



BSRLM Day Conference, University of Southampton, 21 June 2008

This event is dedicated to the memory of Brian Griffiths, 1927-2008

Brian Griffiths (Professor Emeritus, University of Southampton) died suddenly on Wednesday 4 June 2008.

Brian was a pioneer in many ways. Appointed professor at Southampton in 1964, Brian was a founding editorial board member for *Educational Studies in Mathematics* (1968-78) and wrote a number of books and monographs with teachers in mind. In his books he looked at classical mathematics from a contemporary viewpoint (for example, *A comprehensive textbook of classical mathematics* written with Peter Hilton; chapters on analysis in the *SMP Companion to Advanced Mathematics*) and he provided introductions to advanced mathematical topics, such as *Topology* (ATM, 1967), *Surfaces* (CUP, 1976), and *Mathematics of Models* (with Adrian Oldknow, 1993). Brian, along with Geoffrey Howson, pioneered work on the relationship between mathematics and society. Their book “*Mathematics: society and curricula*” remains important.

At Southampton, Brian pioneered and supported the development of undergraduate mathematics options on the history of mathematics, the mathematics curriculum, problem solving and investigations, mathematical modelling, and student-directed projects. These developments were influential in undergraduate mathematics education both nationally and internationally. With Heine Halberstam, he established (in 1975) the annual UK conference on the teaching of mathematics to undergraduates. Brian was involved in the *School Mathematics Project* (SMP), served as a chair of the *Joint Mathematical Council*, and chaired the steering group for LAMP (*Low Attainers Mathematics Project*) 1983-6 and its successor RAMP (*Raising Achievement in Mathematics Project*) 1986-9.

Above all, Brian was a supremely nice person always willing to share his expertise. He never stopped being active in mathematics education and it is fitting that the current issue of the *Mathematical Gazette* (dated March 2008, vol 92, issue 523) contains a piece by Brian on the Golden Ratio. Brian contributed significantly to mathematics education and will be sadly missed.

Selected publications

- Griffiths, H. B. (2008), The Divine Proportion, matrices and Fibonacci numbers, *Mathematical Gazette*, vol92, no523, 14-21.
- Griffiths, H. B. (1999), Fudge and Fiddlesticks: a century after. In C. Hoyles, C. Morgan and G. Woodhouse (eds), *Rethinking the Mathematics Curriculum*. London: Falmer. pp174-183.
- Griffiths, H. B. (1998), The British Experience of Teaching Geometry since 1900. In: C. Mammana and V. Villani (Eds), *Perspectives on the Teaching of Geometry for the 21st Century*. Dordrecht: Kluwer. pp194-203.
- Griffiths, H. B. and Hirst, A. E. (1994), Cubic equations, or where did the examination question come from? *American Mathematical Monthly*, 101, 151-161.
- Griffiths, H. B. (1987), Review: looking for complex roots, *Journal for Research in Mathematics Education*, 18 (1), 58-75.
- Griffiths, H. B. and McLone, R. R. (1984), A critical analysis of university examinations in mathematics (parts 1 and 2), *Educational Studies in Mathematics*, 15(3), 291-311 and 15(4), 423-442.
- Griffiths, H. B. (1984), The implicit function theorem: technique versus understanding, *International Journal of Mathematical Education in Science and Technology*, 15(5), 541-551.
- Griffiths, H. B. (1983) Simplification and complexity in mathematics education, *Educational Studies in Mathematics*, 14(3), 297-317.
- Griffiths, H. B. and Howson, A. G. (1974), *Mathematics: Society and Curricula*. Cambridge: Cambridge University Press.
- Griffiths, H. B. (1968), Pure mathematicians as teachers of applied mathematicians, *Educational Studies in Mathematics*, 1 (1-2), 18-23.
- Griffiths, H. B. (1967), *Topology*. (Mathematics Teaching Reprint). ATM. [Reprinted from ‘Mathematics Teaching’, nos 27-29]

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A. OPEN FORUM

The Society's regular annual Open Forum will take place at the day conference. This will include discussions on the Society's journal, Research in Mathematics Education (led by Tim Rowland for the editors), whether the Society should keep a database of members' research interests and allowing display space for commercial publishers at day conferences.

B. CONFERENCE SESSIONS

Back, Jenni

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Primary Practice and Active Learning: engaging the teachers

The session will describe a professional development course for primary school teachers that sought to develop the work of the 'Improving Learning in Mathematics' project for use with a primary school audience. Data was gathered from observations of teachers' mathematics lessons before and after the course as well as interviews with the teachers. Transcripts of the lessons were analysed both quantitatively and qualitatively and observed and reported changes in practice were considered. The session will consider some of the issues raised by this project for CPD in mathematics for primary school teachers in general.

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Exploring the Link between Task Features and Generalisation

Students' difficulties with expressing generality have been well documented in the literature. To ameliorate this situation, researchers have begun to look for factors that might influence students' generalisation and reasoning process. However, not much is known about the influence of task features such as the format of pattern presentation and the number of variables involved in the rule on students' abilities to express generality. This presentation aims to raise issues for discussion on the possible influence of task features on students' generalisation. First, some key features of generalisation tasks will be presented, followed by research findings in the current literature that have bearing on this issue, and a list of questions for future research.

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Teachers' researching their own practice: Evidencing student learning using TI-Nspire

It is generally accepted that the introduction of interactive technologies into secondary mathematics classrooms presents new challenges to teachers and students both mathematically and pedagogically. This session reports a multiple case study approach as a group of fourteen secondary mathematics teachers began to use the TI-Nspire handheld and software in secondary mathematics classrooms with pupils aged 11-16 years as part of a pilot project. The focus will be on the methodology employed by the researcher in eliciting the teachers' perceptions of the ways in which the technology was impacting on teaching approaches and learning outcomes, with an emphasis on the affordance of the mathematical process skills.

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The impact of ICT on mathematical content

The rapidly increasing use of ICT in the mathematics classroom clearly influences the ways in which teachers teach and pupils learn. Whether through an instructional program that focuses on a specific mathematical concept or topic, or through a more generic piece of tool software that can serve a range of different purposes, computers can offer dynamic visual images that may open up some areas of mathematics to a much wider audience. But does the use of computers in the classroom affect not just how, but also what is taught and what is learnt? Or are pupils learning the same mathematical constructs – more effectively or more enjoyably, perhaps, but with no essential difference to the final outcome? This paper will ask whether using ICT in the classroom can have a deeper level of impact, not just on the efficiency with which pupils learn, but on the nature of the mathematical concepts that they develop.

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Empathy through Project: Educating mathematics teachers as supervisors to their students' projects

There is a paradigm shift in Turkish curriculum recently seems to have “constructivist” features. The changes in the curriculum bring some new concepts with itself that Turkish teachers have difficulties to understand and apply it through their practices, such as portfolios, activities, projects etc. Among the, project serves and fulfil the conditions that students may develop their mathematical abilities and construct mathematical knowledge. Ministry of Turkish Education (MEB) encourages teachers and students to work in a project together. The Turkish Scientific Council (TUBİTAK) supports workshops which aim to educate teachers as supervisor to their students doing a project. This is a qualitative study and multi-method approach used in the study. Open-ended questionnaire was given to two groups of 140 teachers before the study. After a carefully planned 10 day long workshop on project training, open-ended and semi-structured post questionnaires were given to the teachers. Teachers were also observed during their projects and also diaries were kept. Results suggested that teachers had difficulties at every steps in project and generally were not able to properly define what project means. They also experienced identity complications during the workshop that they could not decide who to be.

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Mathematics trainee teachers' attitudes to computers

Trainee teachers' understandings, explorations, views, attitudes, uses and reflections of the subjects on a new technology are important. Furthermore, it will influence their use of the technology in the classrooms. One of the developments in technology about mathematics education is computer (and educational software) which has to be used in mathematics classrooms. Teacher training courses have vital influences on students for their future conceptions and uses of computer in the classrooms. Therefore, this study aims to evaluate trainee teachers' views, experiences and attitudes about using computer in mathematics education. Results show that the trainee teachers usually enjoy working with computer although they are able to do considerably minor works about mathematics. They stated that they can learn and teach mathematics effectively if they use computer better, even if they do not feel confident studying mathematics with computer. They find doing mathematics with computer is motivating and enjoyable and willing to learn more. They believe that computers will improve mathematics

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education. They also stated that if they were able to use computers more in their training they will be a better mathematics teachers. Nearly all of the trainee teachers have stated that they are going to use computers at their professional teaching, although they think that using computers in mathematics education is not an easy task. They believe that computers may help students gain confidence about teaching the subjects in mathematics. As a result, findings mainly indicate positive trainee teachers' attitudes towards use of computer in mathematics education.

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Evaluating Mathematics Pathways

The Evaluating Mathematics Pathways (EMP) project which started in the autumn of 2007 is a three and a half year independent, mixed-methods evaluation of pathways developments in mathematics qualifications. In this session we present an outline of the project, and some early issues arising from the pilots of Functional Mathematics, GCSE mathematics, and GCSE *Additional* mathematics. BSRLM is a stakeholder group with an interest in mathematics pathways, so please come to this session prepared to share your thoughts as points raised in the discussion will be fed through to the project team and will help inform the work.

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The Assessment of NQTs' Beliefs about the Teaching and Learning of Mathematics

Beliefs are hard to pin down. Whether or not they are successfully translated into practice, they give important indications of intentions for the future. The "IMAP web-based beliefs survey" was developed in order to assess beliefs about the teaching and learning of mathematics held by prospective elementary teachers (Ambrose et al, 2004). Instead of the usual Likert scale approach, the IMAP survey gathers data by asking teachers to respond to video clips and teaching scenarios in their own words.

The study reported here investigated beliefs held by three newly qualified secondary teachers. In particular the aim was to evaluate the IMAP survey in the secondary context by comparing it with the alternative data collection methods of interview and observation. The data gathered has enabled construction of a rich picture of the beliefs held by the three participating teachers.

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Learners' understanding of the hierarchical classification of quadrilaterals

The hierarchical classification of quadrilaterals might be regarded as an area of study which would help to promote the development of geometrical thinking. This paper reports our investigations in this topic discussed in our former study (Fujita and Jones, 2007, *RME* vol. 9). In particular, by synthesising past and current theories in the teaching of geometry (van Hiele's model, figural concepts, prototype phenomenon etc.), I propose a theoretical model and method to describe learners' cognitive development of their understanding of hierarchical relations of quadrilaterals. I also consider how the model could be utilised to describe and analyse learners' understanding of the hierarchical classification of quadrilaterals by using pilot data collected in 2008.

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Towards a Constructionist Approach to Mathematical Generalisation

The work presented in this paper is part of the MiGen project, a TLRP project whose research team comprises mathematics educators and computer scientists who aim to design, build and evaluate a pedagogical and technical environment for improving 11-14 year-old students' learning of mathematical generalisation.

We will present:

- the design principles underlying a mockup tool (ShapeBuilder) that was built to explore what functionalities we hoped to implement in the technical environment,
- the major features and rationale for the development of an initial task and a pedagogic environment aimed at supporting the shift from pattern spotting to structural reasoning through a constructionist approach, and
- a preliminary analysis of the data collected in 24 trial sessions with year 6 and year 7 students.

The format of the session will be a presentation with demonstration.

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Computer technology (ICT) enabled mathematics learning and delivery

After the initial mixed response to the integration of ICT components into all subjects of the curriculum including Mathematics, research into the role of ICT in learning has waned. This session will review the latest developments in ICT and how they can be used to boost understanding of curriculum-based mathematical concepts. Earlier studies focussed on desktop-based ICT tools and techniques, but recent developments have made it possible for on-line and Internet-based tools to be readily available to both students and teachers. The session will share relevant examples for Keys stages 1-5. Our studies demonstrate that low achieving students can have a huge boost to their interest and test results in Mathematics if technology is properly deployed. There will be interactive discussions between speakers and participants on the use and impact of ICT-enabled delivery of learning materials. On-line facilities will also be demonstrated to all participants. Key Stages 1, 2, 3 and 4 materials will be presented as examples.

Kertil, Mahmut, Delice, Ali and Aydin, Emin
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Two perspectives, same context, different approaches: Traditional versus modelling problems

This study examined pre-service mathematics teachers' performances in mathematical modelling and traditional problem solving activities. Prospective teachers worked on two types of problems prepared by the traditional and modelling perspectives. They studied on problems first as individually and then with a group work. Thirty seven pre-service mathematics teachers were the participants of the study. A questionnaire consisting two problems, classroom observations, and semi-structured interviews were used to collect data. Findings suggested that pre-service teachers are more successful in solving traditional problems. They, on the other hand, faced difficulties in solving modelling problems. The findings of study are interpreted in the context of Turkish educational system which is under a process of curriculum change.

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The Role of context in linear equation questions: utility or futility?

It is common practice in Key Stage tests and GCSE Mathematics to embed mathematics in real-world contexts – survey of recent GCSE papers suggests that about 50% of the questions involve some real-world context. However, the practice has been criticised by some researchers on the grounds of artificiality and construct validity. This paper will discuss some of this research, and consider the role of context in four linear equation questions, concluding that the purpose of the context is not utility, but abstraction.

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Dynamic Geometry in the classroom: old barriers and new opportunities

Although computers and calculators have had a massive effect on some areas of school mathematics, geometry teaching has been slow to utilise computer software. This paper discussed three barriers to implementing dynamic geometry in the classroom, curriculum scope, accessibility of computers and accessibility of programs. With the development of internet-based freeware, such as Geogebra, it is possible that these barriers may be being overcome. The greater accessibility to students, and the availability of digital projectors, then presents the issue of who should be in charge: the teacher leading whole-class discussion, or the student engaged in individual ‘guided re-invention’.

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Who is Attending to What, and who is Aware of What?

I take awareness to be the basis for action, which means it need not be conscious. I am interested in how attention moves, and what its movement reveals about awareness. I use an experiential methodology, so participants will be invited to engage in tasks which are intended to provide an opportunity to trap movements of attention and core awarenesses in mathematical topics in the upper primary to secondary age range.

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Proving activities in mathematics and mathematics education research

In this presentation we will build on the work of Bell, De Villiers and Giaquinto to identify and classify a wider variety of activities in mathematics which are associated with proof and argumentation. We will then identify and discuss (i) those activities which are used to assess the mathematical competence of students; and (ii) how well each of these activities is understood by mathematics education researchers. In doing so, we will argue that researchers have tended to concentrate on understanding a relatively small subset of the activities associated with mathematical argumentation and proof and that, in particular, the primary argumentative activities used to assess students have yet to receive substantial research attention.

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Learning about motion in a multisemiotic environment: From designing a pattern to animating a firework

Students' intuitive assumptions and arguments about motion are often discontinuous with the principles and styles of reasoning underpinning the Newtonian model. Traditional approaches to the teaching of mechanics and everyday physical experience do not sufficiently challenge these assumptions and arguments. MoPiX, an interactive learning environment developed within the Representing Mathematics with Digital Technologies (ReMath) project*, aims to support students' learning by allowing them to build and control animated models and investigate their behaviours. The behaviours are defined by using equations, enabling students to make links between formal notations, the predicted and/or observed behaviours of their models, and their developing concepts of velocity and acceleration. Students work in a multisemiotic environment involving not only the equations and dynamic objects of MoPiX itself but also conventional pencil and paper and, of course, talk and gesture. The variety of semiotic systems provides a range of meaning potentials and hence rich opportunities for users to construct meanings for the mathematical objects and concepts represented. In the ReMath project, we are investigating the ways in which different forms of representation may affect students' learning. In this presentation, we discuss the potentialities of the multisemiotic environment and illustrate how the various semiotic resources available to students shape their activity.

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The Development of a Semantic Model for the Learning of Mathematics

This presentation will report on the development of a semantic model for the learning of mathematics. It is based on working with Foundation Degree Computer Networking students who had to study mathematics as part of their course. Data was gathered from video recording their computer monitors whilst they were using Derive 6, semi-structured video interviews and from field notes collected during the course of the investigation. The semantic model is based upon ones developed from linguistics, neuro-psychology and cognitive psychology. It attempts to explain how the similar yet different semiotic systems of natural language and mathematical language impact on the student's experience of learning mathematics.

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How shall we talk about "subject knowledge" for mathematics teaching?

Sustained research into mathematics teacher knowledge over two decades, much of it in the UK, has drawn attention to the complexity of the knowledge base of mathematics teachers at all phases of education. Yet the official discourse of the topic remains rather blunt and simplistic. For example, remit 4 for the Williams review asked "What conceptual and subject knowledge of mathematics should be expected of primary school teachers ...". Why juxtapose 'conceptual' and 'subject'? The relevant section of the interim report then begins "This section looks at the importance of subject mastery in teaching mathematics ...". Yet 'subject mastery' does not - for us, at least - adequately capture the range of relevant content knowledge. In this session, we hope to explore whether, and if so how, it might be possible to conceptualise and talk about knowledge for and in mathematics teaching, in ways that are acceptable to, and accessible by, education professionals and policy makers.

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Year 2 ITE students' confidence in teaching primary mathematics

A consideration of the relationship between subject knowledge and teaching primary mathematics based on a survey of 78 students following their second placement (Year 2) of their three year degree course in primary teacher training. Initial findings indicate the link to confidence is stronger than the link to mathematical ability above a certain level. Also emerging is the students' abilities to respond to a range of historical and current experiences.

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Development of "profound understanding of fundamental mathematics": investigating the effectiveness of the Mathematics Enhancement Course

The Mathematics Enhancement Course (MEC) is a programme designed for graduates who wish to train as secondary mathematics teachers but whose mathematics background is insufficient for entry to a PGCE or other route to Qualified Teacher Status in the subject. It has a strong focus upon the development of subject knowledge. In this session I will present some early work focusing on aspects of the MEC as developed by a university which has been involved with the programme for 5 years. In the early days, MEC students sought reassurance that they would not be at a disadvantage compared to other student teachers who had degrees in mathematics. Informal evidence both from MEC and 2 year PGCE providers suggests that the opposite may be true, and that in fact such 'bespoke' courses targeted at a particular student group in fact offer excellent preparation for entry to initial teacher education. I have begun to look at the way in which MEC students view mathematics, and the extent to which the MEC can be said to be successful in developing students' subject (and perhaps pedagogical) knowledge. I would like to share my findings and would welcome dialogue during the session with other colleagues involved in this type of activity.

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Growth in teacher knowledge: individual reflection and community participation

In this presentation I examine the interplay between personal reflection and participation in 'communities of practice' in the development of beginning primary teachers. The project on which I report has involved teachers in reflection on their mathematics teaching with a focus on both subject matter knowledge and pedagogical content knowledge. Evidence from this study suggests that their growth over three years has been influenced by individual reflection as well as by participation in communities of practice, with the interaction between the two dependent on individual contexts. I present some findings from the case studies of Amy and Kate to support my contention that individual reflection facilitates critical alignment (Jaworski, 2006) in communities of practice.

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Young children's approaches to solving conceptually linked addition problems

The paper presents findings from a project which explored 6-7 year old children's understanding and use of addition principles when solving problems. Thirty three children with different abilities in arithmetic were presented with pairs of problems which were conceptually linked by the principles of commutativity, associativity and additive composition. The paper discusses the similarities and differences observed in the problem solving approaches of three cases: a very able child and two children identified as having difficulties in learning arithmetic.

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A Comparison of Mathematics teachers' beliefs between England and China

This session will report the result of a comparative study on mathematics teachers' beliefs in England and China. This study looked at teachers beliefs on: Mathematics Teaching, the Nature of Mathematics, and the goals of Mathematics Education, and it also involved the education context in each country. The research method of this study involved a questionnaire and interviews. The questionnaire design drew on the framework suggested by Kaiser et al (2006) to analyze mathematics education in eastern and western traditions, the classification of three views on the nature of mathematics by Ernest (1989), and the discussion of the goals of mathematics education by Huckstep (2000). Ninety-six Chinese mathematics teachers from 10 secondary schools in Shanghai and 44 English mathematics teachers from 10 secondary schools in Cambridgeshire participated in the questionnaire survey. Furthermore, two mathematics teachers from each country were interviewed to give some insights into the questionnaire results and the education context. This session will provide an opportunity to discuss mathematics education in different cultural contexts.

C. WORKING GROUP

Back, Jenni, **Hirst**, Christine, **De Geest**, Els, **Sutherland**, Ros and **Joubert**, Marie

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Researching Effective CPD in Mathematics Education (RECME) project

The Researching Effective CPD in Mathematics Education (RECME) project will be running a 24-hour summer residential in late June (after the BSRLM day conference). The project team sees this residential as an exciting and innovative way to collect some more of the data we need; we plan to work closely with teachers and organisers of our CPD initiatives to co-construct our understandings. In this workshop we will pilot some of the approaches we plan to use at the residential, and, together with the workshop participants, will debate the potential and value of the methodological stance we adopt. This debate will inform final planning for the residential.