BSRLM Abstracts, University of Sussex, 9 June 2012

Research presentations

Adams, Gill
Liverpool John Moores University
G.R.Adams@ljmu.ac.uk
Pushing the boundaries: women teachers' stories of learning mathematics
A recent focus on teacher professional learning notes a paucity of research on learning throughout a teacher's career (RECME, 2009). Focussing on women mathematics teachers' stories may aid our understanding of the factors contributing to the retention of women in mathematics related careers; currently transition points at all stages see large numbers of women opting out of mathematics (Kirkup et al., 2010).
This session will share findings from the early stages of a doctoral research project exploring women secondary mathematics teachers' experiences of professional learning. The research seeks to examine the participants' experiences, considering their identity formation through participation in social organisations (Holland et al., 1998). It aims to explore how women mathematics teachers come to know mathematics, what they perceive as significant in their professional learning and how this learning is supported. Adopting a life history approach, data was gathered using a series of semi-structured interview-conversations. The initial meetings focussed on teachers' own experiences of learning mathematics and of learning to teach. Data from these conversations will be shared together with reflections on the development of a framework for analysis and presentation of the teachers' stories. Early stages of analysis suggest that success in mathematics often involved confounding the expectations of significant others.

Barmby, Patrick*; **Bolden,** David; **Raine**, Stephanie & **Thompson**, Lynn
Durham University
p.w.barmby@durham.ac.uk
Developing the use of diagrammatic representations in the primary classroom
The present study was a funded project aimed at developing primary children's understanding of mathematics, through developing teachers' use of diagrammatic representations in the classroom. The study involved eight mathematics coordinators from primary schools taking part in professional development sessions looking at teachers' use of diagrammatic representations for mathematics. The sessions drew on research on how diagrammatic representations can be used, specifically looking at representations of multiplication and fractions. Coordinators taking part in the project attended three one-day sessions and were then asked to work with teachers in their schools in order to try and incorporate these ideas into practice. The impact of the project was assessed through pre- and post-tests (with comparison control schools) for pupils on multiplication and fractions. We also completed observations of lessons, interviews with pupils on how they approach particular mathematical tasks, and interviews with the teachers and coordinators involved. This presentation will outline the project findings, highlighting the impact of the project on pupils and teachers and will also put forward implications for future research in this area.

Broughton, Stephen; **Robinson,** Carol L. & **Hernandez-Martinez**, Paul
Mathematics Education Centre, Loughborough University
s.broughton@lboro.ac.uk
Lecturers' adaptations to computer-aided assessment practice
Computer-aided assessment (CAA) has been used for ten years at a university with one of the largest engineering and mathematics student cohorts in the country. This efficient and time-saving tool for assessing students on the mathematical content in these courses allows lecturers to monitor and record the progress of hundreds of students by selecting from a bank of thousands of questions.
Although this would appear to provide a straightforward means of testing large numbers of students, lecturers have developed diverse practices when using CAA with students. For example, some lecturers invigilate students while they do the online test, while others have replaced the online test with a paper equivalent.
Such changes may be explained by the notion of contradictions proposed by Engeström (2000). For example, some lecturers believe that the questions in the online test are too prescriptive and do not test what is desired. To resolve this conflict, these lecturers may replace the online test with a paper test in order to achieve their assessment goals.

This session will examine the findings from questionnaires and interviews conducted with lecturers of first year mathematics modules at this university. By these methods, lecturers explain how and why they use CAA, the issues they have encountered and how they have adapted their practice to counter them. With activity theory providing a framework with which past changes can be explained, possible future changes in practice will also be discussed.

Chadwick, Edmund & **Radu,** Oana
University of Salford; University of East Anglia
o.radu@uea.ac.uk
Evaluating assessment practices in a Business and Industrial Mathematics module
The Business and Industrial Mathematics module is run in the second year of the mathematics undergraduate degree at the University of Salford. The module is worth 20 credits, spans two semesters and is assessed through 100% coursework. The module attempts to prepare and assess students for work related skills important for mathematicians in the workplace. A variety of assessments and delivery are used, including open-ended problems, problem solving, group work, presentations, report writing, employer seminars, and professional studies. The aim of this research is to compare and evaluate the various assessments and assessment practices used, through the eyes of the students who will complete a questionnaire. To provide a control group, the first year undergraduate mathematicians who haven't taken the module, were also asked to complete relevant sections of the questionnaire. The results, together with conclusions drawn from them, will be presented.

Clarke, Nichola
University of Nottingham
nichola.clarke@nottingham.ac.uk
With good reason? Reasoning from students with low prior attainment in mathematics
I describe the reasoning of students with low prior attainment from two Y11 classes, observed over the course of six weeks, in their normal classroom lessons. Students were, consistent with the intended curriculum, afforded limited opportunities to reason. I outline findings on the completeness and warrants of students' argumentation, with reference to the Toulmin model. I then show evidence that students reasoned mathematically in some of those argumentations.

Cowley, Richard
Institute of Education, London
r.cowley@ioe.ac.uk
How frequent are your eureka moments? A discussion of pace in mathematics education
Research focussed specifically on pace is scarce. Pace is raised in a range of literature in various ways as something for teachers to be concerned about yet it is an ill-defined quality. In this session I will present texts for discussion with the aim of considering these questions. How is the term ‘pace’ used in representations of school classroom practice found in educational literature? What ways of representing school classroom practices are evident in the way the term ‘pace’ is used? What are the implications for continuing engagement with the notion of pace in mathematics education? Texts will be drawn from research in education and mathematics education, advisory literature and government and inspection reports.

Damian, Erika
University of East Anglia
erika_damian@yahoo.it
A pilot for problem-solving activities in Year 1 mathematics
The development of problem-solving skills is one of the intended goals of a degree in mathematics. Curricula in mathematics include a variety of disciplines so that students are exposed to a range of examples/problems in different contexts. The underlying idea is that this exposure would, in itself, allow students to develop problem-solving skills. Research in mathematics education shows that exposure alone is not necessarily the most effective way of developing problem-solving skills and that students need to experience active engagement with mathematics. This observation triggered the introduction of modules aimed at teaching how to think mathematically.
We report on a pilot study consisting of clinical interviews with small groups of first-year mathematics students to test a set of problems. We analysed these interviews identifying the problem-solving strategies they used. We compared these with the strategies proposed by Mason (1985). We found that students produce examples but not in a systematic way, and therefore find it difficult to identify patterns. In addition, students struggle to proceed if their initial idea is not useful or indeed if an initial

idea is not found hence failing to connect example generation with generalisation. Finally, formal mathematical writing of their findings is one of the major issues emerging form these interviews

Deacon, Debra & **Edwards**, Julie-Ann
University of Southampton
j.s.edwards@soton.ac.uk
Influences of friendship groupings on motivation for mathematics learning in secondary mathematics classrooms
Friendship groupings in mathematics classrooms are a rarely researched phenomenon, yet they are often used as a pedagogical tool in mathematics classrooms, either briefly for a few minutes discussion or as a more sustained means of learning. This session reports on a small scale study examining the influence of friendship groupings in key stage 4 mathematics classrooms on students' motivations to engage with mathematics. Using a methodological approach of 'zooming in' (Lerman 2001), we present evidence from questionnaires and individual interviews to describe the motivational factors evident in two key stage 4 mathematics classes and link this to evidence from the large-scale quantitative study undertaken in the US by Nelson and deBacker (2008). We report on the influence of environmental factors on students' understandings of their motivation to learn and their knowledge construction, using a theoretical framework of a continuum of intrinsic and extrinsic motivational traits (Ryan & Deci 2000). Findings confirm the multi-faceted nature of motivation and suggest some gender differences in interpreting classroom relationships and differences between groups of close friends and those of friends by association. We interpret our findings in the context of mathematics classrooms organised by student levels of attainment.

De Geest, Els
Open University
e.n.f.degeest@open.ac.uk
Nurturing Possibility Thinking (PT) in mathematics education courses through experiential learning and the use of pedagogical constructs, and beyond
This presentation reports on the Creative Thinking in Mathematics Education Enquiry (CTMEE) at The Open University. The study investigates whether the pedagogical approaches of experiential learning, reflection and the use of pedagogical constructs and frameworks used in an undergraduate distance learning mathematics education course, can lead to creativity seen as Possibility Thinking (Grainger et al, 2007). Data consist of 23 quantitative and qualitative responses from students to an on-line questionaire. Findings suggest that such pedagogical approaches can indeed contribute to developing Possibility Thinking. However, it seems the more subtle task design within such approaches is equally crucial.

Houssart, Jenny
Institute of Education, University of London
j.houssart@ioe.ac.uk
Intervention programmes in primary mathematics: Teaching Assistants discuss their experiences
The session will draw on interview data in which Teaching Assistants (TAs) discuss their experiences of using mathematics intervention programmes with children in primary schools. Initial analysis will focus on what TAs say about whether and how they make changes to the programmes. Possible reasons for and implications of different practices will be considered. Comparison will be made with the literature concerning curriculum implementation by teachers.

Hoyles, Celia; **Kent**, Phillip; **Noss**, Richard & **Smart**, Teresa
London Knowledge Lab, Institute of Education, University of London
c.hoyles@ioe.ac.uk
Cornerstone Mathematics: An approach to technology-enhanced curriculum innovation at scale
We report on a project, Cornerstone Mathematics, that is researching the impact and scaleability of an innovation for secondary mathematics, focused on embedding digital technology at points where its potential for enhancing mathematics learning is clear due to the availability of multiple representations (algebra, graphs, Euclidean geometry, simulations) that are visual, dynamic and inter-connected. The work to date has involved SimCalc and dynamic geometry.
The project is an international collaboration between England and the USA, where extensive prior work was undertaken. The innovation combines four elements that each individually been extensively researched: digital technology designed for mathematics learning, professional development designed

to scaffold teachers' skills and knowledge, new curriculum 'replacement' materials comprising student and teacher texts, and explicit strategies established for scaling and sustainability.
We will present the results of a pilot study with students from Years 7 to 9 based on 9 schools, 18 teachers and 2 curriculum units (linear functions, geometrical similarity). The outcomes were very positive, with evidence from measured gains between pre- and post-testing, teachers' and students' feedback, and structured observations of experimental lessons.
We will also present for discussion our strategies as to how to scale up the work to several hundred schools.

Inglis, Matthew; **Croft**, Tony & **Matthews**, Janette
Loughborough University
m.j.inglis@lboro.ac.uk
Do mathematics graduates develop the skills they need or expect?
In this session we report the results of a survey of mathematics graduates from the 2009/10 graduating cohort. We asked participants to reflect on the skills that they developed during their mathematical study, and to assess whether these skills have been useful in their career to date. We then compared these responses to those from a comparable dataset where incoming undergraduates were asked to give their views on the skills that they expected to develop during their mathematical studies (Challis et al., 2009). In this session we discuss the mismatch between student expectations and graduates' experiences.

Jones, Ian & **Alcock**, Lara
Loughborough University
I.Jones@lboro.ac.uk
Peer assessment of conceptual understanding of undergraduate mathematics
We report the results from an evaluation of an innovative approach to the summative assessment of undergraduate mathematics. First year undergraduates completed a written conceptual test and then assessed the scripts online using a pairwise comparison method. To evaluate the innovation we compared the outcome of the undergraduates' assessments with those of expert and novice groups. As expected the outcomes of the expert and undergraduate groups correlated more strongly with each other than with the outcomes of the novice group, although the differences were not as pronounced as anticipated. We draw on data from follow up surveys and interviews to help interpret the results.

Jones, Keith & **Ding**, Liping
University of Southampton; Shanghai Soong Ching Ling School
d.k.jones@soton.ac.uk
Diagrams in School Geometry Tasks
Diagrams are intrinsic to geometry and hence are integral to geometry teaching. Even so, as with all imaginistic reasoning, pupils interpreting geometry diagrams may focus on irrelevant details, or be diverted by the influence of prototypical aspects. This session reports on an analysis of 13-14 years olds tackling a proof task involving a parallelogram. The analysis focuses on the ways in which the pupils interpreted the diagram as they tried to complete the task and the ways in which the teacher drew their attention to various features of the diagram.

Joubert, Marie
University of Bristol
marievjoubert@gmail.com
The design of mathematical tasks: principles and examples
This presentation begins by drawing on the literature to unpick mathematical tasks, taking into consideration what is meant by a task, how tasks are used and what their role is. It discusses the role of the teacher, the role of the students and the role of resources such as text books, worksheets and, in particular, computers.
It goes on to address the design of tasks, theorising how they can be designed to provoke mathematical learning by referring to the literature (e.g. Brousseau, Sierpinksa) to arrive at a (tentative) set of 'design principles'.
Finally the presentation takes examples of mathematical tasks in which computers are used, designed by both the author and by teachers in 'authentic' classrooms, and briefly analyses them in the light of what has come before.

Kent, Geoffrey
University of Sussex
g.kent@sussex.ac.uk
Collective Intentionality, Intersubjectivity, and Validity-Discourse: Clarifying concepts as a basis for a model of student interaction in mixed ability year seven mathematics classes in England
Key concepts for resolving questions about how we can understand student interactions in the context of small group problem solving from a perspective of communicative action will be presented. Coding and models developed from original thesis research explore the interactions of students engaged in problem solving in small groups in the context of the adoption of a particular form of non-traditional practice, Complex Instruction, in Year 7 heterogeneously grouped (mixed ability) mathematics classrooms in England. Working hypotheses about the technical features of communicative practices in small group interactions, norms and conditions that facilitate and impede participation, how communicative interaction can breakdown, and how to support it in a classroom setting are identified. In seeking to understand small group interactions around mathematics learning from a perspective of communicative action, certain key concepts became problematic. Among these are the concepts of intersubjectivity, intentionality (Intentionalität vs. Absicht), validity-discourse (Diskurs), consensus theories of truth, and the counterfactual norms entailed in ideal speech situations. These will be discussed in the context of the theories and models and will contribute to discussion questions about the critical potential of approaching the interpretation of student interactions from a standpoint of communicative action.

Marks, Rachel
King's College, London
rachel.marks@kcl.ac.uk
"I get the feeling that it is really unfair": Educational triage in primary mathematics
Multiple reviews highlight the, often negative, implications of ability-grouping in secondary mathematics, but knowledge of such practices in primary schools is limited. Despite this, primary school ability-grouping, particularly in mathematics, is increasing. In this presentation I extend discussion from an earlier BSRLM presentation of a specific practice enacted through ability-grouping: educational triage. Educational triage involves the direction and redirection of educational resources towards those most likely to benefit, whilst taking support away from those deemed as 'hopeless cases'. Such practices have been documented previously in GCSE mathematics and more recently in elementary education in the US. In this presentation I examine evidence of the same practices happening in primary mathematics.
This presentation draws on a subset of data from my PhD research, presenting the outcomes and experiences of Year 6 (ages 10-11) pupils at 'Avenue Primary' who experienced rigid setting in mathematics. Quantitative and qualitative data will be presented in examining pupils' educational outcomes and experiences.
This study suggested that 'Avenue Primary' enacted a strong process of educational triage. Teachers readily admit to such practices, often citing external accountability to justify their approaches. Pupils deemed capable of reaching Government targets for the end of primary school – Cusp pupils – were assigned the best teachers and additional resources, whilst the 'hopeless cases' experienced severely limited mathematical access. Cusp pupils made an attainment gain of more than twice the gain of the 'hopeless cases'. Qualitative data, highlighting the differential practices and pupils' experiences of these, will be discussed in this presentation.

Morgan, Candia
Institute of Education, University of London
c.morgan@ioe.ac.uk
Mathematics as a human activity? The changing nature of mathematics in GCSE examination questions
We seek to analyse how school mathematics has changed over time by using the lens of 'O' Level/GCSE examinations from 1980 to the present day. One aspect of this analysis considers the question: to what extent is mathematics construed as a human activity in which claims are based on the outcomes of investigations, reasoning or decision-making rather than on agentless facts?
In this presentation, we will present the analytical tools used to address this question and illustrate their application, comparing examination papers and questions from different years. It is notable that, although use of the passive voice has reduced considerably in recent years, driven by a policy of increasing readability, this does not seem to have resulted in greater human agency in the way mathematical activity is presented.

Osmon, Peter
King's College, London
peter.osmon@kcl.ac.uk
A response to the JMC Report: Digital technologies and mathematics education
The report claims that our economic future depends on the innovative abilities schoolchildren develop on top of their mathematical knowledge. But today's schoolchildren inhabit an Information Technology (IT) world so far removed from traditional school mathematics that the latter may seem like a dead language. Consequently school mathematics must change. The Report recommends that IT tools such as computer algebra systems and dynamic geometry should mediate mathematics learning, together with student-led computer programming and modelling, and corresponding sustained changes to teachers' CPD, high-stakes assessment, etc. However, the report stops short of suggesting that a school mathematics that meets the students in their IT world would have significantly different content. My viewpoint, as one of those IT innovators referred to in the report, seems relevant: I found I had learned the wrong mathematics at school and college - instead of traditional algebra, geometry and calculus, I needed some set theory, Boolean algebra, logic, automata theory, probability (which I did have) and, of course, programming.
Is it helpful to compare the traditional STEM knowledge hierarchy (C20 engineering, C19 classical physics, continuum maths) with clear demarcation of knowledge domains, with the younger information one (C21 IT applications, late C20 computer science, discrete mathematics) where domain boundaries are still fuzzy (thus graph theory and Turing machines are claimed by both discrete mathematics and theoretical computer science)? I have been presenting a series of papers at BSRLM day conferences, aiming to tease out issues relating to the level-3 mathematics curriculum. These also seem relevant. In the case of mathematical modelling one of my observations is that the range of models schoolchildren can make is constrained not just by their mathematical knowledge but also by the application domains they are familiar with and, as the report says, for the current generation.

Sevimli, Eyup & **Delice**, Ali
Univeristy of Marmara
eyup.sevimli@marmara
May Mathematical Thinking Type be a Reason to Decide What Representations to Use in Definite Integral Problems?
Research on mathematics education has investigated the structure and components of mathematical thinking for a long time. The nature of calculus frequently requires the use of different approaches. In particular applications of definite integral problems contain components of visual and analytical solution strategies. Therefore, students might not find the correct solution if they don't interpret and choose appropriate strategies in definite integral problems that accord with their mathematical thinking types. For this case study, students' problem-solving strategies were investigated in terms of their preferred and used representations. The participants were three of thirty seven first year undergraduate mathematics education students who were selected through a purposeful sampling technique according to their mathematical thinking type and representations preferences. Mathematical Process Instrument and Representations Preferences Test were used for defining the participants' mathematical thinking type and representations preferences respectively. After administration of the tests, the main data was collected through an interview with *analytic*, *harmonic* and *visual* participants. Results show that algebraic representations were a necessary tool for the problem-solving process for all participants. Moreover, the *visual* participant wanted to solve the problems using different representations, it seemed that prior knowledge and habits could sometimes prevent this. On the other hand, the findings revealed that the methods and approaches used in the traditional teaching process affected students' problem solving behaviour.

Simpson, Adrian & **Iannone**, Paola
Durham University; University of East Anglia
p.iannone@uea.ac.uk
Performance Assessment in Mathematics – Preliminary Empirical Research
This talk will outline the experience of introducing a form of oral performance assessment into a first year undergraduate degree module. While oral assessment is commonplace in many countries, it has all but disappeared from undergraduate mathematics in the UK and we will explore some of the issues regarding implementing this form of assessment, some of the potential advantages, and how this particular form of oral assessment was used with a group of first year undergraduates. We will detail the outcomes in terms of students' performance and student and tutor views of the assessment process.

Skilling, Karen
University of Sydney
karen.skilling@sydney.edu.au
What teachers do and say to engage students in mathematics
"I said the reason you should do math's is: you have to and it is a skill you can show an employer and give an example of something you did not want to do and did not like and did not understand"
In the context of dips in achievement, falling participation rates and lack of interest in post-compulsory mathematics courses teacher perceptions of student engagement in mathematics are explored in this study. Thirty-one Year 7 mathematics teachers from ten high schools located in the Sydney metropolitan region were interviewed as part of a larger project investigating student engagement, motivation and achievement in mathematics. The interviews reveal how teachers perceive student engagement and the strategies and practices they use in mathematics classrooms. The focus for this study is to explore whether teachers identify motivating strategies as part of their mathematics teaching and to elicit explicit instances of addressing motivation or lack of motivation for their mathematics classes and individual students.

Valentin, Justin
King's College, London
justin.valentin@kcl.ac.uk
Mathematics teaching in the Seychelles: The challenges of reform in a small developing state
This paper is drawn from my PhD research which aimed at investigating the outcomes of a primary mathematics teaching reform in Seychelles. As part of the research, four schools were chosen for in-depth fieldwork. In each school, samples of P3 and P6 mathematics lessons were observed, post lesson interviews were carried out with the teachers, and a focus group interview was held with a group of six teachers about their experiences of enacting the reform. This paper is based on the focus group interview data in which the teachers shared their experiences of their attempts to renew their practices in line with the reform. Data analysed using the constant comparative approach reveal four themes: reform message, school-based support, instructional challenges, and impression of outcomes which collectively suggest that primary schools in Seychelles were challenging sites for pedagogical reform. The results have implications for teacher in-service education and policy making on pedagogical reforms.

Venkatakrishnan, Hamsa
University of the Witwatersrand, South Africa
hamsa.venkatakrishnan@wits.ac.za
Grounded analyses of primary mathematics teachers' use of representations and explanations
In a context of evidence of poor primary mathematics teacher content knowledge and pedagogic content knowledge (PCK) in South Africa (Carnoy et al, 2011), a 20 day content knowledge/ PCK focused course is being piloted as part of a larger research and development project. In this course a range of PCK-oriented tasks are set, in order to understand points of possible intervention in terms of openings for constructive teacher development.
In this session, teacher responses to decimal/integer tasks are shared for their role in opening up indicators relating to the ways in which different representations of ideas are used and connected. The representational forms I am currently focusing on are: descriptions of actions/processes, diagrammatic and symbolic, and word descriptions. For teaching though, the use of multiple representations is insufficient: explanations have to establish the connections between these forms.
In looking across different teachers' work, we have started working with the idea of 'connections maps' to describe responses. Indicators for describing contrasts within these maps currently include: presence of alternative representations; stating versus establishing connections between representations; precision and formality of mathematical language.
Conversations based on using these indicators are currently in the process of being tried out, framed by the following questions:
- What understandings of the mathematical objects and operations under consideration can be gained through following your explanation and representations?
- Would a student who did not know how to get the right answer to the set question, be able to answer a similar question independently by following your explanation and representations?

Watson, Steven & **Evans**, Sheila
University of Nottingham
steven.watson@nottingham.ac.uk
Observing changes in teachers' practice as a consequence of taking part in professional development
In this session we will describe the development of a system for lesson observation. This system has been designed to be used to observe changes in teachers' practices as a result of taking part in professional development (PD). The PD promotes and supports secondary mathematics teachers' use of inquiry-based learning and problem-solving. Many approaches to the evaluation of PD rely on the assessment of changes in teachers' thinking and beliefs, largely because of the complexity and difficulty of analysing practice. As part of a design-based research study we have been developing an observation protocol that allows the rapid analysis of a number of lessons by creating a lesson structure model and identifying the facets and dimensions of lesson episodes. In this way we are able to code episodes and identify changes in the nature and structure of practice. In this session we will describe the ongoing development work and the system that has been developed and trialled so far.

Working groups

Clarke, Nichola
University of Nottingham
nichola.clarke@nottingham.ac.uk
Sustainability and Mathematics Education
In the first part of the session, we will look at some materials for cross-curricular teaching of mathematics and science developed in COMPASS, an EU funded Comenius project (2011), and the issues that this teaching raises for the design of professional development. In the rest of the session, we will review the first draft research agenda developed from the previous BSRLM conference.

Hoyles, Celia; **Joubert**, Marie & **Pope**, Sue
Institute of Education, London; University of Bristol; University of Manchester
marievjoubert@gmail.com; sue.pope@manchester.ac.uk
From research to practice: making an impact?
Whereas this working group has taken as its context first a particular project and second a Royal Society initiative, the focus of the working group this time will be more on the mechanisms through which research might achieve impact, particularly at the level of classroom practice.
We begin by looking at CPD, which includes M-level study and other initiatives, discussing as a group what the role of research is in CPD, how it influences teacher professional development and how or to what extent we might claim that there is an impact at classroom level.
We explore the idea of making research 'teacher friendly' discussing what this means and how it can be achieved. For example, we look at an initiative by the NCETM, in which online modules of study – each focusing on a particular research paper – were created and discuss the effectiveness of this approach. We also consider articles published in teachers' professional journals such as MT, MiS and Primary Mathematics.
Finally we discuss more direct approaches such as workshops and teachers' conferences. In particular we showcase the BCME 2014 conference as an opportunity to reach teachers, discussing a) how to attract teachers to such workshops and b) what these workshops might look like in order to achieve maximum impact.