
National Teaching Fellowships

HEFCE awards 20 National Teaching Fellowships of £50,000 each year, administered by the Institute for Learning and Teaching (ILT). They are designed to recognise excellent practice in teaching and the facilitation of learning by individual teachers who can demonstrate national standards of excellence. The first wave of fellowships included three mathematicians - Patricia Egerton, Keith Hirst and Peter Edwards - who were featured in our August 2000 issue. The second wave included two more - Chris Budd and Michael McCabe whose summaries are published here. Further articles will be carried from all the projects as they develop.

Communicating mathematics and science to the public

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Communicating mathematical ideas to a general audience is a vital skill for any mathematician in the workplace, and as mathematics becomes increasingly important to modern technology, it is vital that we have good communicators of mathematics and that the significance of mathematics becomes as widely known as possible. Unfortunately the techniques for communicating mathematics have in general not been taught to undergraduates, nor has the vast creative potential of undergraduates as enthusiastic communicators been exploited. The project funded by the ILT teaching fellowship aims to change this.

The University of Bath has been actively involved for several years in several projects aimed at enthusing the public in general, and young people in particular, in the power, beauty and unreasonable effectiveness of mathematics. Before telling you about the project I'd like to tell you about some of these and how the ILT project will build on them.

Every Saturday morning, as part of the national programme of Royal Institution mathematics masterclasses, the University (both at its main site and also at its Oakfield campus in Swindon) acts as host to over one hundred young people. These students are at level Key Stage 3 and are nominated by their schools to take part in the programme. Each week the students attend a workshop comprising a lecture combined with various hands on activities. The subject of the classes has varied from castles to bar codes and from origami to the number pi. We have run the classes for over ten years and a collection of them has been compiled in the book *Mathematics Galore*, by myself and Chris Sangwin and published by Oxford University Press. Over the years we have run them, a small number of undergraduates have helped with the hands on workshops, typically those interested in taking up a career in teaching.

More recently, the whole university has been very active each year putting on a show during National Science Week called *Bath Taps Into Science*. During this we put up stalls in the middle of the Bath shopping centre which are designed to convey the fun of maths and science. Mathematics has its own stall which includes chaos

machines, mazes, mathematical origami and paper darts. (A paper dart thrown from the stall hit a visiting member of parliament, who grabbed it with enthusiasm and said how useful it would be in the House of Commons!) The first year that we ran this show we asked for volunteer helpers from the undergraduates and assembled a splendid team of mathematicians. Decked out in bright yellow *Bath Taps Into Science* sweat shirts, their enthusiasm and creativity exceeded all expectations. Clearly there was great potential here!

In the last year we have started an EPSRC funded project called *Visions of Maths and Science*. This is a collaborative venture with a Bath based media and video company called *Bright Filament Productions*. In this project we are making videos of the live workshops in the masterclass programme and related workshops in physics, as well as filming the National Science week activities. The videos are meant to communicate the excitement and fun of the workshops as well as providing a resource of material which can be used by teachers and anyone else working with young people. So far the videos that we have produced are *Bath Taps Into Science*, *Maths Magic* and *The Liquid Nitrogen Show*. All are available (at a cost of £10 including postage and packaging, from the Dept. of Maths). Several more videos are planned including one on *Chaos* and another on *Bubbles*, and we have just filmed a *Mathematical Christmas Show*.

So far so good, we have lots of things going on, but how could these involve undergraduates? The teaching fellowship gives a wonderful opportunity to develop the public understanding of science activities to both train undergraduates and make more effective use of them as a resource. The resulting project will give final year mathematics undergraduates the opportunity to learn various skills in mathematics communication and to apply these skills in three different practical projects.

A major part of the project will be the practical projects which can be chosen from a variety of events with which the University of Bath is currently involved. These will be mathematics Masterclasses, workshops in schools in Bath and North East Somerset, workshops at the local

science centre *Explore at Bristol* and also at the Science Museum. Each student on the project will select two of these. For assessment they will then help to design and to participate in the workshop (as part of the University of Bath team) and to then write a short critical commentary on the effect and impact of the workshop. Following on from the excellent experiences of the last two years each student will also take part in National Science Week, again helping to design an exhibit, taking part and commentating on the result. They will get a free *Bath Taps Into Science* sweatshirt as a reward! Finally each student will produce a short permanent article/video/web-site about a modern mathematical idea of your own choosing. (We will keep a library of such to help with our overall programme in communicating mathematics to the public). This will give them an opportunity to explore what could be a complex mathematical topic, and to understand it so well that they can explain it (and its significance) to a lay audience.

As part of the project each student will receive training in communication skills from lecturers at Bath actively involved in science communication (including the recently appointed Bath writer in residence) and also from school teachers involved in the masterclass programme. They will also attend a workshop skills session at *Explore at Bristol* and learn video and web site production skills and tips on dealing with the media,

from the professional media and web-site company *Bright Filament Productions*, which we have already worked with so positively. A substantial part of the funding of the award will go towards paying for the time of these experts. We are also using part of the award to commission a report from *Bright Filament Productions* on ways in which aspects of the media and current media practice can best be introduced to students in mathematics. The rest of the money for the grant will be spent on the various expenses of the workshops and also in building up a resource of visual aids and IT equipment that we need to help run them.

The project will be assessed in the same manner as a standard final year project, with 50% of the mark on the design and commentary on two projects chosen from: (i) a mathematics masterclass (ii) a workshop at *Explore at Bristol* (iii) a schools workshop (iv) a workshop at the Science Museum; 25% on the design and commentary on a project for National Science Week; and 25% for the creation of either (i) a short popular article suitable for a newspaper (ii) a video (iii) a web-site which describes the significance of a modern mathematical development.

At present, all of this is so much theory, and we start the project in earnest at the start of the next semester. Six students will be taking part in the first year and we will have no shortage of things for them to do!

LOLA, the Missing Link in Computer Assisted Assessment

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Teaching by questioning is fine in theory, but not always so easy in practice. We can ask students to complete work on paper, but then the feedback is slow. We can provide computer assisted assessment (CAA) to speed up the feedback and can even deliver CAA on-line, but the interaction is primarily with a computer and the lecturer is sidelined. Low tech solutions which make face-to-face teaching more interactive range from a show of hands to use of numbered or lettered cards and paper marking templates. High tech solutions for the "interactive classroom" range from simple, portable handsets allowing MCQ delivery and immediate response analysis to more sophisticated hard-wired systems using calculators. In the future mobile phones may provide another approach. Besides the technical issues there are the pedagogical issues, such as how to integrate questioning into a busy lecture schedule, what areas of mathematics can benefit most from an interactive classroom, how best to display feedback ...

Have you experience of using "interactive classroom" technology, exploiting group response systems such as PRS, CPS, Classtalk or Discourse? Can such systems be

considered as 3rd generation CAA, following on from OCR/OMR (1st generation) and computer-based CAA (2nd generation). Do you have strong views for or against the use of this type of technology in the classroom or indeed would you like to have the opportunity to use it yourself?

Project LOLA ("Live and On-line Assessment") is my national teaching fellowship project in which I am trying to exploit the benefits of both on-line CAA and group response systems. While there is a well-established community of CAA users, group response systems are still to catch on in a big way. Contestants in "Who Wants to Be a Millionaire" can "Ask the Audience", so should we be doing so as well? or does the technology simply get in the way?

If you have any reactions to these questions, if you are already using group response systems or would like to do so, Michael McCabe would be very interested to hear from you. He will be reporting on project LOLA in a later newsletter.