

Plenary Panel

Beyond Maths Year 2000

The panel was chaired by Barbara Jaworski who introduced the panelists and promised to keep them to their allotted time. She hoped that they would not hesitate to be controversial and that the audience would make good use of their opportunity to contribute to the debate.

Below are summaries of the panelists' contributions:

Barbara Young

I have been asked to give the teacher's perspective and so I have consulted a large number of practising teachers and asked them to take a 'blue skies dreaming' approach to the question. I got all sorts of responses to this and, given the short time available, I have picked out a few that I can offer my full support for.

- the National Numeracy Strategy has brought improvements in the arithmetic skills of year 7 pupils. It's working! Now as it moves into KS3 there are enormous training needs, but even the older teachers are fired up with enthusiasm. There are, though, a number of concerns, of which I will mention two. First, the new framework does not include any open-ended problems under Using and Applying Mathematics; they are for teachers to put in. This is a dangerous omission which downgrades their importance. Secondly, there is a move to end KS3 at the end of year 8, apparently in order to make it easier to set targets for the number of pupils reaching the expected standard (which is level 5 by the end of year 8, but between level 5 and level 6 by the end of year 9). My fear is that this would lead to more pressure to enter pupils for GCSE at the end of year 10, which I see as a very misguided approach to acceleration.
- Local Management of Schools has led to fewer in-service training opportunities for teachers outside of their own schools. In particular, local authority provision of INSET has been dramatically reduced. This means that teachers are getting fewer opportunities to go out, meet teachers from other schools and 'play' with some mathematics! These opportunities are vital for maintaining enthusiasm.
- the introduction of the new style AS courses this year has been almost a disaster. There have been all sorts of logistical problems with sharing six modules between two teachers over two years and even capable students have struggled badly with the early exams.
- Key Skills are not a popular idea in schools at present! The idea is brilliant but it was not at all thought through. It has involved students in an enormous

amount of work, which many of them have resented because they had no choice but to do it.

Celia Hoyles

My brief is to consider how technology might influence the future of maths teaching and learning. Let's start with what kind of thinking we might want pupils to develop. Among mathematical habits of mind I would count an inclination to:

- look for structures and invariants
- visualise, draw diagrams, conduct thought experiments
- move between representations
- mix experiment, induction, conjecture with deduction to build systematic explanations and proofs

So what might change with ICT? One possibility is that nothing will change. On the other hand modes of delivery and access to resources may begin to reflect the availability of ICT. Attendant dangers are increased anxiety and complexity for pupils and teachers and the 'digital divide' which sets those with access to new technologies apart from those without.

The potential of ICT is not to 'deliver' the curriculum for us but to unlock mathematical habits of mind and widen access to mathematics. These possibilities rest on four features of ICT:

- new representational infrastructures
- new ways to interrelate representations
- new ways to model, experiment, conjecture...
- new ways to collaborate

Our existing mathematical notations have been developed over millennia and shape our way of thinking about mathematics. But historically they have served an intellectual élite rather than the majority. They have evolved through the static and inert media that existed at the time. The new models and infrastructures available through ICT are dynamic and traditional symbolic notation is only one of several notations available. The execution of processes can be performed without human participation. Access to these processes is no longer restricted to a privileged minority.

ICT offers new ways of linking different mathematical representations. It also offers new ways of collaborating in different sites so that the diverse expertise, information and perspective offered by participants at a distance can be brought together. Collaboration at a distance also introduces a need to make processes explicit.

So how can we realise the potential offered by ICT? Firstly we need to recognise the need to rethink curricula and pedagogy. Secondly we should identify the potential that exists and the pitfalls that must be avoided. Thirdly we must acknowledge and exploit the 'overhead' of technology. Finally in our use of ICT we have to pay attention to explanation, justification and 'incorporation' of techniques.

Robert Hunt

I am involved with the Millennium Mathematics project based at Cambridge University, and am Deputy Director of the Isaac Newton Institute for Mathematical Sciences. The MMP is a national initiative which provides enrichment materials for able pupils through a number of projects including the NRICH website, the online magazine *Plus*, of which I am Editor, and the MOTIVATE videoconferencing project funded by NESTA which links able pupils in inner city schools with Cambridge mathematicians.

The University of Cambridge has been involved with World Maths Year 2000 through the Newton Institute's production of a series of posters designed to be displayed on the London Underground, which are now, as funding allows, being made available to schools.

There are a number of outstanding questions about university-based projects such as these.

- Is it appropriate for universities to be involved in the operation of an enrichment project of this kind? Or should their role be to set such projects up, demonstrate their viability and then let somebody else run them? What level should the enrichment materials be aimed at? What is a university's role in life long learning?
- What is the most appropriate delivery method for these materials? Cost is an issue. Delivery by the web is much cheaper for the provider.
- The MMP has had practically no direct government funding; funding has instead been achieved through sponsorship by individuals, companies and charitable organizations, and through LEA funding, which has involved a substantial amount of fund-raising effort. Should this be necessary?
- During the last 35 years there has been a very serious decline in the number of A level candidates taking Further Maths. How can we arrest this decline? Should university maths departments be required to adjust their degree quality downward in response? How should they try to influence the picture?

John Bibby

I believe we could be on the edge of an era of massive change in the public image of mathematics. The huge investment that was put into MY2000 has raised consciousness and the continuation project "Count On" which I am directing will build on this. The aims of "Count On" may be summarized in three words "Maths for All". This means for all ages, all abilities, through all subjects, at all times, in all locations and with all partners. There will be a special focus on "difficult to reach groups" and non-traditional learning environments, with a particular emphasis on adult basic skills.

Count On will have three main strands of delivery. The first will be through the website at www.counton.org. The second strand will be a series of "MathFests" around the country. Anybody interested in hosting a MathFest should email mathfests@counton.org. Thirdly we shall have a number of new projects. We are currently discussing

- Maths Mysteries - a video and book in the style of a *whodunnit*, aimed at KS3 maths students
- Number Partners - a scheme providing maths mentors for KS2 children
- Maths Comics - aimed at KS2 and KS3 these will be sent out through schools and as inserts in other magazines
- Maths 2020 - a major discussion forum planned for March 2003 which will look at new models of learning in mathematics

We welcome ideas: please email me at John.Bibby@counton.org or John.Bibby@mathemagic.org.

Questions from the floor and panel responses:

1. Adult learning has been sold short by MY2000. Functional innumeracy amongst adults runs at 23% in the UK. In Europe this figure is only exceeded in Ireland and Poland. This situation is the fault of school teachers. The National Numeracy Strategy may go some way to address the problem by providing a focus for underconfident teachers. Adult Basic Skills and Family basic literacy and numeracy should be the main foci for Count On.

- *(John Bibby) Adult Basic maths and Family maths are indeed main focuses for Count On. We aim to make maths a less elitist activity.*
- *(Celia Hoyles) what is needed is stronger links between communities. Blaming is not helpful, though it has been very common in the past (secondary*

schools blaming primary schools, colleges and universities blaming secondary schools etc.)

2. We should all be greatly concerned about the supply of maths teachers. We are in a downward spiral where shortage of teachers leads to poor teaching, which discourages pupils from studying maths beyond the compulsory phase, which exacerbates the shortage of teachers. There is a need for unified action on this, but instead we hear of good maths graduates being told that they can do better than make a career in teaching. The TTA Skills Tests and other "rubbish" are also putting people off maths teaching. As mathematicians, maths educators, parents we should be working together on improving the curriculum.

- *(Barbara Young) although Robert Hunt talked about a decline in the number of students taking Further Maths, at Tarporley we have seen an increase and 70% of our A level students do mathematics as one of their subjects. We have achieved this by entering as many candidates as we can for Higher tier GCSE. This is against a national trend where many more candidates have been entered for Intermediate tier since grade B became available at Intermediate. However we also need to make teaching less off-putting. The workload problem has now reached dangerous proportions. One solution may be to change the school year to build in preparation time before school terms rather than expecting development work to go on alongside teaching. More clerical and technical assistance would also help. New teachers are now not surviving, even the good ones.*
- *(Celia Hoyles) maths teachers need to enthuse about their job to their pupils. We should all make a new year resolution to encourage somebody into teaching and not pass our whinges on to the kids.*
- *(Robert Hunt) There is a need to influence careers advisers not to discourage students from taking maths at degree level on the spurious grounds that it is "not useful for future career options". For maths undergraduates thinking of teaching pay is an issue (especially for Oxbridge undergraduates). For well qualified graduates, jobs outside teaching offer much better prospects.*

3. Why would anyone want to be a maths teacher at the moment? I did, though I had a 'good' maths degree from a 'good' university. The salary is not the whole story. In other countries maths teaching carries high status (for example in France). The maths teacher is seen as an applied mathematician and a high standard of mathematical knowledge is required. But surely the image of mathematics as numeracy is not helpful, with its associated 'delivery' of the curriculum using downloaded worksheets dictated by one individual? In the long term it must make the teacher supply problem worse.

- *(Barbara Young) I agree that it's fatal to see maths as just numeracy, but that is not what is happening. There are also puzzles, problems and fun activities. Now that the basic skills are there at KS3 and teachers are trained there is more room for fun.*
 - *(John Bibby) The continual assessment of pupils is part of the problem. It stifles the possibility for innovation in teachers' practice.*
 - *(Celia Hoyles) We need to support good teachers to provide a counterweight for narrow teaching and reinforcement for their own innovative ideas. How can we work together on this? What structures exist? JMC? ATM/MA?*
4. I've been a maths consultant for two and a half years and before that taught for 15 years. I don't feel I've been brainwashed by the Strategy. It offers a structure. It is a maths strategy really. Not every lesson has to follow the 3-part structure. In my experience teachers' enthusiasm has grown as a result of the Strategy and it has raised the profile of maths.
 5. The pattern of recruitment into maths teaching has changed. There are many more mature entrants (who have already tried more lucrative professions). Teacher training needs to be more tailored to their needs. Retention is also important and inspection plays a large part in squeezing out the time to think that people need. The Graduate Teacher Programme is not working. The trainees are thrown in at the deep end and many of them drown. In my view all teacher educators and inspectors need to teach in school. This would promote unity in the profession. It would be good to have inspectors in teacher education as well.
 6. Naming is important. Numeracy is not mathematics as a square is not a parallelogram. Teachers need time to 'play' with mathematics. They want good classroom ideas, but they also want time to reflect. At the moment there is no incentive to take time over reflection.
 7. The situation in mathematics education is desperate, but what about education in general? Behaviour, play and education are all undervalued. You only need to look at the shoddy way universities treat their students.
 8. I am also a National Numeracy Strategy consultant for KS2. There have been problems with the strategy, but there has also been a change of culture which has meant that it is no longer acceptable not to be able to do maths. Ten year olds now love fractions! Springboard is fun!
 9. The Catch Up notion is awful!
 10. We need to get beyond the name issue. Now Numeracy means maths.

11. We have heard a number of different views of the Strategy because we are looking from different perspectives. Where is the independent evaluation of the effects? How much money is the government spending on this?