sight to confirm a judgement by Steen (1999) that it 'is a field in disarray'. As a PhD

student, looking at competing methodologies there can seem a bewildering complexity from which to choose. It appears that there are relatively few (three to five, depending on authors) theoretical perspectives or paradigms that guide the field, but a plethora of methodologies that can be used with them. One thing I realise would help me, is if authors were explicit about the 'not's' of any approach they use. In this vein I reflect on my own use of enactivist methodology, and its affordances and constraints, and why narrative approaches (the 'story' in the title) are becoming increasingly important for me. I would value a discussion about some of the issues raised. Does multiplicity matter? Are we a field in disarray? Can or should we be doing anything to try and converge on paradigms? or, agree on effective methodologies?

**Daniel Dinis Da Costa**

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***Exploratory factor analysis of student-teachers' perceptions of 3-D descriptive geometry education in Mozambique***

This study explores the factors underlying student-teachers' perceptions about descriptive geometry education in Mozambique. A grounded theory mixed-method was used to gather data from six focus groups' discussions, ten interviews and a questionnaire with 120 participants. Principal Component Analysis for a four-factor solution was then performed which inductively revealed an interpretable structure, showing items clustered into four factors: Spatial Visualisation and Reasoning, Professional Learning, Evaluation and Learning Support, and Practice. The first is concerned with 3-D geometry foundations, whilst the second consists of items on learning to teach geometry. The third factor pulls together aspects which mediate learning. The final factor concerns practical issues. Practice is found to be the only factor moderately strongly fitting the data. Possible explanations of poor fit are discussed, and implications for further research are suggested.

**Jose Manuel Diego-Mantecón**

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***Assessing Spanish and English students' mathematics-related belief systems***

This is the third of the three papers in which we describe our adaptation, to the Spanish and English educational contexts, of the mathematics-related beliefs questionnaire (MRBQ) developed at the University of Leuven (Op't Eynde and De Corte, 2003). In our earlier papers we showed how the MRBQ was refined to yield four reliable scales, and ten subscales for both Spanish and English Students (Diego-Mantecón et al., 2007), and how the four scales highlighted a number of culture-, age- and gender-related differences (Andrews et al., 2007). In this paper, we examine the structure of students' belief systems as reflected in the interrelations of the subscales. In so doing we present further evidence of the revised MRBQ's sensitivity to nationality, age, and gender.

**Helen M. Doerr**

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***Teachers' Learning and Students' Mathematical Writing***

While much research has focused on the role of writing in student learning, considerably less attention has been paid to how teachers learn to enact writing practices in their classrooms. This study examines how a group of middle grade teachers learned to address mathematical writing when using contextually complex curricula with a diverse population of urban students. Two major shifts occurred in the teachers' practices. The first shift occurred as they moved from seeing the curricular materials as a barrier to seeing them as an opportunity for student learning. The second shift came about as the teachers saw that opportunities for writing needed to be addressed in ways that supported the students' development as mathematical writers over time. I will describe how the teachers' instructional approaches developed over time and conclude with some tentative remarks about a practical theory of teacher learning.

**Patricia George & John Monaghan**

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***Student choice of tool***

We will report on a Year 6 mathematics lesson where pupils were given the task of planning a spectacular birthday party to a given budget – prices (food, music, hire of hall etc) were given but pupils had a wide degree of choice on what they included. Pupils, in pairs, could plan their work using a spreadsheet (tool 1) or using paper-pencil-calculator (tool 2). The class was divided over the tools used. The focus of our session will be on pupils' reasons for choice of tool used and what they did with these tools. The lesson took place in October 2007 and our session will report on initial data analysis. Data collected included: video of the lesson; screen capture and audio recording of three pairs of pupils; pupil work; interviews with the pupils and the class teacher.

**Brenda Hamlett**

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***Mathematical content knowledge of pre-service primary teachers: Developing confidence and competence***

This paper examines the extent to which first year pre-service teachers enrolled in BEd courses in Primary and Early Childhood Education at a Western Australian university can be considered mathematically literate when it comes to teaching the WA primary mathematics curriculum, and describes how confidence and competence have been developed through the introduction of a multiliteracy unit.

**Markus Hohenwarter & Keith Jones**

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***Working Group: Ways of linking Geometry and Algebra: the case of GeoGebra***

Geometry and algebra have been called "the two formal pillars of mathematics". As such, in school mathematics curricula around the world, geometry and algebra are given a prominent position, especially at the secondary school level. In some countries this means entirely separate courses on geometry and algebra, while in other countries, the curriculum alternates topics from the various components of mathematics. This working group session provides a forum for discussing ways of linking geometry and algebra through consideration of the affordances of GeoGebra, a free open-source software that is a versatile tool for visualizing mathematical concepts from elementary through university level. Following a presentation of examples of teaching ideas using GeoGebra for secondary school mathematics, there is the opportunity to discuss current emphases and treatment of geometry and algebra in the school curriculum and the current and potential impact of technology such as GeoGebra and the implications of all this for the development of, for example, mathematical reasoning and proof in students. Looking to the future, a further topic for discussion might include the implications of all this for the pre-service and inservice education of mathematics teachers and what changes in the school mathematics curriculum might come about over the next ten years or so. The working group is open to all.

**Markus Hohenwarter and Zsolt Lavicza**

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***Mathematics Teacher Development with ICT: towards an International GeoGebra Institute***

Research indicates that despite the established benefits of using ICT in mathematics education, the process of embedding ICT in classrooms is complex and teachers need more than just being provided with software if the promise of ICT is to be more fully realised. GeoGebra is free open-source software that is a versatile tool for visualizing mathematical concepts from elementary through university level. To support users of the software, GeoGebraWiki and a user forum provide platforms for sharing teaching ideas and supporting, and receiving support from, fellow users. Given that research suggests that, for the majority of teachers, solely providing software is insufficient and that training and collegial support enhances teachers' willingness to integrate technology into their teaching and develop successful technology-assisted teaching practices, we describe our aim of establishing an

International GeoGebra Institute (IGI) to provide training and support for teachers and to design a certification scheme that enables participants to become GeoGebra trainers at different levels. While our current plan is that IGI will be first established at Florida Atlantic University (USA), our goal is to collaborate with colleagues and to set up other institutes in various locations. In our talk, we outline the ideas and plans for IGI and seek feedback from participants. Furthermore, we are looking for colleagues who would be interested in collaborating in IGI-related projects.

**Anesa Hosein**

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***What ARE they doing?: Strategies that students employ to solve problems***

An ongoing study investigates how students' learning differ when answering mathematical problems with the aid of various types of software namely, black-box software (no steps shown), glass box software (steps shown) and open-box software (allows interaction at each step). Students answer nine conceptual or procedural problems whilst thinking aloud. This session invites audience to view video data clips and help answer the following questions: Is there any difference in how students learn with the software types? Are students likely to explore with one software type over the other? Are they making more self-explanations or drawing more on real-life contexts depending on the software type? Are their strategies for solving the problems varying depending on the software type?

**Marie Joubert**

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***Classroom Mathematical Learning with Computers: The mediational effects of the computer, the teacher and the task***

This presentation reports on a study concerned with student implementation of mathematical tasks, in authentic mathematics classrooms, which involve the use of ICT. It analyses students' mathematical learning and relates this learning to the design of the tasks.

Video data taken from six case study lessons, and supported by data such as screenshots and written material, was analysed using a theoretical framework developed from the work of Brousseau (1997). Brousseau's theory suggests a relationship between the mathematical learning of students and the types of interactions between the students, the teacher and the mediational means. The findings of the study reveal disappointing levels of mathematical learning in terms of Brousseau's theoretical perspective. A detailed analysis of the tasks, as they were set up by the teachers, however, demonstrates the limitations of these tasks in terms of their potential for bringing about the sorts of learning described by Brousseau and contributes to an explanation of the disappointing mathematical learning of the students. These findings, informed by the non-interventionist paradigm adopted, in which naturalistic classroom situations are studied, point to the need to support teachers in the engineering of classroom tasks to take into account the dialogic relationship between the mathematics and feedback from the computer, so as to exploit the power of the feedback and to plan their own interventions accordingly.

Reference: Brousseau, G (1997) Theory of Didactical Situations in Mathematics London:Kluwer.

**Phillip Kent**

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***Pseudo-mathematical Practices and Techno-mathematical Literacies in the Workplace***

Results are presented from the recent project, "Techno-mathematical Literacies (TmL) in the Workplace", investigating the functional mathematical knowledge required by employees in workplaces in different industries. We focused on situations where communication between "communities of practice" depended on artefacts, "symbolic boundary objects," representing mathematical models that are part of the workplace practices. We found often that there was a failure to understand these models which led to limited communication. For example, we observed shopfloor employees of an automotive company struggling to find meanings for statistically-expressed data used in process monitoring and improvement. We commonly observed such "pseudo-mathematical"

understanding – numbers were labels disconnected from the underlying mathematical models. In prototype learning interventions, we adapted existing symbolic boundary objects to the development of software tools, “technology-enhanced boundary objects,” for the learning of TmL. We assessed whether employees could then progress to more effective levels of communication.

**Vlasta Kokol-Voljc**

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***Use of mathematical software in pre-service teacher training: the case of GeoGebra***

Use of mathematical software in pre-service teacher training for preparing students to become mathematics teacher, has two aspects:

- Using mathematical software as a support for pre-service teacher training
- Preparing the future teachers for using mathematical software for their teaching.

In the presentation theory and practice of the second item will be discussed and the software GeoGebra will be used to illustrate ideas.

**Chris Kyriacou & John Issitt**

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***Teacher-pupil dialogue in mathematics lessons***

This paper reports the findings of a systematic review of the literature looking at what characterises effective teacher-initiated teacher-pupil dialogue to promote conceptual understanding in mathematics lessons in Key Stages 2 to 4. The review was based on an in-depth analysis of 15 studies. Eight key characteristics were identified: going beyond IRF (Initiation-Response-Feedback); focusing attention on mathematics rather than performativity; working collaboratively with pupils; transformative listening; scaffolding; enhancing pupils’ self-knowledge concerning how to make use of teacher-pupil dialogue as a learning experience; encouraging high quality pupil dialogue; and inclusive teaching.

**William O. Lacefield**

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***An Exploration of Primary Teachers’ Instructional Methods and Dispositions Toward Teaching Mathematics***

Do primary teachers’ dispositions toward mathematics instruction have an effect on their teaching effectiveness? In the hopes of stimulating opportunities for reflection as well as professional development ideas, this session will highlight a research study that explored primary teachers’ dispositions toward mathematics instruction and their methods of teaching mathematics. Discussion will focus on the importance of the study of dispositions and future research possibilities.

**Elaine Lam**

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***Mathematics education in Barbados and Trinidad: challenges and progress***

Mathematics education in Barbados and Trinidad is undergoing significant changes from traditional ‘chalk and talk’ to more emphasis on problem solving approaches and culturally situated Mathematical questions. This session will provide an overview of Mathematics education in the Caribbean region with specific focus on Barbados and Trinidad based on the author’s PhD thesis. Findings from this study are based on over 40 interviews and 80 hours of observations. Curriculum documents as well as specific Mathematical problems will be examined. There will also be some discussion regarding the possibility of education borrowing - the attempt to share best practices across the region – as a means of improving the quality of education in the region. The session will focus on the themes of cultural conflicts, teaching styles and implications for Maths education in both the Caribbean and globally as some of the challenges in Barbados and Trinidad are universal. By examining Maths education in a different context, we may be able to learn more from each other.

**Chris Little**

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***Coursework assessment of A level Mathematics: A survey of student opinion***

The session will report the results of a short survey of student opinion after completion of a piece of coursework in numerical methods for A level mathematics from a sixth form college. 228 students (138 males, 90 females) responded. The session will give the opportunity to discuss these results in the context of the decreasing use of coursework assessment in 'high stakes' assessment of mathematics at GCE and GCSE in England and Wales.

**Heather Mendick, Sumi Hollingworth, Marie-Pierre Moreau & Debbie Epstein**

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***Being a Sumbody: new stories of choosing mathematics***

We live in 'new times' defined by a political framework of neo-liberalism. This has led to an expansion of market economics, notably into public sector areas including education. Within this world consumer choice is central; it makes the free market function. These choices are not only acts of consumption; they are also a means of making one's-self; individuals must become 'entrepreneurs of the self'. In this session we will look at: What does it mean for students to make subject choices within this framework of compulsory choice and entrepreneurship? And, in particular, how do people choose mathematics in this context? We will do this by looking in detail at interviews with 11 people who chose to study mathematics at university.

**RECME research team (Els de Geest, Rosamund Sutherland, Marie Joubert, Jenni Back & Christine Hirst)**

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***Working Group: Developing a Framework for Researching Professional Development in Mathematics***

In October 2007 the National Centre for Excellence in Teaching Mathematics (NCETM) launched the Research into Effective CPD in Mathematics Education (RECME) project. The design and research questions of this study were in part informed by previous NCETM/BSRLM workshops and by a literature review funded by the NCETM. This workshop will present the current status of the RECME project and will include an overview of the literature review. Participants will be invited to contribute critical feedback to the presentations and to make suggestions regarding future directions; the aim of the workshop is to take into account the voice of the community so that RECME develops as a collaboration between all interested parties.

**Nusrat Fatima Rizvi**

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***Synthesis of taxonomies/frameworks used to analyse different aspects of written and tested curriculum***

Several researchers (Smith et al 1996; Biggs, 1995; Anderson & Krathwohl, 2001; Porter, 2002) have developed different taxonomies/frameworks for analysing written and tested curricula. This paper synthesises them in order to develop an integrated framework which is appropriate for mathematics curriculum. The paper will also discuss how the new framework is being used in analysing different aspects of examination curricula of secondary school mathematics in Pakistan.

**Stuart Rowlands**

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***Reflections on the philosophy of mathematics education***

Much reference has been made to Paul Ernest's 'philosophy of mathematics education' to legitimise current trends in mathematics education. This session presents the argument that

1. The 'philosophy' is more a sociology than it is philosophy.
2. The very basis of the 'philosophy' contains a contradiction – that mathematics cannot be separated from its social origins, yet mathematics has a logical necessity that is independent of origin.

3. The 'philosophy' downplays mathematics as a formal, academic discipline in the attempt to promote a child-centred pedagogy.
4. The 'philosophy' makes unwarranted assumptions that have been taken as 'given'. For example, that 'absolutist' or 'Platonist' views of mathematics necessarily implies the transmission model of teaching mathematics.

It is the very nature of philosophy to discuss. The aim of the session is to promote debate that is otherwise practically non-existent in education.

### **Tony Shepherd**

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#### ***NCETM Mathematics Teaching Self Evaluation Tools Focus Group***

The self-evaluation tools will enable teachers to evaluate their own strengths and weaknesses, and provide tips on some possible next steps. It is envisaged that this will be of use to teacher educators, teachers, mentors and managers. Tools for assessing subject knowledge for teachers of learners at all stages are being developed. We also recommend a number of tools developed by partner organisations. We are currently testing the tools with a variety of potential users, and using the feedback to make improvements. The workshop will allow BSRLM members to test the tools and give feedback to NCETM. Users can access the self-evaluation tools if they are registered on the NCETM portal by using the link on the home page.

### **Andreas Stylianides**

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#### ***Tasks with Notable Influence on Students' Mathematical Experience: The Blonde Hair Problem***

In mathematics courses for students of all levels, instructors select/design and implement many mathematical tasks of which only few stand out as having notable influence on students' mathematical experience. What features of these tasks and their implementation might account for this influence? This informal session will explore this question in the context of the Blonde Hair Problem (BHP). In every enactment of a mathematics course for prospective primary teachers during the last four years, more than 30% of the prospective teachers included the BHP in the list of three activities from the course (more than 40 activities in total) that they felt contributed the most to their learning. In the session, I will engage the participants in solving and discussing the BHP. Also, I will describe how the BHP was implemented in the course and I will make available to the participants written reflections of prospective teachers who worked on the problem. On the basis of these reflections, our collective goal will be to (1) characterise prospective teachers' experience with the BHP, and (2) gain insights into features of the BHP and its implementation that might have contributed to this experience.

### **Fay Turner**

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#### **Beginning teachers' use of representation as viewed through the lens of the Knowledge Quartet**

The observations I will present in this session are from the first three years of a four-year longitudinal study into the development of mathematics teaching in beginning primary school teachers. The study involves participants in reflecting on the mathematics content of their teaching through the lens of the Knowledge Quartet framework. One interesting theme that has emerged relates to the teachers' use of representations in their teaching. Data from the study suggests that use of representations was a key feature of lessons and that these representations were not always appropriate. There is some evidence from the participants' reflections that focussing on content knowledge has facilitated the development of pedagogical content knowledge in relation to the use of representations. I will show three video clips of teaching episodes to stimulate discussion and offer some ideas of my own

**Anne Watson**

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***Adolescent learning and the mathematics curriculum***

This session is inspired by the presentation by Stanislav Stech at PME in Prague, 2006. I shall present some thoughts about the learning of adolescents in a Vygotskian tradition and how the secondary mathematics curriculum presents opportunities for their intellectual development through engaging with scientific concepts. Examples will be given. I should like to see how these ideas relate to the work of colleagues who approach adolescent learning from the perspectives of agency and identity.

**Marcus Witt**

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***Can working memory training affect the mathematical performance of children in primary school?***

There is considerable research evidence linking working memory performance with children's mathematical attainment in primary school. There is, however, much less evidence concerning the possibility of training working memory and still less regarding the effects of such training on children's mathematical performance. In this study 21 normally achieving children in Year 5 were given a six-week course of working memory training. Their working memory and mathematical performance were compared with those of a control group matched for age, mathematical and working memory ability. The results suggest that working memory training may represent a profitable way forward for improving children's accuracy with mental calculation.

**Tracy Wylie**

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***Observing Students' Use of Images through their Gestures and Gazes***

In this paper I report on a study observing six year 13 students (18 years of age) working in pairs on a set of mathematical problems, to test the hypothesis that students who have access to a geometrical image will be more successful in solving a problem than if they do not and this use of imagery is demonstrated through students' actions. The research was done from a constructivist perspective, looking through a socio-cultural lens, and uses the language associated with the area of semiotics. It is concerned with the relationship between mental imagery, thought and action. The results have showed that it is possible to observe students' use of imagery through their gestures and those students who have access to and are able to manipulate mental images are more successful problem-solvers.

**Constantinos Xenofontos**

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***Primary teachers' beliefs about mathematical problem solving, their problem solving abilities, and the impact on instruction: A case study of three Cypriot teachers.***

While teachers' beliefs about mathematics, its teaching and learning have been extensively examined, mathematics teachers are neglected as far as both their beliefs and abilities on problem solving are concerned. This session will be about three Cypriot primary teachers. The main purpose of the research was to sketch the three teachers' profile, as regards their problem solving beliefs, abilities and teaching actions. All of them were interviewed about their mathematical problem solving beliefs. A non-routine mathematical problem was presented at the end of each interview, and the teachers were observed while they were solving it. Additionally, the teachers prepared a lesson individually, based on the problem and taught it to their classrooms. Teachers' actions were the focus of the three lessons' observations. Research findings confirmed the well documented argument about inconsistencies between teachers' beliefs and practices. Moreover, the impact of beliefs and abilities on teachers' instructional practice is found to be complex as well, while these three factors (beliefs, abilities and practices) are not in a cause and effect relation.