BSRLM Day Conference
Institute of Education, London, 12 March 2011

A. Open Forum

The Open Forum will take place at the day conference. This is an opportunity for members of the Society to meet with the executive committee to discuss issues raised by either the members or the committee. You are welcome to bring your lunch to the Open Forum at 13.15.

B. Conference Sessions

Adler, Jill[1], **Stevenson**, Mary[2] & **Clarke**, John[3]
King's College London[1], Liverpool Hope University[2], University of East London[3]
jill.adler@kcl.ac.uk

Refining our description of "deep understanding of mathematics"

Previously (BSRLM 2009), we presented an initial analysis of emerging themes related to 'understanding mathematics in depth' (UMiD) as reflected in interviews with lecturers and students of Mathematics Enhancement Courses at three institutions in the UK. We discussed emerging trends that led us to suggest that the notion of 'understanding of mathematics in depth' for these participants was constituted by an amalgam of mathematical, teaching and learning discourses. Understanding mathematics in depth meant: knowing that and knowing why (knowing basic proofs or being able to work from first principles); understanding formulae, their parts and when these are used; knowing the history of mathematical concepts; being able to connect different aspects of mathematics to each other and to their applications; and being able to see a problem from a number of perspectives. These are resonant with Shulman's (1986) elaboration of the Subject Matter Knowledge (SMK) and Ma's (1999) "profound understanding of fundamental mathematics" i.e. knowledge that has breadth, depth and thoroughness. In this presentation we offer a more refined analysis of the interview data using critical discourse analytic tools developed by van Leeuwen (2008) and his approach to discourse as "recontextualised social practice" (p.1). van Leeuwen extends Bernstein's notion of recontextualisation beyond pedagogic discourse/texts to social texts more generally. He argues that all social texts recontextualise social practices, key elements of which are social actors, their roles and identities; actions and their performance, settings and timings. These may be excluded or transformed, thus adding purposes, and legitimations for actions. Through this lens, the notion of UMiD as talked about by both lecturers and teachers is a recontextualisation from the practices in the MEC, and thus a window into the programme and its focus on extending and deepening prospective teachers' mathematical knowledge. We focus our analysis on representations of actors and actions with respect to UMiD, together with how these are legitimated. Of particular interest are the domains of knowledge drawn on for legitimation and the extent to which these are from the domains of mathematics, or of teaching and learning.

Aysel, Tugba, **O'Shea**, Ann & **Breen**, Sinéad
National University of Ireland
tugba.aysel@maths.nuim.ie

A classification of questions from Irish and Turkish high-stakes examinations

In both Turkey and Ireland entrance to third level education is determined by performance on a high-stakes examination at the end of second level education. This project studies the effects of these examinations on the teaching and learning of mathematics at post-primary level in these countries. Questionnaires were administered to students and teachers in schools in Istanbul and in the Dublin region. In addition 21 Turkish and 25 Irish mathematics teachers were interviewed. The

exam systems in these countries are quite different from each other. In order to compare the examinations we attempted to classify the types of questions asked. We used various classification systems including: Blooms Taxonomy (Bloom B., 1956) and Smith`s modification of it (Smith et al, 2007), Schoenfeld`s Framework for Balanced Assessment (Schoenfeld, 1992); and the Levels of Cognitive Demand Framework developed by the QUASAR Project (Smith & Stein, 1998). We will report on the use of these frameworks and the results obtained for the Turkish and Irish mathematics examinations.

Back, Jenni
University of Plymouth
jenni.back@plymouth.ac.uk

Inducting young children into mathematical ways of working in Hungary

This session will describe the findings of a small scale research project that is being carried out in a Kindergarten class (children aged 3 - 6 years) and a year 1 class (children aged 7 years) in Eastern Hungary. I have made a number of visits at intervals over the course of this academic year to look at the ways of working that the teachers adopt with young children in mathematics. Data has been collected using classroom observations, video recordings of lessons, field notes and interviews with the two teachers involved. I have the support of an interpreter with me during data collection and translations of the video recordings have been made. The aim is to build up two cases studies over the course of the academic year and analyse the teachers' practices for comparison with established practices in England.

Barber, Patti & **Houssart**, Jenny
Institute of Education, London
p.barber@ioe.ac.uk

Consulting pupils about mathematics - a straightforward questionnaire?

In this session we will share our experiences of working alongside a primary school to consult pupils on their views of mathematics. We will consider the process of building on existing questionnaires to develop one appropriate for a particular school, reflecting on how our discussions with school staff at this point shed light on school practices. We will move on to how the pupils responded to the questionnaire and in particular will consider how questions they found it difficult to answer told us more than those they answered with ease.

Bolden, David & **Barmby**, Patrick
Durham University
d.s.bolden@dur.ac.uk ; p.w.barmby@dur.ac.uk

A representational approach to primary ITT students' developing competence and confidence in their mathematics

Representations of mathematical concepts play an important role in the understanding of learners (Greeno & Hall, 1997), and also in the pedagogical processes involved in developing that understanding (Leinhardt et al., 1991; Brophy, 1991; Fennema & Franke,1992). For pre-service teachers, who are developing their own understanding and learning how to teach the subject of mathematics, their knowledge of mathematical representations is even more important. However, Turner (2007) highlighted that pre-service teachers' choice and use of representations could be problematic. In this presentation, we report on work with a cohort of pre-service primary teachers, with the aim of developing their understanding of mathematics and their confidence in their subject knowledge and their teaching of mathematics. This was attempted through the introduction and use of representations associated with mathematical concepts covered in primary schools. We present the results of attitude measures of pre-service teachers' confidence in teaching maths and also studying maths. We also draw on qualitative questionnaire comments from teachers, in identifying whether and how use of representations supported pre-service teachers' competence and confidence in teaching mathematics.

Borthwick, Alison & **Harcourt-Heath**, Micky
alison.borthwick@norfolk.gov.uk; micky.harcourt-heath@norfolk.gov.uk

Children's perceptions of, and attitudes towards, their mathematics lessons

Among the reasons attributed to the crisis in mathematics education, disaffection with pupils remains high. While there are studies that investigate this pupil disaffection at secondary school, there are few that consult younger children in order to ascertain their views of mathematics. The research study examines this issue by using drawings as the primary source of data collection, followed by interviews. It offers a view of how some children perceive their mathematics lessons and what this could mean for the future of the subject. This session explores how some children perceive their mathematics lessons in primary schools. During the presentation there will be an opportunity to look at some of the children's drawings and consider the implications of the data.

Breen, Sinéad, **Corcoran**, Dolores, **Dooley**, Thérèse, **O'Reilly**, Maurice & **Ryan**, Miriam
St Patrick's College, Dublin City University
dolores.corcoran@spd.dcu.ie

The application of lesson study across mathematics and mathematics education departments in an Irish third-level institution

This presentation reports preliminary findings arising from a research project, which embodied cross-disciplinary collaboration into the teaching and learning of Mathematics. The project involved the use of a form of Japanese lesson study by colleagues from the Education Department and the Mathematics Department of a College of Education & Humanities in the Republic of Ireland. Five colleagues worked together to explore the goals of teaching two research lessons; the first of which was part of a module in the history of mathematics for BA students, and the second, a lesson in mathematics education for BEd (Primary) students. Following ethical clearance, the research lessons were videotaped using both a static camcorder focused on the teacher and a roving camera to record student participation. The research lessons were also observed in situ by the remaining participants of the lesson study group. Both research lessons were later transcribed. In this presentation we will report on our initial findings from the different perspectives of preparing, teaching, observing and reviewing the research lessons. The potential for conducting lesson study in a cross-disciplinary fashion will be evaluated, as will the contribution of video-stimulated recall to research into the teaching of mathematics.

Bretscher, Nicola
King's College London
nicola.bretscher@kcl.ac.uk

A survey of technology use: the rise of the interactive whiteboard and the narrowing of teachers' classroom practice

This study reports the results of a pilot survey of UK mathematics teachers' technology use (n = 89) in secondary schools. Previous surveys are confused by a lack of differentiation between hardware and software use. This survey aims to provide insight into the types of software teachers choose to use in conjunction with particular types of hardware. For example, is there a difference in the range and type of software that teachers use in a whole-class context, with an IWB, compared to when students are given direct access to computers or laptops? Teachers were asked about their access to hardware and software; their perception of the impact of hardware on students' learning; the frequency of their use of ICT resources and the factors affecting their use of ICT. The results of the survey suggest that the rise of the interactive whiteboard may have accompanied, if not engendered, a narrowing of classroom practice.

Brown, Margaret, **Hodgen**, Jeremy & **Küchemann**, Dietmar
King's College London
jeremy.hodgen@kcl.ac.uk

Models and representations for the learning of multiplicative reasoning: Making sense using the Double Number Line

There has been a great deal of work on the didactical use of models, such as the Double Number Line, much of it focused on using models as a support for teaching (e.g., Van den Heuvel-Panhuizen, 2003). However, less attention has been devoted to documenting the ways in which students and teachers make sense of and engage with such models in developing understandings of multiplicative reasoning. In this presentation, we will discuss this issue drawing on data from the

ESRC-funded Increasing Competence and Confidence in Algebra and Multiplicative Structures (ICCAMS) study. Specifically, the presentation will be based on analysis of semi-structured interviews with the Year 8 students together with observational evidence from classroom trials and professional development sessions. Whilst the focus will be on the Double Number Line, we will make links to the "model method" used in Singapore (Ng & Lee, 2009) in addition to the ratio table (Vergnaud, 1983) and the Cartesian graph (Janvier, 1987). We will discuss the pedagogic value of such models in addition to identifying some obstacles to this. Finally, we will discuss how the use of models could be supported by teaching materials.

Bruce, Cathy
Trent University, Peterborough Ontario, Canada
cathybruce@trentu.ca

Bridging research-practice gaps through collaborative action research: Understanding early algebra concepts

Collaborative action research involves teachers and researchers working together to study areas of mutual interest (Bruce & Flynn, 2010; Capobianco, 2007). It is a powerful professional learning strategy for engaging a range of teachers with different levels of experience, not only to build teacher mathematics understanding, but also to build teacher confidence in exploring challenging mathematics ideas with students. In a study of over 300 teachers working in small groups, and 17 case studies, one group of 5 primary grade teachers (children ages 4-9) from three different schools in Ontario, Canada, worked together to conduct collaborative action research in their classrooms over two years. In the first year, the team goal was to investigate early algebra using an inquiry-based approach to mathematics teaching and learning. With the support of a district mathematics lead and university mathematics research partners, the teachers decided to co-plan and co-teach lessons on repeating and growing linear patterns to effect change in their mathematics instruction, and related student understanding. The team used four release days from the classroom to examine student learning from a developmental perspective. They generated, tested, and refined an instructional trajectory in early algebra based on student evidence, primarily in the form of photos of student work and videos of student learning. Researchers found evidence of significant teacher learning (including deeper understanding of patterning and algebra) and shifts in teacher beliefs about their mathematics teaching (such as raised expectations for students and greater teacher confidence). Survey data of collaborative action research teachers in the project demonstrated positive self-efficacy gains (Ross & Bruce, 2010) as well as increases in teacher valuing of the usefulness of research to support effective teaching practice. This model of professional learning is one of several models being tested by the Trent Mathematics Education Research Collaborative (www.tmerc.ca).

Clark-Wilson, Alison
University of Chichester
a.clarkwilson@chi.ac.uk

How teachers learn to use complex new technologies in secondary mathematics classrooms: The notion of the hiccup

This session will report the outcomes of a longitudinal doctoral study which sought to illuminate the process through which secondary mathematics teachers learned to use a complex new multi-representational technology, the TI-Nspire handheld and software alongside the TI-Navigator wireless network system. The research examined the trajectories of fifteen teachers, with a focus on the pedagogical appproaches that privileged the exploration of mathematical variance and invariance. Analysis of the data reveals the importance of the idea of the 'hiccup'; that is the perturbation experienced by teachers during lessons stimulated by their use of the technology, which illuminates discontinuities within teachers' knowledge.

Coles, Alf
University of Bristol
alf.coles@bris.ac.uk

Gattegno's 'Powers of the Mind' in the primary mathematics curriculum: Outcomes from a NCETM project

In this session I report on the outcomes of a 'Mathematics Knowledge Network' (MKN) project, aimed at developing rich tasks in the primary curriculum. The work was funded by the National

Council for Excellence in Teaching Mathematics (NCETM) and carried out in collaboration with the Arts based charity "5x5x5=Creativity". The approach to the project was informed by the prinicples of "5x5x5=Creativity" derived from the Reggio Emilio pre-schools, and by Gattegno's ideas on the 'subordination of teaching to learning' and 'powers of the mind'. I analyse the students' responses through the filter of Gattegno's 'powers of the mind' and raise questions about what might be possible in the primary curriculum, given the results. The motivation for the project came from a headteacher who wanted support in developing a more creative approach to teaching mathematics in school X, where he worked. As part of the project I taught, once a week, two mixed year 3/4 classes over a twelve week period. The sessions were jointly planned with the two class teachers, who helped out in the lessons, and there were reflection meetings each week to discuss, evaluate and plan the following week. In the last two sessions, following input from "5x5x5=Creativity", we gave all students a 'Learning Journal' in which to document their work, organise what they did, and take forward any questions they still had.

Georgiou, Ioanna
University of Warwick
i.georgiou@warwick.ac.uk

Challenges from an action research project on mathematics through history and culture

The presentation will focus mainly on the challenges that arose from the one-year action research project undertaken in 2007-08, as part of my doctoral research. The purpose of this project was to develop and teach a secondary mathematics course using historical and socio-cultural elements. The presentation will encompass an account on the analysis of part of the data, specifically related to difficulties and problems and the respective solutions sought. Some of the categories that emerged and are related to these challenges are “Complaints heard”, “Complexity adjustments to students' level”, “Mathematical difficulties” and “Students' interests and contributions/teacher in challenging position”. Some examples, respectively for each of the aforementioned categories, include the students' initial denial to try, the omission of parts of the designed curriculum, the occasional shelter to basic mathematics in order to overcome certain barriers and the students' asking questions beyond the scopes of a maths lesson, but at the same time, unavoidable (or even wanted?) for a mathematical education using socio-cultural and historical elements.

Griffiths, Graham, **Ashton,** Jackie**, Kaye,** David**, Kelly**, Beth & **Marsh**, Daian
London South Bank University
g.griffiths@lsbu.ac.uk

Family mathematics/numeracy: identifying the impact of supporting parents in developing their children’s mathematical skills

For a number of years, parents have been encouraged to become involved in their children’s learning. This has led to ‘family learning’ provision of various types being developed and funded. Specific funding of Family Language, Literacy and Numeracy (FLLN) has promoted such classes including the Family Numeracy classes run by LLU+ at London South Bank University. There have been a number of studies looking at parental involvement in their children’s learning, though less so with a focus on the perspective of the parents (although see Abreu and Cline 2005). The numeracy team at LLU+ have started a small scale, pilot investigation in the impact of the provision in supporting their children. Previous authors (Civil et al 2008, McMullen and Abreu 2010) have noted that such parental support means that parents are engaging in some aspect of teaching and that this requires some form of training. The study involves interviewing parents about how able they are to support their child’s learning and the extent to which the courses involved have assisted this process. The session will involve looking at what the parents have said about what assists them. Examples of learning and teaching techniques and approaches will be considered by participants. Finally, a discussion will be held about what further work should be undertaken in this area.

Griffiths, Martin
University of Manchester
martin.griffiths@manchester.ac.uk

Where has all the beauty gone?

Bertrand Russell famously talked of mathematics as possessing an "austere beauty". It would seem though that the capacity to appreciate the aesthetic aspects of our field is not necessarily the preserve of the mathematical elite. Indeed, a number of educators believe that such considerations have, in conjunction with various cognitive factors, the potential to play a significant role in the student learning of mathematics. As mathematicians and teachers, we occupy a privileged position in the sense that each of us is likely to be endowed with a heightened awareness of just what it means for a piece of mathematics to possess 'beauty'. One question we might ask ourselves in this regard is: Are students benefitting from this in their learning? In order to nurture students' aesthetic sensibilities with respect to mathematics, the learning environment must be conducive both to facilitating the requisite intellectual involvement and to encouraging the independent and creative exploration of mathematics. We consider here the possibility that the current climate of test-score-driven schooling is in fact inhibiting teachers' natural tendencies toward the aesthetic, thereby making the establishment of such learning environments rather rare events. Our preliminary studies have involved a number of lesson observations viewed through both theoretical and empirical lenses associated with various writings on the mathematical aesthetic. We discuss our findings thus far, and then briefly consider whether current trends might indeed have long-term implications for mathematics as a creative field of endeavour.

Griffiths, Rose
University of Leicester
rnag1@le.ac.uk

Exploring children's interest in seeing themselves on video: metacognition and didactics using "Photobooth"

I have been videoing five children aged 7 to 11 doing arithmetic, using software on my laptop that allows instant replay on the laptop screen. In this session I would like to explore the benefits and limitations of using video of children working (and in particular of 'Photobooth'), in three main areas:

1. the use of visually stimulated recall with children, to find out more about their methods of working, their view of what they did and how they felt;
2. the advantages to the researcher of having a video record of an interview;
3. the potential for the teacher, especially with children whose experience is one of failure in mathematics, to show the child that they have made progress and thus to influence their future learning.

We will watch extracts from children's interviews, examine transcript material from the original interviews, and discuss the commentary from children when they saw themselves on screen. Several practical points arise from this work, and I will welcome suggestions from colleagues of ways to improve the method to make it more effective.

Hall, Graham
University of Wales, Caerleon, Newport
graham.hall@llandrillo.ac.uk

Promoting creativity through mathematical modelling

There are features of school mathematics which seem to restrict creativity: Students work through problems using standard algorithms with little opportunity for imaginative input; School mathematics usually leads to solutions that are right or wrong – there is little or no room for negotiation. This contrasts with real-world mathematics, where stimulating debates can take place around the formulation of an appropriate mathematical model for a particular application. Practitioner research has been carried out with groups of pre-university students to introduce mathematical modelling as simplifications of real world situations. Students work in small groups to discuss and reach agreement on factors to be included or excluded from the model. Flow charts are constructed for the processing steps of the model. Students are then supported in converting their formulations into spreadsheet models. Work follows patterns advocated by Jaworski (2003). Problems which have been tackled successfully are: Population modelling for a nature reserve where owls and mice co-exist in a predator-prey relationship; Modelling the spread of an infectious

disease; Traffic flow modelling for a small town centre; Environmental modelling, identifying relationships between rainfall and flooding. The use of mathematical modelling in combination with new technology proves to be a powerful combination for motivating young people to develop key skills in numeracy, problem solving and working with others, in addition to improving communication skills. The approach follows the MeE theory of Martin (2002) in which students are motivated to engage in a series of interesting challenges as a step towards engaging with the subject as a whole. The objectives of the project can be related to theories of adult learning, linking pedagogy with reflective learning (Boud and Walker, 1998), and participation in a community of practice (Lave and Wenger, 1991).

Hossain, Sarmin[1], **Archer**, Rosa[2] & **Grantham**, Barry[3]
Brunel University[1], St Mary's University College[2], Liverpool Hope University[3]
sarmin.hossain@brunel.ac.uk

Students' perceptions of how the MEC and PGCE prepare them to teach mathematics

A team of researchers are conducting a longitudinal study exploring 'mathematics knowledge for teaching' within UK's Mathematics Enhancement Course (MEC) - a 'subject knowledge' course providing an alternative route for non-mathematics graduates wishing to become mathematics-teachers. The study aim is to provide systematic evidence of what and how mathematics is constituted by MEC students, during teacher education and as played out in their teaching. In phase one of the study (Jun 2009) MEC tutors and 18 students from three institutions were interviewed about the MEC and their orientation to 'understanding mathematics in depth' (UMiD). While this data-analysis is on-going the second phase of this study has commenced. This paper reports on phase 2, in which the original MEC students were interviewed on completion of their PGCE course and discusses preliminary findings. In Jun 2010, 15 participating students were probed on "elements of the PGCE", "on what they learnt on the MEC and how this contributed to their learning and teaching on the PGCE" and "UMiD on the PGCE". They were asked to reflect on certain responses from June 2009 to elicit if their views had changed given their PGCE experience. For example, earlier some students expressed that the MEC would give them a 'leg-up' in the PGCE- this was explored in the second interviews. Given early stages of data-analysis, comment on "students' shifts in UMiD from MEC into PGCE" is premature. This paper will focus discussions on preliminary themes emerging related to students' perceptions of MEC and PGCE elements which have contributed towards their overall-training for mathematics teaching. Interestingly, these can be contextualised in "teaching", "mathematics" and "mathematics for teaching" discourses. The discussions will provide insight into how the MEC and PGCE in combination prepare those from an alternative route into teaching mathematics and their respective contributions to this preparation.

Houssart, Jenny
Institute of Education, London
j.houssart@ioe.ac.uk

"I can be quite intuitive": Teaching Assistants talk about how they support primary mathematics

This session will report on the early stages of a study which looks at the contribution teaching assistants feel they make to mathematics teaching in primary schools. Extracts will be presented from interviews with Teaching Assistants who provide support to individuals with particular needs. We will look at what they say about the knowledge and understanding they bring to the support they give pupils with mathematics and how they feel they acquired this.

Ineson, Gwen
Brunel University
gwen.ineson@brunel.ac.uk

Using design-based research to develop a programme of mental mathematics for teaching

The Williams review (2008) recommended a renewed focus on mental mathematics in initial teacher education programmes. This paper describes a design-based approach to develop an intervention programme for primary trainee teachers to develop their mental mathematics for teaching. This was used to address the question of what the crucial features (Gorard, Roberts and Taylor, 2004) are that must be in place to cause change in trainee teachers' knowledge of mental

mathematics for teaching. This question was addressed by designing an intervention on the basis of current, albeit impoverished theoretical understanding of the knowledge that trainee teachers require for teaching mental mathematics.

Inglis, Matthew
Loughborough University
m.j.inglis@lboro.ac.uk

Individual differences in students' use of optional learning resources

This session discusses how students use optional learning resources in a typical blended learning environment. Specifically, the frequency with which students attended live face-to-face lectures, accessed online recorded lectures and visited a mathematics learning support centre was recorded during a course on multivariate calculus. Four distinct study strategies emerged, but surprisingly none involved making heavy use of more than one resource. In contrast with some earlier research, the general strategy a student adopted was related to their academic achievement, both in the multivariate calculus course, and in their degree programme more widely. Those students who often accessed online lectures had lower attainment than those who often attended live lectures or the support centre. In the session I will discuss the implications of these findings and suggest that "blended teaching environments" may be a more accurate description for what have previously been called "blended learning environments".

Johnson, Sarah & **Barmby**, Patrick
Durham University
p.w.barmby@dur.ac.uk

Primary pupils' difficulties with fractions: A representational view

The misconceptions that children have about fractions relate particularly to the way in which fractions are represented as numbers, and the standard ways that we use to represent fractions in diagrams and pictures in mathematics teaching (Kerslake, 1986). In terms of representations, Hart (1981) reported that although diagrams sometimes help with the solution of fractions problems or were used as a checking procedure, the actual process that children used with diagrams did not necessarily support conceptual understanding. Behr et al. (1983) differentiated between continuous and discrete representations of fractions. However, Nunes and Bryant (1996) highlighted that pupils may have a limited range representations of fractions available to them: "The disconnection between pupils' understanding of division of discontinuous and continuous quantities developed out of school and their learning of fractions might come about exactly because pupils do not think of fractions as having anything to do with division, and only relate fractions to part-whole language" (p. 228). In this presentation, we present the findings from a small-scale study of Year 5 and Year 6 pupils' understanding of fractions. As part of the study, 15 pupils completed a series of questions related to fractions. The presentation will look at the results from these questions, looking in particular at the range of representations of fractions used by the pupils in tackling the questions. Based on the results, a critical look at guidance for teachers in teaching fractions in primary schools will be presented.

Jones, Ian[1], **Inglis**, Matthew[2] & **Gilmore**, Camilla[1]
University of Nottingham[1], Loughborough University[2]
i.jones@nottingham.ac.uk

Operational, relational and substitutive conceptions of the equals sign in British and Chinese school children

Research into children's understanding of the equals sign in arithmetic contexts has found two key conceptions. The first is "operational", in which the equals sign is viewed as an instruction to conduct an arithmetic calculation, and the second is "relational", in which it is viewed as signifying numerical sameness. We hypothesised and looked for a "substitutive" conception in which the equals sign means the mathematical expressions on both sides can be exchanged for one another. Using an instrument adapted from the literature and administered to 11 and 12 year olds in Britain and China, we found that the substitutive conception exists independently of the operational and relational conceptions. Moreover, the substitutive conception was notable by its absence in British children, where the operational conception was dominant, and notable by its presence in Chinese children, where the operational conception was weak. This confirmed our prediction based on how the equals sign is typically defined and presented in textbooks and classrooms in each country.

However, we were surprised to find that the substitutive conception is stronger than the relational conception amongst Chinese children.

Kent, Phillip[1], **Kent**, Geoffrey[1], **Altendorff**, Lori[1], **Boaler**, Jo[2] & **Sebba**, Judy[1]
University of Sussex[1], Stanford University[2]
p.kent@sussex.ac.uk

The REALMS Project: Evaluating complex instruction in secondary mathematics classrooms

We present interim findings from a one-year research project, 'Raising Expectations and Achievement Levels for all Mathematics Students', which is evaluating the use and effectiveness of a particular approach to 'mixed ability' mathematics teaching. This 'complex instruction' approach advocates a focus on collaborative problem solving in groups and incorporates strategies for developing group work skills in students, and 'group worthy' learning tasks. The research is following the mathematical progress of Year 7 students in six schools which are adopting complex instruction, and comparing this progress with six comparison schools having similar socio-demographic profiles but using 'ability' grouping for mathematics. Data are being collected in the form of video observations of lessons, interviews with teachers and students, pupil questionnaires, and end-of-year test performance in relation to Key Stage 2 SAT results. From these data we explore the learning opportunities of complex instruction, effects on students' understanding of mathematics, and attitudes towards mathematics, the challenges faced by teachers, and the forms of support that teachers need. This session will overview the project and present some of the interesting emergent findings for discussion.

Landa Hernández, José Armando & **Santos Melgoza**, David Martín
Chapingo University, México

An interdisciplinary study of a Computer Micro-world

This project aims to study how a microworld could be used to promote the development of ideas approaching to the notion of function. The task has been developed using a Dynamic Geometrical System (GeoGebra) were we have included a geometric representation of parameters a, b and c for functions such as $\mathbf{f(x)= a(x-b)^n+c}$. In this microworld students can drag points or/and sliders to visualize its effects on the graph of a function to match it over another target graph. As the so-called micro-world include a compendium of functions such as $\mathbf{f(x)= a\varphi(x-b)^n+c,}$ we will discuss this device as a context to explore learning and teaching processes from diverse perspectives. We will talk about our experiences trying to develop an interdisciplinary research about the didactic features of the micro-world. We will focus on the increasing difficulties and transitions faced by students in order to unpack some complexity regarding to the notion of function.

Marks, Rachel
King's College London
rachel.marks@kcl.ac.uk

"Ability" in primary mathematics education: Patterns and implications

In this presentation I discuss findings from my PhD study of ability in primary mathematics. The literature abounds with studies into the negative implications of ability practices in secondary mathematics. My research suggests these practices are highly prevalent and just as problematic in the primary sector. This mixed-methods study explored ability in two schools: one where pupils were set from Year 2 (ages 6 - 7) for mathematics and one employing a mixed-ability organisation. 284 pupils (of which 24 were focal pupils) and 8 teachers in Year 4 (ages 8 - 9) and Year 6 (ages 10 - 11, the final year of primary school) were followed for a full academic year to explore the understandings, practices and implications of ability in primary mathematics. I present data demonstrating the pervasive nature of ability suggesting that ability acts beyond setting or grouping, infiltrating everything that teachers do, even when they believe themselves to be free from the auspices of ability. Data demonstrate the strength of young children's convictions that mathematical ability is innate, that individuals are born to be, or not to be, mathematically able, and that we are powerless to change this. I argue that these beliefs stem from the ways ability is used and talked about in education, and discuss the implications of this for pupils.

Monaghan, John
University of Leeds
j.d.monaghan@education.leeds.ac.uk

An extension of Valsiner's zone theory

Valsiner expanded Vygotsky's construct, the zone of proximal development, to include the zone of free movement and the zone of promoted action. In this session I will consider interrelated transformations of both students and teachers zones in the context of developing inquiry communities in primary mathematics classrooms. The session will address the theoretical framework for a paper I am currently working on with Mohammed Abdul Hussain and John Threlfall.

Newell, Robert
Institute of Education, London
r.newell@ioe.ac.uk

The extent to which a primary mathematics teacher's success in the classroom is dependent on subject knowledge

This paper tracks 5 Primary PGCE Trainee Teachers through their Course: In particular it considers their Subject Knowledge (as measured through exam results and the PGCE mid- course Audit) and explores the extent of its significance in helping children to understand mathematical ideas and to make connections. It analyses the choices the trainees make prior to, and during, the 10 lessons observed. The Trainees reflections are heard in their post lesson discussions and in their focus group discussion at the end of the course. This is evaluated in terms of the balance between Subject Knowledge and Pedagogic Content Knowledge alongside Generic Teaching Pedagogic knowledge. Consideration is given to the need to create teachers who help children to make connections in maths when many trainees have not experienced such teaching themselves and are often fearful of trying to teach in such a way.

O'Shea, Ann & **Breen**, Sinéad
National University of Ireland
ann.oshea@nuim.ie

The use of tasks to develop mathematical thinking skills in undergraduate calculus courses - a pilot study

Mathematical thinking is difficult to define precisely but most authors agree that the following are important aspects of it: conjecturing, reasoning and proving, making connections, abstraction, generalization and specialization. In order to develop mathematically, it is necessary for learners of mathematics not only to master new mathematical content but also to develop these skills. However, undergraduate courses in Mathematics tend to be described in terms of the mathematical content and techniques students should master and theorems they should be able to prove. It would appear from such descriptions that students are expected to pick up the skills of (advanced) mathematical thinking as a by-product. Moreover, recent studies have shown that many sets of mathematical tasks produced for students at the secondary-tertiary transition emphasize lower level skills, such as memorization and the routine application of algorithms or procedures. In this presentation we will consider some suggestions from the literature as to how mathematical thinking might be specifically fostered in students, through the use of different types of mathematical tasks. Efforts were made to interpret these recommendations in the context of a first undergraduate course in Calculus, on which large numbers of students may be enrolled. This itself constrains to some extent the activities in which the teachers and learners can engage. The tasks referred to here are set as homework problems on which students may work individually or collaboratively. We will report preliminary feedback from the students with whom such tasks were trialled, describing the students' reactions to these types of tasks and their understanding of the purposes of the tasks.

Onion, Alice
King's College London
alice.onion@kcl.ac.uk

Women's stories of learning mathematics

In this session we will look at women from three generations of one family. All three women have no formal qualifications in mathematics and all left education at the minimum school leaving age.

They have been video recorded talking about their experiences of learning mathematics at school and their current levels of confidence. Given their different ages (83, 64 and 45) we might expect their stories to be different, but there are surprising similarities. I am at an early stage in this 'grounded' research, approaching the topic with no preconceptions of what I might discover.

Osmon, Peter
King's College London
peter.osmon@kcl.ac.uk

A Tablet Tsunami is coming to a school near you

Information Technology is now pervasive in education: administration of student records, repositories for learning materials, Internet access to stored knowledge, testing (mostly MCQs), IWBs (mostly used by teachers) and ILEs, but while PC labs are now common, for the most part schools' investment in technology has not been targeted directly at learning and, arguably, with the exception of Geogebra, there is not very much high quality interactive material available to support maths learning at any level. Howevers, econd generation Tablet PCs (with A4 size screen, high connectivity and interactivity) will soon be available in large numbers. Recall the transformation of other kinds of work, not least raised productivity, once every worker had a networked PC in front of them, and it seems clear Tablet PCs will change schooling dramatically. Imagine: each child's Tablet will be their interactive Textbook/Workbook/Test-paper. Where are the interactive maths learning materials for Tablets to come from? What research-based guidelines are there for such materials?

Part, Tracy
London Metropolitan University
tracypart@hotmail.com

Mathematical wellbeing? What are the implications for policy and practice?

The Capabilities framework has emerged from the belief that agential freedom, in isolation can not provide the discourse terrain to evaluate the ways in which differences are translated from policy into practice. Amartya Sen argues that agential freedom is conditional upon well-being; that is the individual's ability to identify and capitalise on opportunities as they present in everyday life. In an educational setting, advocates argue that traditional models for evaluating progress fail to provide a sufficient space to evaluate the effect of participation on well-being. This project will attempt to investigate the "usefulness" of mathematical well-being to empower adult learners to consider reflexively the impact of their perceptions and values on the way that they approach the learning of mathematics. Expected sample size of 8 – 10 learners from a variety of educational settings including AE, FE, out reach, residential and work based learning. Data gathering tools include life history, discourse analysis of mathematical discussion, in-depth interviews and learner created artefact. This research intends to capture learners' voice through collating narratives to compile a mathematics and/or educational history to be interpreted through Bourdieu's notions of habitus and field. Participant histories will then be used to identify the key themes and subsequent, more targeted, in-depth interviews will provide the thick descriptors for interpreting their learning experiences. A Foucauldian lens will provide the theoretical framework for the discourse analysis on the grammatical structures that underpin mathematical discussions. The research is in the early stages with only 4 interviews completed. However some themes have begun to emerge including; poor image of mathematics, poor relationship with formal mathematical structures (language), lack of confidence and / or mathematical imagination and lack of well-being to visualise future self as a mathematician.

Pope, Sue[1] & **Noyes**, Andy[2]
Liverpool Hope University[1]; University of Nottingham[2]
popes@hope.ac.uk ; andrew.noyes@nottingham.ac.uk

Early entry in GCSE mathematics

The change in school accountability measures at KS4 to include GCSEs in mathematics and English at grade C or above has led to increasing use of early entry to ensure that performance targets are met. We discuss the evidence around school entry practices from two surveys completed as part of the independent evaluation of the mathematics pathways project and discuss the need for a quantitative research study into the impact of early entry on participation and attainment.

Rodd, Melissa
Institute of Education, London
m.rodd@ioe.ac.uk

Mathematics and Yet But: undergraduates' reasons for studying mathematics

This session draws on research from the ESRC-funded project Understanding Participation rates in post-16 Mathematics And Physics (UPMAP). Part (i) will be a presentation of methodology and some results from interviews with undergraduates. Part (ii) will be a discussion on whether or how such research could or should impact upon government education policy – please come and air your views! In part (i) the reasons for conducting 'narrative-style' interviews, informed by psychoanalytical theory and practice, will be explained and samples of analysis given. This methodology acknowledges unconscious influences on choice-making generally and undergraduates' choice of course of study particularly. Our analysis includes attributions of 'reasons' for choice of which the interviewee is not aware and may not be able to be aware. This is because choices based on, for example, a need for safety or a fantasy of being noticed are unconscious 'reasons' or psychic defences. The focus in this paper will be on undergraduates who are reading mathematics with other subjects of study and addresses the questions 'why is this person studying mathematics?' and 'what is the role of the minor or joint subject?' The image of mathematics as a place where "this is this and that is that" - a notion cited by several students in our study – allows the minor or joint subject to function as a place for fantasies, defences or projective identifications and not merely a hedging of bets or lack of commitment. In part (ii) problems with such a troublesome methodology will be raised and issues relating to policy discussed. We shall address the issue of defensivity in/by those who are 'consumers' of the product of research. How does one convince a 'rational agent' that there are unconscious forces directing student choice? How might the UCAS procedure adapt? How should policy impinge on the relationship between advertising products (like maths degrees) and recruitment to those degrees?

Santos Melgoza, David Martín
Chapingo University, Mexico

Micro-worlds, self-regulated learning and epistemic status of subjective math information

In this study the main aim was to evaluate whether a micro-world in which a geometric representation of the parameters a, b and c of the function $f(x)= \mathbf{a}(x-\mathbf{b})^{\mathbf{n}}+\mathbf{c}$ promotes self regulated learning**.** We argue that the micro-world environment is favorable for promoting students' learning of the notions that underlie the idea of function as well as their self-knowledge during a learning episode. We focus on psychological variables relevant to the epistemic status that students assign to the information) coming about during a learning episode (e.g., beliefs of self efficacy and math proclivity. Data were collected from 16 Mexican first year high school students, 6 males and 10 females. All of them completed a task in the micro-world in which they manipulated the geometrical representation of a function using sliders, to change the shape and parameter values of a function, in order to match another function with specific parameters. They were asked what they think they learned, how they support their conclusions and how confident they were about what they get from the task. Findings highlighted Self-reference language as a learning strategy. It is discussed the role of learning aims awareness students bring about during the commitment to the task and its relation with the confidence in the explanation the students offer of what they think they learned. The way students accomplish the activity and how they explain their conclusions support that the micro-world empowers function idea acquisition and show important aspects of the relation between student's self-confidence in arguments and learning aim awareness as part of a metacognitive process of objectivization.

Skilling, Karen
University of Sydney
karen.skilling@sydney.edu.au

Exploring the spectrum of engagement in mathematics - student and teacher perspectives

Concerns regarding dips in mathematics achievement and engagement, particularly during the 'middle years', of schooling calls for greater understanding of the factors that influence student learning. To make progress on better understanding the importance of engagement and how it influences achievement in an educational setting, taking account of teachers' perceptions of

students' engagement provides balance and affords comprehensive exploration of the types and levels of engagement operating in mathematics classroom. This paper reports on findings one qualitative study nested within a larger project with a key aim to improve academic engagement in mathematics. The purpose of the current interview study was to establish the circumstances and factors that contribute to shifts in student's engagement and achievement in mathematics from both the students' and teachers perspectives'. One of the key aims of this study was to understand the influence of factors on levels of engagement separate from the students' achievement level in mathematics and to examine teachers' perceptions of factors influencing students' mathematical knowledge and engagement. In relation to this study the following research questions are addressed: 1) How do individual, classroom and school-levels factors influence middle year students' levels of engagement and achievement in mathematics? 2) How do teachers perceive students engagement and achievement in mathematics? 3) How do teachers perceptions of their students' levels of engagement compare to students self report? The theoretical framework used for this research, The Motivation and Engagement Wheel (Martin, 2007), examines multidimensional factors affecting motivation and engagement on both behavioural and cognitive constructs. The analysis of the students' responses indicates that students' learning in mathematics is influenced by both their ability and level of engagement. The descriptions of 'engaged' and 'disengaged' students' given by teachers were complex and dense, describing multiple types of engagement and ways for determining it. To better understand where disaffection (Nardi & Steward, 2003), 'lack of engagement' (Sullivan, Tobias, & McDonough, 2006) and 'switching off' (Brown, Brown, & Bibby, 2008; Martin, Anderson, Bobis, Way, & Vellar, 2010) differ to disengagement, a matrix was established reveal the spectrum of engagement through to disengagement and focus on the interplay between affective dimensions on student achievement.

Stansfield, Jayne & **Vaughan**, Kathryn
Bath Spa University
j.stansfield@bathspa.ac.uk

The sound of silence

In this session we report on a short-term collaborative project in which we observed mature students studying on a mathematics enhancement course last year. Having begun with the two seemingly disparate research interests in understanding understanding, and observing the emotion linked to the decision to engage in mathematical action, the emerging theme of silence in the classroom became a major shared focus. By maintaining our individual roles of teacher/observer and observer in the sessions and analysing different forms of data, such as audio recordings and students' written work, we have been able to gain a deeper interpretation of the events. In keeping with our enactivist methodology we have continued to reflect on the data and our interpretations of the data. We are now of the opinion that 'silence' may not adequately describe what we see and that in a mathematical community it may be helpful to consider such terms as 'thinking silence', 'busy silence', 'consensual silence' or even 'mathematical silence'.

Thomas, Stephanie
Loughborough University
s.thomas@lboro.ac.uk

Teaching at university: An example from linear algebra

The teaching of university level mathematics which includes extensive data collection in the 'university classroom' has been an (almost) un-examined practice until recently. As Speer et al (2010) put it, it required "researchers to move into the classrooms and offices of collegiate teachers in order to collect data that can support analyses of practice" (p. 13). My study, at least partially, is aiming to fill this gap. My research into the teaching of Linear Algebra at a UK university, in working closely with my supervisor, involved interviews with a mathematician and observations of his lectures over one semester. This represented the first half of the Linear Algebra module that all first year mathematics undergraduates were required to take as part of their degree programme. My research questions focussed on the lecturer's strategies, his reasons, intentions, motivation and beliefs, in planning and delivering an approach to the teaching of Linear Algebra that was specifically aimed at 'avoiding' the traditional DTP (definition-theorem-proof) style. Audio-recordings of the meetings with the mathematician provided the raw data for analysis of the planning for teaching, and audio-recordings of the lectures for the implementation of that planning. I take an activity theoretical approach to analysis and report on some of my findings.

Valentin, Justin
King's College London
justin.valentin@kcl.ac.uk

Speaking through school reports: Teachers' impressions of an instructional reform activity

This paper relates to an instructional reform activity which was implemented in the Seychelles in 2006 to deal with perceived poor mathematics teaching. Inspired by the three-part lesson structure of the National Numeracy Strategy in UK (DfEE 1998), a Mathematics Lesson Structure or MLS was developed and made mandatory in all state primary schools. This paper draws on findings collected from documentary analysis carried out on 10 school reports for the period Jan 2006 – December 2006 which discussed teachers' engagement with the reform. The evidence reveals that the teachers were positive about the reform, and felt the quality of their mathematics lessons was improving. The findings provide a context for further studies about instructional reforms in other small island developing states.

Venkatakrishnan, Hamsa & **Adler**, Jill
University of the Witwatersrand
hamsa.venkatakrishnan@wits.ac.za; jill.adler@wits.ac.za

Problematising procedural practice: A place for disaggregation?

In recent work, we have analysed a range of teaching episodes which, according to literature characterising procedural approaches to mathematics teaching, display elements of procedurally-oriented practice. The international literature indicates that procedural approaches are ubiquitous. Manifestations of procedural approaches in South Africa though, indicate significant qualitative diversity. This makes disaggregation useful, whilst also rendering the umbrella term 'procedural' problematic to use. Our episodes appeared to display disconnections that varied in both nature and degree. In the process of trying to find a language to describe the similarities and differences across these episodes, and drawing from existing literature in the area, we have focused on the notions of 'input objects', 'operations', 'intended domains' and 'enacted domains'. Our sense is that current writing on procedural approaches tends to only deal with the 'tip of the iceberg', and that our terms help us to disaggregate procedural approaches in ways that might help us to tailor feedback to teachers in more nuanced ways.

Vosper Singleton, Damon
King's College London
vosper.singleton@gmail.com

Application of concepts of cultural-historical activity theory in mathematics education research

In my research into the development of notions of mathematical activity I have brought grounded methods to cultural-historical activity theory, working with interview and observation data to understand the classroom as an activity system. Studies applying cultural-historical activity theory in mathematics education research often distribute collected data between discrete categories derived from a theoretical description of the activity system under investigation. However, in my research I found such rigid and pre-determined assignments problematic, in that they inhibited my understanding of the action of a system as complex as the classroom. Engeström's third generation of activity theory (Engeström, 1996) offers a means of understanding the complexities generated when engaging with multiple subject perspectives; I suggest that in this case the framework is best employed as a language of description, rather than as a means of permanently categorising aspects of the social situation being investigated. Data from my study has been more fruitfully interpreted through allowing categorisations to remain fluid and multiple. This has aided my appreciation of the dialectic nature of development and the potential for contradictions to arise within the system. In this presentation I discuss data relating to pupils' written work; my aim is to understand how a sense of the purported object of the activity, mathematics, arises out of involvement in the classroom activity known as 'doing mathematics'.

Ward-Penny, Robert
University of Warwick
r.m.ward-penny@warwick.ac.uk

How do teachers choose between the applied options of A-Level mathematics?

One-third of the current mathematics A-level consists of applied mathematics modules, drawn from a range of options that are typically labelled as 'mechanics', 'statistics' or 'decision mathematics'. The decision about which modules should be offered to pupils arguably constitutes the most sizeable instance in English school mathematics where teacher choice helps to shape the curriculum. However, this choice is not well understood; for instance, although the 2007 QCA report on A-level participation advanced that there was a high level of 'strategic' entry, it also reported that the modules which were perceived to be easiest were in fact amongst the least subscribed. This presentation will describe a research project which was conducted to explore this state of affairs. In the first stage of this project an on-line questionnaire was completed by participants from 337 different centres. The results of this questionnaire demonstrated varying levels of provision between schools, and also indicated how each of the three main streams of applied mathematics was viewed by teachers. In the second stage 11 follow up interviews were conducted to explore some salient issues further and bolster validity. The results of both sets of data show an interesting relationship between perception and provision, and suggest that decisions about provision are influenced in a complex way not only by strategic motivators, but also by intrinsic and inertial ones. This finding may have timely wider implications for curriculum design and reform.

Watson, Anne
University of Oxford
anne.watson@education.ox.ac.uk

Functions as a thread throughout the curriculum

Last BSRLM, Keith Jones ran a session about measurement and how it comprises a collection of concepts that arise throughout school mathematics. In the same vein, The Nuffield-funded Secondary School Mathematics research team is now offering a session about functions to examine how concepts associated with functions arise in the curriculum, and what research there is about how these come to be learnt and understood through the school curriculum. It appears that teachers' and researchers' own concepts of function are sometimes limited to what they believe can be done by students at different ages. Our project on the research basis for teaching the key ideas of secondary school mathematics is reviewing what is known about pupils' prior understandings of functions that secondary teachers might expect to be able to draw on, the possible routes of progression in functions at the secondary school level, and what is known from research about different teaching approaches that might inform classroom choices. This session provides an opportunity for the BSRLM community to consider, and contribute towards, our understanding of this key area of mathematical knowledge.

Xolocotzin Eligio, Ulises
University of Bristol
U.XolocotzinEligio@bristol.ac.uk

Economic activity and maths learning - Project overview

We will present the research plans and initial data of a project that explores the links between the out-of-school economic activities of UK children (8 - 16) and their learning of mathematics. This project follows the Situated Learning Theory assertion that learning is grounded in the context in which it occurs. The idea is to explore the mundane economic environment of children in order to identify the sort of informal mathematics that they might be learning whilst taking part in it. The aim is to inform and enhance children's classroom mathematics experience to make it meaningful and engaging, especially for underachievers. Economic activity is interpreted and researched in a broad sense, covering activities around money (e.g., paid work, pocket money, gambling) but also other non-monetary transactions (e.g., swapping, collecting, giving gifts). Attention will be paid to children's understanding of the social aspects of their economy (e.g., comprehension of financial institutions and mechanisms) but a focus will be made on the mathematical part of it.

The session will have two inputs. First, the kinds of children's economic activity that have been reported in the literature (world-wise and in the UK) will be presented. Attendees will be asked to discuss and speculate about the sort of mathematics that such activities might involve. Second, the

methodology (e.g., sample and questinonaires) of a survey directed to explore children's economic activities will be presented. A discussion will be opened to gain feedback and recommendations. Future plans for the project will be also presented.

Yesildere, Sibel[1] & **Akkoc**, Hattice[2]
Dokuz Eylul University, Izmir, Turkey[1]; Mamara University, Istanbul, Turkey[2]
sibel.yesildere@deu.edu.tr; hakkoc@marmara.edu.tr

Prospective elementary mathematics teachers' pattern generalisation structures for figural patterns

This study investigates prospective elementary mathematics teachers' pattern generalisation structures. Prospective mathematics teachers were given four open ended linear and non-linear (quadratic) figural pattern problems which require them to make generalisations. Prospective teachers' responses to these problems were analysed using Radford's (2006) framework to investigate how they identify a commonality among the terms of patterns, establish a hypothesis and find an algebraic expression for the rules of patterns. The analyses of data indicated that prospective teachers relied on naïve induction during arithmetic generalisation and figural patterns were served as accessories that facilitate presenting patterns in a numeric form.

C. Workshops

Rogers, Leo
University of Oxford
Leo.Rogers@education.ox.ac.uk

History in the Mathematics Curriculum

The Working Group aims 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. This session continues the earlier meetings of the group and will review the outcomes and material from the meeting of the History and Pedagogy of Mathematics group held in Vienna in July, update on recent activities, and introduce plans for a new website about materials aimed at secondary pupils, teachers, and teacher trainers.

Watson, Anne[1], **Pratt**, Dave[2] & **Jones**, Keith[3]
University of Oxford[1], Institute of Education[2], University of Southampton[3]
anne.watson@education.ox.ac.uk; d.pratt@ioe.ac.uk; dkj@soton.ac.uk

National Curriculum Review

The recently announced review of the National Curriculum for England is looking to "build the evidence base for the review" to ensure that "the construction and content of the new National Curriculum is based on evidence and informed by international best practice". In a project funded by the Nuffield Foundation, the Secondary School Mathematics research team is undertaking a review of the research basis for teaching the key ideas of secondary school mathematics, covering matters such as what is known about pupils' prior understandings of mathematics that secondary teachers might expect to be able to draw on, and the possible routes of progression in mathematics across the secondary school years. This working group session will begin with some short inputs by the Nuffield-funded research team on some components of secondary school mathematics. The bulk of the session will be open to participants to discuss the evidence base, covering both primary and secondary, for the National Curriculum review and how this evidence might help inform the construction and content of the new National Curriculum.