



**BSRLM Day Conference
University of Bristol, 20 June, 2009**

A. Janet Duffin Memorial Lecture

The Janet Duffin Memorial Lecture will take place at the day conference. The speaker is Nathalie Sinclair of Simon Fraser University, Canada.

B. Conference Sessions

Ampah – Mensah, Alfred

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Teachers' use of language in teaching mathematics in basic schools in Ghana.

This presentation will highlight teachers' use of language in the teaching of mathematics in a primary and junior secondary school in Ghana. Ghana's language policy is for teachers to use English, which may be unfamiliar to most pupils, for classroom interaction. Pupils are expected to acquire their school subject knowledge through the medium of an unfamiliar language – English. This study is an ethnographic case study to examine how teachers used language to enhance learners learning of mathematics. The study also focused on how teachers used and taught mathematical language. Data was collected through video and audio recordings and field notes of mathematics lessons and were triangulated with teacher interviews and documents. It was observed that classes were teacher dominated and controlled with very little interaction. Teachers however used the local language for explanations and also to reprimand pupils, even though this practice was against the official language policy. Though teachers largely used decontextualised explanations (Khisty, 1993), they also adopted various teaching strategies to help pupils to acquire the appropriate mathematical language (Gutierrez, 2002). These issues will be explored in this paper.

Back, Jenni

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RECME Findings: professional development and student change

Marie Joubert's presentation (see programme) raises some questions about student learning and its relationship with changes in teachers' practices. It is generally agreed that changed student behaviour and more particularly improved student learning is the ultimate goal of professional development for teachers of mathematics. This presentation will focus on some of the findings of the RECME (Researching Effective Continuing professional development in Mathematics Education) Project in relation to student learning. Jenni will share examples of the ways in which professional development encouraged teachers to talk about student learning and give examples of the ways in which the participating teachers talked about student learning. Further discussion will consider the implication of these findings for designers of professional development opportunities.

Billingham, Tim

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Using learning styles to build rapport and promote mathematical thinking in primary learners

A presentation of research into how primary teachers can use knowledge of children's learning styles to build rapport and promote mathematical thinking in primary learners. Children often harbour a negative attitude towards mathematics. If the mathematics teacher could be an influential and extremely positive role model for learning mathematics, children

would release their negative attitudes and adopt a positive attitude similar to that of the teacher. Employing a simple and elegant test, teachers can identify children's primary and secondary learning styles in minutes. This research attempts to discover simple techniques teachers can use to engage and enthuse mathematics learners. By matching language with specific learning styles, teachers can build rapport with children. Attitudes and behaviours are observed that demonstrate mathematical thinking in response to a teacher verbally converging with their learners' specific learning styles.

Black, Laura, Mendick, Heather, Rodd, Melissa and Solomon, Yvette
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Mathematical relationships: insights into psychoanalytic tools

This session focuses on psychoanalytically exploring extracts taken from autobiographical narratives of our relationships with maths. We look at how 'positions' and 'states of mind' shift in response to experiences of maths pedagogy, curriculum and assessment: moving between feelings of 'now I am judged', 'now I am chosen', 'now I am wrong', 'now I belong', 'now I am abandoned' or 'now I am loved'. We discuss how these feelings engender defences which are a response to and in turn affect a person's relationship with maths. For, borrowing from psychoanalysis, we are all 'defended subjects', forged out of unconscious defences against anxiety. We will ask: How far can these psychoanalytic understandings take us in looking at people's relationships with maths? How can we connect these psychic processes to social processes around gender, class, and so on? What are the implications for how we teach and assess maths?

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Subject knowledge or teaching practice(s): well qualified mathematicians engagement with lesson planning

We have been interested in trying to get new mathematics teachers to think about mathematics and mathematical structure in planning their lessons rather than reproduce procedures - a linear vs networked conception of the topic to be taught. We have been concerned, however, that apparent expertise in mathematics is not an indicator of planning lessons in this way. The Ofsted Report (2008), Understanding the Score, said: "The main difference between good and satisfactory lessons is in teachers' expertise in mathematics and how they use it to promote the learning of all pupils." As part of a pilot study we have interviewed some students who had PhDs in mathematics and found that their constructions of the mathematics to be taught was predominantly procedural. We have developed our Map, Narrative, Orientation (MNO) approach to formulate a relational space which enables us to generate a description of these aspects of lesson planning. This session will look at some data from the interviews and lesson planning and an analysis based on Dowling's Social Activity Method (SAM).

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Generalisation and perceptual agility: How teachers fared in a generalising problem

This presentation reports a study that inquires into teachers' perceptual agility when solving a quadratic generalising problem. Lee (1996) describes perceptual agility as the ability to see a pattern in multiple ways. For some time now, its importance in mathematical generalisation has been emphasised by several researchers (Lee, 1996; Mason, Graham, & Johnston-Wilder, 2005). The emphasis seems even greater in today's society where 21st century learning calls for students to think creatively and use both conventional as well as innovative methods in problem solving. Thus, it would be reasonable to perceive perceptual agility not as a luxury but a must-have for all students, and no longer just for the more-able students. However, to nurture students and develop their perceptual agility, teachers must firstly be adept at seeing a pattern in different ways so as to provide proper guidance. But are teachers perceptually agile themselves? This is what this presentation will attempt to unveil. In this presentation, the capability of a group of teachers in deriving multiple rules for the same problem will be discussed. In particular, their generalising strategies will be focused on.

Coles, Alf

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The ethics of learning within a research context

In this paper I raise the issue of what constitutes ethical behaviour in the context of a long-term classroom-based research project. I argue that there is a dilemma, as a teacher-researcher, in the need to gain informed consent and the desire to keep classroom discourse focused on learning mathematics. Drawing on transcript data from a teacher meeting in which we discussed a video clip of me teaching, I suggest Varela's (1999) concept of 'ethical know-how' may offer a way through the dilemma. After a presentation of these issues and the data (including watching part of the same video clip as we did in the teacher meeting), I hope to provoke an extended discussion.

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Trainee teachers' perceptions of paired placements: Maslow's hierarchy in evidence

This work arises from funding that each of our institutions has had to develop work with trainees in paired placements. Interviews were conducted with each of the trainees who experienced a paired placement, and their mathematics mentors, and with some of the professional mentors in schools. Transcripts of these interviews with trainees were analysed using Maslow's hierarchy of needs. In this session, we present evidence at several of Maslow's levels, such as physiological and 'belongingness' needs, esteem needs, the need to know and understand, and self-actualisation needs. We, further, explore the models for placements in each of our institutions which have arisen as an outcome of this funded work.

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Teaching Pythagoras's Theorem through an Historical Perspective; Ideas and Students' Reactions

Within the context of an annual research plan, a group of 12 students who lacked success in secondary (IGCSE) mathematics were taught mathematics using a non-traditional approach. Among the lessons taught in this program was "Cultural Mathematics", where students were taught mathematics through an historical and cultural perspective. Students could provide feedback at any point of the course and decisions were made as to how the program should evolve. One of the chapters taught involved Pythagoras's Theorem, which was approached through its uses in Ancient Babylonia and China, through its existence and proof in Ancient Greece, and through Pythagoras and the Pythagoreans. The design of the lessons is presented here, along with comments and students' reactions to this novel historical/cultural approach. Students were assessed through a Project. All students completed their task, some more successfully than others. The fact that they had never done a project in mathematics before, seemed to have an important role to play.

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Students' expectations and the double-edged sword of liminality in mathematics educational transitions

In two complementary ESRC funded projects we are studying the transition of students into mathematics and mathematically demanding subjects at college and university. In this paper we focus our attention on a particular kind of "transitional practice" where students are in between the two phases of the transition, i.e. they are about to finish or have already finished their GCSEs or A-levels and are waiting to become college or university students. Practices that may take place in this in-between phase include open days, taster days, induction week events or waiting for grades which determine entry. We focus our analysis on 25 + 10 interviews with pre-college and pre-university students, respectively, and their expectations for mathematics in further or higher education. In order to analyse our data, we borrow from Turner's (1969) concept of liminality to explore the outcomes of these experiences for students and how these liminal "spaces" (Gyerin, 2000) impact on their transition, particularly in relation to learning mathematics. Our analysis suggests that on the one hand,

these spaces provide for a re-storying of the students' identities in which they imagine themselves as "new", more grown-up individuals. But, on the other hand these spaces can also provide for the creation of false expectations of what studying mathematics at a higher level really involves. For instance, some students might expect mathematics to be more "fun" or more applicable to their studies, but these expectations are not met or could be totally different when they arrive at the new institution. We will explore some of the possible consequences of this more negative side of liminality and what institutions might be able to do to acknowledge these problems.

Hunter, Jodie

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Facilitating productive discourse in Primary mathematics classrooms

In current reform of mathematics classrooms developing mathematical learning communities in which students have opportunities to engage in productive mathematical discourse is of key importance. A challenge for teachers is to develop collaborative interaction through orchestrating and facilitating productive mathematical discourse. In this paper, I address how a teacher used interactional strategies in order to facilitate the participation of Year 5 and 6 students in mathematical discourse. I outline the pedagogical strategies the teacher used to shift students' patterns of participation from passive listeners and engaging in non-productive disputational talk to engaging in collaborative interaction and productive mathematical discourse.

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Cognitive and emotional aspects of second year mathematics students.

Encounter with abstract algebra: the role of the lecture

Abstract Algebra is one of the mandatory courses taught usually in the second year of a Bachelor degree in Mathematics and is typically considered by the students as one of the most challenging ones. Often, after their first encounter with Abstract Algebra, students tend to avoid third-year or further courses in this area of mathematics. Previous research attributes student difficulty with Abstract Algebra to its multi-level abstraction and the less-than-obvious, to students, *raison d'être* of concepts such as cosets, quotient group etc. The study we draw on here is a close examination of the cognitive, social and emotional aspects of Year 2 mathematics undergraduates' learning experience in Abstract Algebra. Our data consists of: observation notes and audio-recordings of 20 lectures and 12 group seminars of a 10-week Year 2 Abstract Algebra course attended by 78 students in a well-regarded mathematics department in the UK; regular interviews with 13 of the 78 students, the course lecturer, two group seminar leaders and two group seminar assistants; the 78 students' coursework and exam papers; and, the markers' written comments on marked student coursework. Analysis is currently in progress. In this paper we will concentrate on some preliminary observations on the lecture data (observation notes and audio-recordings) and we will discuss issues including: the apparently diminishing student engagement over the ten weeks of the course; the variable learning effectiveness of the examples and visualisation used in the lectures; the lecturer's various strategies for introducing new concept definitions and for improving the interactivity of the lectures; and, the potential, but perhaps elusive to the students, significance of the running oral commentary that supplements the lecturer's writing on the board.

Joubert, Marie

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Professional development for teachers of mathematics: dimensions of change

This presentation has two intertwined strands. The first develops a step-wise analytical framework for the analysis of data taken from the Researching Effective CPD in Mathematics Education (RECME) project, which came to an end at the end of March 2009. The second presents relevant findings from the RECME project, as the framework is developed. The focus of the presentation is change; change in teachers, change in teaching practice and change in student learning. The findings suggest that teachers learnt new knowledge and skills which can be understood in terms of mathematics, the ways students learn mathematics, students'

understanding of mathematics, ICT used in mathematics teaching and learning, information and research literature. Teachers also reported changes in terms of attitudes and beliefs. Changes in teaching practice included trying out new approaches and ideas in the classroom and embedding changed ways of working within the classroom. Changes in approaches to teaching might provoke changes in student learning; the presentation concludes by considering the research challenges involved in unpicking both changes in student learning and the relationships between such changes and changes in teachers' classroom practice.

Kleanthous, Irene

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The influence of parental aspirations on students' dispositions to study further maths in HE

During this session I will discuss the findings of the pilot for my PhD study. This PhD study aims to investigate the influence of parental aspirations on students' dispositions to study further maths in HE both quantitatively and qualitatively. For the quantitative part of the project a scale was designed to measure students' perceived parental aspirations, inclination to mathematics and maths self-efficacy. The questionnaire was distributed to 300 students in Cyprus and the results indicated that parental influence was not statistically significant. On the other hand the qualitative design of this PhD examined 22 students' perceptions of parental influence through individual interviews. The qualitative data analysis provided some interesting insights on students' perceptions of parental influence. I argue that parental influence is unconscious and I draw on Bourdieu's concepts of habitus, social and cultural capital to discuss the findings of this PhD project.

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Language and proof: Can a non-proof prove?

The way words are used in natural language can influence how the same words are understood in mathematical contexts. In this session we present evidence which suggests that this phenomenon -- which Pimm (1987) called the semantic contamination effect -- plays a role in determining how students engage with mathematical proof. Analyses of responses to argument evaluation tasks suggest that students may hold two different and contradictory conceptions of proof: one related to conviction, and one to validity. Here we demonstrate that these two conceptions can be preferentially elicited by making apparently irrelevant linguistic changes to the task instructions. After analysing the occurrence of the noun ("proof") and verb ("prove") referents to mathematical proof in natural language, we report two experiments that suggest that the noun referent privileges the validity conception, and that the verb referent privileges the conviction conception. In short, we show that non-proofs can sometimes prove.

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The Effect of Real-World Context in Sequence Questions

This session will report on interim findings of a research study into the effect of real-world contextual framing on questions on arithmetic and geometric progressions (APs and GPs). This involved a sample of over 600 year 13 students, who answered a test on APs and GPs. They were randomised to answer one of four test versions, in which questions with the same mathematical solution were framed in Explicit, Algebraic, Word and Pattern forms. Facility rates were then compared to identify the effect of each form of framing on the difficulty of each question. A questionnaire was also given to students to explore their attitudes to real-world contextual framing in mathematics questions. If time permits, the results of this questionnaire will also be presented.

Osmon, Peter,

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Towards a maths A-level curriculum for the 21st century

Maths A-level is a university entrance qualification- primarily for courses leading to the various quantitative professions. The current poor take-up of maths at A-level effectively restricts the number of candidates for entry to these professions- or at least reduces their

effectiveness- matters of national concern. The A-level curriculum may be a factor contributing to poor take-up. Under the headings: up-to-dateness, foundational across the range of professional needs, and coherence, a proposed investigation of the curriculum's fitness for 21st century purposes is described.

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Analysing the relations between teachers' cognitions: Differences and similarities in the teaching modes of two primary teachers

The teacher's cognitions (goals, beliefs and knowledge) assume a major role in their practice. Through the exteriorization of those cognitions – in action – teachers reveal their perspective and how they envisage the teaching process. To study these cognitions, the relations between them and the way they are exteriorized (type of communication, resources and pupils way of work) a model has been elaborated. For such process we focused on the practice of two primary teachers and, from the analysis of that practice, using the model, is possible to frame the teaching modes of each teacher. In this session I will present, briefly, the modeling process and discuss the teachers cognitions identified in a concrete set of episodes. I will discuss the similarities and differences in the teaching modes of the two teachers in that specific set of episodes. This intends to conceptualize, in a deeper way, the elaboration of a "single case" from the two teachers teaching modes. This "single case" aims to be a theoretical one, inspired by the particular cases of those two teachers. (I will and ask for the participants to analyse and relate the similarities and differences in teacher's practices according to their own framework to gain a greater insight concerning different possible conceptualizations of such "single case".)

Rodd, Melissa

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Professional development in mathematics teaching: two applications of psychoanalytic tools

This session follows on from the presentation and discussion in *Mathematical Relationships: insights using psychoanalytic tools* in that I apply ideas developed through our collaborative *Mathematical Relationships* work to mathematics teacher development. The two 'applications' I shall report on are (1) the application of the tool 'defended subject' to mathematics teachers learning geometry; (2) the application of the tool 'states of mind' to observing in mathematics classrooms; in particular, classrooms in which mentors or leading teachers are observing others teach pupils who have additional to typical needs. In (1) the 'defended subject' is used to help understand why geometry is a particularly difficult part of mathematics to teach. In (2) 'states of mind' are used to explain different 'readings' of classroom observations, particularly when pupils with dyslexia, dyspraxia, ADHS or autism/Asperger's are involved. A discussion point I shall raise is how do such psychoanalytic notions become 'tools to think with' in the context of mathematics teachers' professional development? All welcome, whether you attended the *Mathematical Relationships* session or not, though some ideas discussed during that session will be used in this shorter session.

Russell, Rosemary

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Why do parents help their children with maths ?

My PhD research, 'Parents Helping Their Children With Mathematics', illuminated the hitherto unresearched 'hidden' help that parents give their children with maths. In other words, help that is initiated by parents themselves, without prompting from school or researchers. Help of this kind, is behind closed doors, in the privacy of the home, away from the view of schools and researchers. It established that the practice exists; that without prompting from school or researchers, parents do help their children with maths, and the practice is more widespread than had previously been acknowledged. It identified seven new aspects of why and how parents help with maths. In this presentation, I shall discuss the methods I used to research this topic. I shall be reporting on some of my findings by focusing on answering the question: Why do parents help their children with maths?

Sunderlik, Jan

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Contrasting pre-service teacher education and school practice in two countries

In this session, I will present two contrasting mentor meetings methodological issues and some approaches to exploring the development of mathematics pre-service teachers' during their student teaching. I am looking from an insider's perspective, trying to identify themes that are similar for both countries, Slovakia and England.

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Breaking the anxiety spiral: the impact of innovations in teacher trainees' subject knowledge instruction

In November 2008 we presented initial findings from a longitudinal research project which had tracked primary teacher trainees' attitudes towards mathematics through their PGCE year. The data included information about trainees' anxiety about mathematics as well as their perceptions of themselves as mathematicians and as teachers of mathematics. Questionnaires were given to all the trainees at three points during the year in order to establish a general, global picture about their changing attitudes. The factors that influenced those changes were explored in more detail through interviews with small groups of trainees.

In this paper, which had an identical methodology, we report the findings from the second year of the project. This year, the way that the trainees' subject knowledge was addressed was changed. Half of the subject knowledge sessions focused on trainees carrying out and then reflecting on mathematics investigations. This was in contrast to the previous year's more 'traditional' didactic approach where there was an emphasis on conveying knowledge. The changes in trainees' attitudes this year are compared with those from last year and their comments about the causes of those changes are examined, specifically with reference to the changes in the subject knowledge provision. The findings provide further insight into trainees' experiences of learning to be primary mathematics teachers and the, often unexpected, factors that have an impact on their changing attitudes.

C. Working groups

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Geometry Working Group

During the primary school years, children are typically expected to develop ways of explaining their mathematical reasoning. This working group session provides an opportunity of working with Nathalie Sinclair on some of her data from a project which involved young children (aged 5-7 years old) in a whole-class situation using dynamic geometry software (specifically Sketchpad). Amongst the classroom episodes the working group can analyse is one in which the children are looking at the rotational symmetry of various 2D shapes and making conjectures about what the symmetry might be for other shapes. In another episode the children try to decide whether two lines that they know continue (but cannot see all the continuation) will intersect, or not. Everyone is welcome to join this working session; it is open to all.

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Consultation on QCA proposals for AS/A-level maths

QCA has published proposals for revision of the AS/A-level maths curriculum from 2011. The proposals may be found at-

http://www.qca.org.uk/qca_22191.aspx

QCA is consulting with interested parties and the aim of the working group will be to generate an agreed response.

Rogers, Leo

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History in the Mathematics Classroom

The 2008 Programmes of Study for KS3 and 4 declare that one of the Applications and Implications of Mathematics is that pupils should be “Recognising the rich historical and cultural roots of mathematics” (Key Concepts 1.3 (c)). There is a significant lack of easily accessible material available to help teacher-trainers, teachers and pupils achieve these stated aims, and a general lack of experience in integrating appropriate historical and cultural ideas into mathematics teaching. There have been many claims made for the benefits of introducing the history of mathematics in our teaching, and one objective for a Working Group is to examine some of these claims and test the ideas in our current climate. From the experience gathered we may be able to produce case studies and investigate possible theoretical foundations to inform both cognitive and affective aspects of or teaching. From a practical point of view, by starting with our standard curriculum we need to examine whether it will be possible to suggest historical information or short ‘episodes’ that can support the rationale, learning and motivation of particular areas of mathematics at different levels. The aim of the Working Group in the first instance will be to select, share, trial, evaluate and modify appropriate material in the light of teachers’ experience so that together we may discover sensible ways of introducing the “rich historical and cultural roots of mathematics” to our pupils.

Watson, Anne

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Trigonometry Working Group

In this session we will review the initial activities undertaken by members of the working group, i.e. short teaching experiments and a scoping survey to find a range of methods used by teachers to start trigonometric thinking. In addition we will be circulating relevant readings. We shall identify issues raised by these and propose next actions. New members are welcome to join the group and please email anne.watson@education.ox.ac.uk if you would like to catch up with readings and notes from earlier meetings.