

What we did in our Easter Holiday!

This year, the IMA was able to support the attendance of 6 delegates at the 6th British Congress of Mathematics Education (BCME-6), thanks to the funding provided by the International Congress on Industrial and Applied Mathematics (ICIAM) 99 Fund.

The ICIAM 99 Fund is designed to help promote activities, in the UK, that occur in one of the following two categories:

- The organisation of short workshops that continue the development of the promising themes that emerged from ICIAM 99 and ICIAM 03
- Any other activity within industrial and applied mathematics the committee consider to be worthy for recommendation

BCME-6 took place at the University of Warwick from 30 March to 2 April 2005. All the leading UK mathematical associations united to bring this single conference to those dedicated to mathematics and mathematics education. The conference consisted of lectures, workshops, exhibitions and social occasions, that were to offer all delegates a rich and rewarding experience.

Due to the origins of the funding, this offer of financial support was open to all teachers of mathematics, regardless of membership with the IMA. With the help of the London Mathematical Society (LMS), Mathematical Association (MA) and the Association of Teachers of Mathematics (ATM), the IMA was able to advertise this offer to a wide audience.

The delegates who received the ICIAM99 funding, consisted of 5 teachers of mathematics in Primary, Secondary and Colleges of Further Education and one Open University Post Graduate Certificate in Education (PGCE) student. As truly dedicated professionals, these 6 people gave up part of their Easter holidays to attend this conference, and you can read about their experiences at BCME-6 in the following reports.

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BCME-6 Conference Reports

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BCME 6 was a unique event, never before have so many organisations concerned with mathematics education come together in one conference, as the title "Routes of Unity" suggested. Many of the 500 or so delegates were veterans of ATM or MA conferences (the list of organisations represented also included the Association of Mathematics Education Teachers (AMET), the British Society for Research in Learning Mathematics (BSRLM), The joint Mathematics Council (JMC), The Royal Statistical Society (RSS) and, of course the IMA), but there were also a number for whom this was their first mathematics education conference.

The organisers were fortunate in obtaining main speakers of the highest quality. Professor Celia Hoyles (Institute of Education, University of London, and Chief Advisor for Mathematics) in her opening plenary spoke of the role technology can play in engaging students in mathematical reasoning, urging that mathematics be seen as structures and relationships rather than merely rules and procedures. She questioned whether ICT is still on the

periphery for learning mathematics and described one of her research projects in which English schoolchildren communicated on the web with their counterparts in Cyprus, setting and solving kinematics problems for one another. Insights from mathematics in the classroom were also at the heart of Professor Mike Askew's (King's College, London) closing plenary, in which he told a series of stories, many taken from his experiences of observing hundreds of mathematics lessons, and was entitled "One Destination, Many Routes". He insisted that high standards in education are not incompatible with social justice, and, referring repeatedly to the writings of Nell Noddings, argued for the importance of caring relationships in the classroom and every teacher's responsibility to the pupils, their parents and society at large. He took issue with the "delivery" model of teaching in which lesson plans may be downloaded from the internet, making a telling comparison with the current transformation of school cooks into "re-heaters" of pre-prepared meals.

Throughout the conference, a dazzling array of sessions were on offer each day, and it was always a difficult choice which ones to attend. Mike Ollerton (St Martin's College, University of Lancaster) ran a very enjoyable workshop based on ideas from ATM publications. Most of the time was spent working in small groups on the various mathematical tasks: one that particularly interested me involved the ratio of areas of polygons formed by cutting a regular pentagon along diagonal lines and generalising to a regular n -gon. Afterwards, we discussed how these tasks might be used in the classroom, especially in a mixed ability context.

In a very different session, Paul Andrews (University of Cambridge), Gillian Hatch (Manchester Metropolitan University) and Judy Sayers (University of Northampton) presented some fascinating findings from their five-way international study on the teaching of solving linear equations to lower secondary pupils. Substantial video footage of mathematics lessons in Belgium, Finland and Hungary (subtitles provided!) gave a helpful insight into very different teaching approaches and challenged some preconceived ideas about mathematics teaching in Europe. The lesson from Hungary was particularly striking for the way in which the pupils took much greater responsibility for the lesson than appeared to be the case in the other classrooms. Their relationships with the teacher were such that they felt able to make extended comments about the mathematics and to communicate their ideas to one another using the board. In addition we noted the smaller class sizes common in all of these countries.

Two of the highlights of the conference for me were the sessions run by John Mason (Open University) and Anne Watson (University of Oxford). John's two workshops were "Developing Algebraic Thinking" and "Developing Geometric Thinking". (The second was planned in conjunction with Sue Johnston-Wilder, Open University). In the first session we were invited to work on a series of ordering tasks involving fractions (ordering by size would have been much too obvious!) and rectangles. Throughout we kept standing back from the mathematics to talk about what we had noticed about what we were doing, in particular asking "when does a label become a variable"? In the geometry session John offered some very pleasing geometrical problems, and talked about the need for "stressing and ignoring" in order to make sense of the structure. We finished with some

elegant proofs of results relating to Vecten's work on the "Bride's Chair" diagram, which were very satisfying. "Questions Worth Asking; Questions Worth Answering" was the title of Anne Watson's workshop. She presented us with a number of ordering tasks involving various algebraic expressions, number operations, methods of counting and methods of integration. A great many different answers were possible. Sometimes a question could be tweaked, opening up further "dimensions of possible variation", and we discussed what it is that makes something surprising and how that can promote mathematical thinking.

Always with a gathering of this kind the snatches of conversation and longer discussions that take place are just as valuable as the timetabled sessions themselves, and it was a privilege to spend time with so many stimulating people with such a strong commitment to mathematics education.

I would like to thank the ICIAM99 fund and the IMA for providing the means to attend this conference.

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Attending BCME-6 was a tremendous opportunity. For me personally, to bring myself up to date with thinking in maths education and to share ideas with others; for the organizations represented, there was the opportunity to learn from others with different backgrounds and contexts: concern had been expressed that BCME-6 had the danger of being twelve conferences in a shared venue rather than a single conference, but from my perspective at least, this seemed far from the case.

In the opening plenary, Professor Celia Hoyles presented research on using Information and Communication Technology (ICT) as a tool to support collaboration and the social construction of mathematical knowledge, something that we too have been trying at St Ives. This contrasted with my first small group session, in which Ro Bairstow presented a number of web-based resources as a way of providing reinforcement and alternative delivery of maths via the Internet.

The evening began with a drinks reception at Warwick's new mathematical institute, the centre of attention being Ian Davenport's splendid mural, juxtaposed with a display of fractals: patterns, apparent randomness, and the nature of art.

Paul Ayres' talk on cognitive load theory was thought provoking, and challenged the conventional wisdom of introducing new material in problem-based contexts. In maths there are, he claimed, no generic 'problem solving skills'. There is though more to learning than merely knowing stuff, and if my desire is that my pupils become independent thinkers capable of solving a range of unfamiliar problems, I'm unsure that a diet of worked examples and similar problems will achieve this. Kate Mackrell ran a very good workshop on using dynamic geometry software in a primary classroom, and I was inspired to try some of this out on my return.

Tony Gardiner presented a worrying state of affairs in UK maths teaching, particularly at the upper end of the ability spectrum. There is a feeling that we've merely attained "short term improvements by teaching in a way that prevents long term growth", challenging us to look at ways of reworking the delivery of the curriculum to look for ways of deepening understanding. Joyce Brown's session on mathematics and bell ringing provided some relief and amusement, as well as providing an unusual practical context for a number of concepts. The ACME drinks reception and the conference dinner provided more opportunity for

socialising and talking through some of the ideas from earlier in the day.

My first session on Friday was another computing workshop, exploring tools to make Excel spreadsheets more dynamic and accessible. Chris Sangwin's work on using computer algebra systems for online mathematics assessment was really impressive, and I can imagine a whole host of contexts in which this can be used - subsequently I've discovered this is now available in the open source virtual learning environment Moodle, and its certainly on my agenda for St Ives. BCME-6 was ideal for facilitating this cross-field collaboration between mathematics, computer science and education.

The session on bringing research alive in the classroom provided plenty of opportunities for discussion, and I'd like to add my voice to those wanting easier access to research journals for teachers and opportunities for publication of teacher led research; BCME-6 illustrated the value of more contact between the research and teaching communities in maths education. James Nicholson's session on students working with complex data painted a similar picture for statistics education to that painted earlier by Tony Gardiner for mathematics, but here James did present a clear vision of how the situation can be improved, by placing more emphasis on reasoning with data and exploring statistics within the context of other subjects.

On the final morning, I attended two of the research presentations, and was somewhat reassured to learn from Anne Cockburn and Paola Iannone that, in Year 1 at least, maths teaching is on the whole better than it was 20 years ago, with more motivation, understanding and social interaction.

Looking back over the conference, there is a feeling that all is not as it should be in UK maths education, and some blame may fairly be laid at the feet of an over-emphasis on assessment, as "too much assessment narrows teaching and learning". The content though *is* important, and it seems that subject knowledge does really matter, for both teachers and pupils, and that generic approaches do no favours to anyone. By bringing together mathematicians, educationalists and teachers, BCME-6 went some way to providing just the sort of Continuing Professional Development (CPD) that can help to address this. A further theme was that of the ever increasing importance of ICT in mathematics education: we saw some evidence of how ICT is being used to allow pupils to engage with more challenging maths and to facilitate discussion and collaboration, and I suspect that these roles will be increasingly important in improving pupils' mathematical experience.

At St Ives, we're already doing much to explore the use of ICT in these ways, but BCME-6 has given me ideas for new things to try out. Making our pupils' experience an even richer, more varied, and genuinely mathematical one is also a priority, and after BCME, keeping up with, and contributing to, the academic research is a good way of making this happen.

I'm grateful to the ICIAM99 fund and the IMA for making it possible for me to attend the conference, and to Vanessa Thorogood, the IMA's education officer, for dealing with all the arrangements so efficiently.

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BCME-6 was a wonderful experience for me both as a mathematician and a teacher. To be surrounded by nearly 600 like-minded