

# 2009 Conference Report Summary

The Future of Mathematics in Schools and Colleges – a policy perspective | [acme-uk.org](http://acme-uk.org)

July 2009



It has been a fascinating rollercoaster ride during my first months as chair of ACME. Since taking over the reins in September, we've negotiated our way around a range of challenges in curricula, qualifications, assessment and teaching – but never losing sight of our overall objective – to influence policy to improve the outcomes of teaching and learning mathematics in England.

I'm not a mathematician by background, having an academic career in chemical engineering – however, I fully embrace the critical importance of equipping students with a mathematical education for their own benefit, and for the benefit of the nation as a whole. Moreover I have spent time as a teacher, so the issues of the classroom resonate with me too.

Not only is mathematics a fundamental component of the STEM agenda – it is also a central component of many other subjects in medical sciences, social sciences and humanities. But the work of promoting mathematics education is not made any easier by our national culture of negative perceptions towards the subject. We need to break this cycle – in which it is acceptable, if not 'cool', to admit to being unable to do mathematics in a way which no one would ever admit to being unable to read or write. This undermines our ability to succeed in a technologically bound global economy.

I hope those of you who attended the 2009 ACME Conference found it a challenging and constructive occasion. We value the opportunity to discuss many of the pertinent issues with practitioners and policy makers. This year, a lot of the focus at the conference was on some of the key qualification and curriculum challenges that are currently on the policy agenda. For many in the community, top of this list must be the ongoing efforts to implement one of the key recommendations of the 2004 Smith Report which called for a second GCSE in mathematics.

It was somewhat unfortunate that the conference fell at a time when we were unable to discuss, in the detail we would have liked, the criteria for a pair of mathematics GCSEs which had been developed by ACME and partners. Nevertheless, I think no one left the day without appreciating the level of support for two GCSEs, nor without a degree of frustration with the piloting and roll-out timetable. One of ACME's roles is to press for a less protracted timetable for introducing the pair, and also that the pair will be the only mathematics GCSEs on offer come 2015 when first teaching is expected.

The pair of GCSEs will better equip students in understanding the methods of mathematics as well as being able to apply their mathematics, something employers continually identify as a key demand. But the conference also touched on many other issues – such as changes to the primary curriculum and future developments in 14-19 qualifications – which will all have a major impact on future mathematical capabilities of the nation.

This report provides a summary of the headline messages from the day. It is intended to demonstrate to you – as attendees at the conference – that we listen to your views, and value the opportunity to hear your contributions. All of this will feed in to ACME's ongoing schedule of work to improve the way we all teach and learn mathematics.

I look forward to seeing you all at the 2010 ACME Conference, if not before.

**Professor Dame Julia Higgins FRS**  
Chair, ACME

The Advisory Committee on Mathematics Education (ACME) is an independent committee, based at the Royal Society and operating under its auspices, that aims to influence Government strategy and policies with a view to improving the outcomes of mathematics teaching and learning in England and so secure a mathematically enabled population. ACME was established by the Joint Mathematical Council of the UK and the Royal Society, with the explicit support of all major mathematics organisations, and is funded by the Gatsby Charitable Foundation. Details of ACME's current membership and activities are available at [www.acme-uk.org](http://www.acme-uk.org).



# PANEL SESSION

The conference panel session gave an opportunity for delegates to hear from and question a group of policy makers and practitioners about future mathematics education policy issues coming up over the next 5 years or so.



**Lord Martin Rees of Ludlow, Kt**  
*The President of the Royal Society*

ACME is, I think, one of the great successes which the Royal Society can at least claim credit for having instigated. It started a number of years ago and I believe it has had a substantial impact on mathematics education in a number of ways. There has been a turnaround in the number of A-Level candidates and indeed the target for the number of A-Level candidates has recently been raised to 80,000. ACME has also worked very hard on the two mathematics GCSEs issue, with great success. I would like to thank all within the mathematics community for your help in helping ACME achieve its goals. Finally, I would like to acknowledge the work from the excellent Chairs that have been with ACME over the years: from Professor Sir Christopher Llewellyn-Smith FRS, to Sir Peter Williams FRS, Professor Adrian Smith FRS and the current Chair Professor Dame Julia Higgins FRS.

*"ACME is, I think, one of the great successes which the Royal Society can at least claim credit for having instigated."*

Lord Martin Rees of Ludlow, Kt



**Professor Adrian Smith FRS**  
*Director General of Science and Research,  
Department for Business, Innovation and Skills*

Adrian began by outlining the key role of his department in advancing the STEM agenda and ensuring that there are enough STEM graduates to meet national requirements. He suggested that a future agenda for ACME could be to look at the mathematical needs of emerging areas within biology and medicine.

*"All of us do maths in one way or another in every day of our lives, and without some understanding of mathematical principles, we can't rely on getting to grips with the world that we live in. We need a population that can use mathematics, just as we need one that can read and that can use language."*

Baroness Morgan

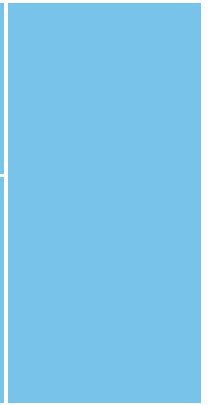
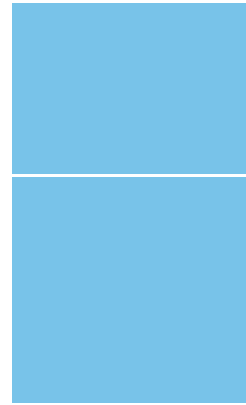


**Professor Celia Hoyles**  
*Director of the National Centre for Excellence in the Teaching of Mathematics (NCETM)*

Celia followed by outlining her vision for the next 5 years. She pleaded for coherence across Government policies which had a relevance to mathematics, as well as the need to sustain good mathematics initiatives such as the NCETM itself. Finally Professor Hoyles emphasised the importance of instilling a love for mathematics in teachers and their students alike.

*"There should be an obligation for everybody to keep up to date, but also to regenerate their love for the subject ...it's only really then that we will have a teaching force that understands for example the mathematical needs of the workforce, ...any sort of industry, for example the financial industry, ...; how to use ICT to foster mathematical learning, how to cope in the classroom with the very gifted and the less gifted, and so much more."*

Professor Celia Hoyles



**Jennie Golding**

*Director of Specialism, Woodroffe School, Lyme Regis*

Jennie gave a view from the 'student face'. She was concerned about the de-professionalisation of teachers of mathematics in the face of multiple education reforms. She felt that change needed to be 'reined in' and that governments should not just select recommendations from reviews but adopt them wholeheartedly. She was worried about the role of high stakes external summative assessment in undermining learning for understanding and engagement.

*"The Select Committee enquiry into testing and assessment produced overwhelming evidence that high stakes assessment is now undermining learning for understanding and engagement and the message is clear, the role of external summative assessment for accountability purposes should, itself, be reassessed, so that practitioners can invest in teaching for long term understanding, confidence, robustness and fluency, not only in applications but in delight in the subject itself."*

Jennie Golding

**Catharine Darnton**

*Headteacher, Gillotts School, Henley-on-Thames*

Catharine focused her thoughts on the new 14-19 Diplomas. She raised concerns about how they would cater for future mathematicians as well as the logistics of teaching them to 14 year olds in out-of-school settings. Would the new Diplomas replace A-Levels? What will the assessment be like? These all remained unanswered questions.

*"Now it seems to me that anybody who does mathematics at university needs mathematics and AS further mathematics ... but there is no Diploma that would allow me to do that ..."*

Catharine Darnton

**Ronnie George**

*Head of Mathematics, Brighton, Hove and Sussex Sixth Form College*

Ronnie gave another view from the 'chalk face'. She used the analogy of learning to do ten pin bowling to describe the restrictions placed on the teaching and learning of mathematics in her college and others like it. She desperately wanted the students to become mathematical thinkers and develop an ability to 'bowl without the barriers up'.

*"I think we need to think more highly of our students, all of them, not just the top end, and their ability and potential. I think we need to trust and support our teachers to actually develop them as mathematical thinkers, and in short, basically, I think we have a duty to let them have a go at bowling without the barriers up."*

Ronnie George



*"Any landscape where a single GCSE survives as well as the pair, simply won't equip the students with the maths education they need..."*

Professor Dame Julia Higgins FRS

# SUMMARY OF THE KEY MESSAGES RECEIVED FROM CONFERENCE WORKSHOPS



Dr Jack Abramsky



Roger Porkess

## Twin Mathematics GCSEs

### Dr Jack Abramsky and Roger Porkess

Our workshops focused on the totemic issue of the twin pair of mathematics GCSEs – ‘Methods in Mathematics’ and ‘Applications of Mathematics’. These represent the spirit of Recommendation 4.2 of Professor Adrian Smith’s 2004 report *Making Mathematics Count* which – some five years after publication – is still awaiting implementation. While the session was not as informed as we would have liked, due to the embargo on circulating the more detailed subject criteria, the discussion proved to be very lively and constructive nevertheless.

Some of the key areas of discussion included:

- There being a lack of clarity over which of the two GCSEs would be the harder – to which it was pointed out that both would be designed to be of the same standard;
- A concern that whichever GCSE is counted in performance league tables may lead to students only being entered for that one (post conference note: In the terms agreed for the pilot this will not be possible – candidates in the pilot must be entered for the twin pair of GCSEs). In the pilot, a pass in either will count in the league tables;
- Welcoming the focus on assessing different skills;
- Enthusiasm for the opportunities for better learning, tempered with concern that these could be lost, particularly for weaker students, if there was significant extra content;

- ‘Applications of Mathematics’ would have the benefit of allowing more cross-curricular work and should help to develop some specific skills needed in employment;
- Functional Skills should be subsumed into the new pair, built into one or both of the qualifications (although it was broadly agreed that the better home for them would be ‘Applications of Mathematics’);
- Strong support for the position that continuing with a single GCSE Mathematics after the pilot in parallel with the new pair of GCSEs will jeopardise the take up of the latter;
- Issue of progression, as it is intended the pair (when taken together) will be better preparation for study at/for Level 3 mathematics.

The key points which emerged from the discussions were that:

- Delegates were excited by the proposed model for the twin GCSEs;
- There would be ample schools to take part in the pilot;
- Some aspects of the existing GCSE pilots have caused problems for the participating schools and these should be addressed in the pilot;
- There is considerable enthusiasm for what the Applications of Mathematics GCSE could achieve;
- Schools will not look favourably on additional content, so this should be kept to a minimum;
- The two GCSEs must be packaged together, as they should be taught together and taking both would give students double the chance of achieving a grade C;
- In addition, it was agreed that the idea of two separate grades will need to be sold to parents.

ACME will be closely involved with monitoring the progress of the pilots, and the issues raised in the workshop will help inform our thinking as we take a close interest in their development over the coming years.

For more information on ACME’s role in the pair of GCSEs, you can contact Roger and Jack via the ACME email address: [acme@royalsociety.org](mailto:acme@royalsociety.org)



Fiona Allan



Professor Alice Rogers



Peter Thomas



Laurie Jacques

## Level 3 Mathematics in 2016

### Fiona Allan, Professor Alice Rogers and Peter Thomas

Our workshops tackled the subject of the proposed review of 14-19 qualifications from the perspective of Level 3 mathematics. The review is scheduled to take place in 2013, with first teaching in 2016.

Emerging from the sessions were a number of key points including:

- The importance of having post 16 pathways for those who do not wish to do as much mathematics as an AS Level but can cope with mathematics at this level, and also for those who do not want to do such challenging mathematics as in AS and A2 mathematics;
- The strong level of interest in a flexible baccalaureate-type model not unlike the International Baccalaureate (IB) structure;
- That studying mathematics beyond 16 should be strongly encouraged but not necessarily compulsory;
- A fairly general view that there should be three core pathways in mathematics at Level 3:
  - a specialist one (looking somewhat like A-Level);
  - a path for those for whom mathematics is a substantial but smaller part of their progression needs; and
  - a path for those for whom the mathematics needs are more general.
- Mathematics teaching should focus on logical thinking, careful reasoning and problem-solving; its assessment should be more holistic, especially for those taking the more specialist courses.

These workshops represent a first stage in our thinking on this area of work – we are producing a discussion document which will outline some ideas for a 14 -19 qualifications structure publishing in the coming months. We still have ample time to debate many of the issues well in advance of any review and to think in detail about how mathematics will fit within any new framework.

For more information on the key messages of the workshops, please see: <http://www.acme-uk.org/downloaddoc.asp?id=142>

## Primary Mathematics

### Laurie Jacques

In this group we were first asked to consider how the assessment of 'Using and Applying' Mathematics (UAM) might be made more effective in ensuring that this part of the primary mathematics curriculum is actually valued and taught properly. Delegates came up with the following conclusions:

- Assessment of UAM could make it another hurdle to jump over unless handled carefully;
- UAM can draw out mathematics attainment which wouldn't otherwise be demonstrated in a test, especially if linked to Assessing Pupils Progress (APP);
- Subject knowledge plus CPD for primary teachers is a more effective driver for improvement in this area of learning than assessment.

The group also looked at the role of the Primary Mathematics Specialist (PMS) as recommended by the Williams Mathematics Review in 2008. It was agreed that the following factors needed consideration:

- PMS needed to be knowledgeable of secondary mathematics and aim for a Masters level qualification ultimately;
- They should be experienced and credible teachers within their primary schools;
- An aspect of the assessment of the impact of the new CPD for PMS might include them asking about their impact on primary school colleagues;
- There was shared concern about how the PMS can be sustained beyond the initial funding support from Government.

ACME will be playing an active role in continuing to shape the primary curriculum during the coming months. Please contact Laurie via the ACME email address should you wish to know more about this work, [acme@royalsociety.org](mailto:acme@royalsociety.org)



*"Pupils need to use maths to understand problems in all subjects, from science to geography to home economics."*

Baroness Morgan

*"Is there anywhere else in the world where it is actually acceptable, actually cool... to admit to your peers that you can't do mathematics and you can't do basic arithmetic?"*

Professor Dame Julia Higgins FRS



Wendy Hoskin

## Future Issues in Mathematics

### Wendy Hoskin

Two groups looked at what the future issues might be in mathematics. Delegates were briefed that ACME would be looking in more depth at how to meet the future mathematical needs of 5-19 learners as seen by both national policy makers and the classroom practitioners on the ground. The mathematics curriculum, the assessment of mathematics and the professional development of teachers of mathematics are three key factors to take account of. Delegates were asked: 'Which other factors do you think will require special attention?' and 'If you could decide on the most important issue that ACME should focus its attention on next, what would it be and how would you justify it as a priority?'

One of the groups honed in on 'Embedding Mathematics across the curriculum' as the number one issue that ACME should tackle next. This would involve:

- Gaining an understanding of mathematics requirements across the curriculum;
- Involving teachers, parents and students in the development of high quality mathematics tasks (for mathematics departments and across the curriculum);
- Creating time as Mathematics departments to reflect on practice;
- Providing subject specific CPD for non mathematics teachers and staff;

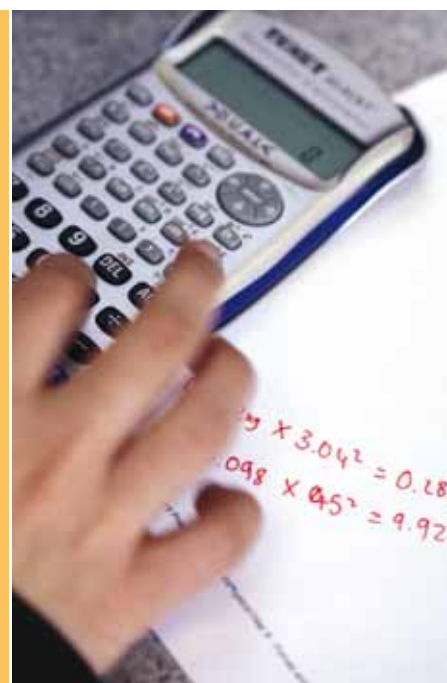
- Looking at *learning* and not just assessment in mathematics;
- Developing industry links/support for teachers and students.

The second group felt strongly about the need for a consolidation and reiteration of what ACME already knows about mathematics education (from its evidence-based work) designed for different audiences, such as policy makers, teachers and school and college leaders. The accompanying communication strategy needs to be joined up, possibly in the form of a 'one stop shop' on mathematics education to include, for example, the STEM enhancement and enrichment directories. The group was also concerned about the issue of assessment and how it affects what we know about good teaching and learning in mathematics. Finally, the group highlighted the importance of the learner voice and the need to ask pupils and students what works for them and to find out why and when they give up mathematics – is there a self-belief issue or is there some other psychological reason for it?

For more information about the future issues in mathematics, please contact Wendy via the ACME email address, [acme@royalsociety.org](mailto:acme@royalsociety.org)

*"We need to engage employers to make sure we are giving young people the kind of mathematics education that is real value to them when they are in the workplace."*

Baroness Morgan





## The view from the government

### Baroness Delyth Morgan of Drefelin (Parliamentary Under-Secretary of State for Children, Schools and Families, DCSF)

The minister took the opportunity to talk about her longstanding interest in STEM issues, and related these to her time working for medical charities and her stint as a minister in the Department for Innovation, Universities and Skills.

Critically, Baroness Morgan pointed out, mathematics informs everything that we do – it underpins a large proportion of our decisions. She highlighted instances of this within the government and civil service, where use of numbers and statistics reinforce many of the key arguments and decisions.

Some of the other key points which the minister addressed include the:

- Need to tackle the unfortunate prejudice against mathematics in the country;
- Importance of delivering a population that can use their mathematics in the same way that people read and use language.

And to deliver these a system needs to be established which:

- Tackles prejudice within schools at an early stage;
- Delivers education which supports those struggling with their mathematics but also provides stretch and challenge to the most able;
- Engages employers to ensure that young people are receiving the mathematical education they require to flourish in the workplace;
- Provides training and support to recruit and retain first-class mathematics teachers.

The minister highlighted some of the specific areas where work is ongoing to deliver improved mathematical education:

- In primary, the Rose Review is focusing on 'mathematical understanding' which aims to provide students with ample opportunities to use and apply their mathematics across the curriculum;

- Functional skills at 14-19 will help pupils to use their mathematics to solve real world problems, across a range of subjects including geography and home economics;
- The new single GCSE will be introduced from 2010 which will reflect the revised Key Stage 4 programme of study;
- On-going work with ACME to deliver a pair of mathematics GCSEs for first teaching from 2015;
- Diplomas will contain substantial mathematics in the principle learning, with mathematical concepts applied to real world situations in the lines of learning;
- In conclusion, the minister reiterated the desire to make mathematics an exciting, absorbing subject to study across the whole 5-19 spectrum and that DCSF will continue to value the constructive working relationship with ACME.

*"That mathematics does inform almost everything that we do and whether we have an understanding of mathematical principles or not, a large proportion of our decisions, I believe, are based on those principles, whether we know it or not, and numbers have an almost magical quality, allowing you to prove, perhaps, something is the case, rather than simply making kind of vague assertions."*

Baroness Morgan

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