Editorial

In his Autumn Statement, the Chancellor announced that £600 million would be spent on 100 new free schools, including elite maths colleges for 16-to-18 year olds. Twelve free schools specialising in mathematics, linked closely to university mathematics departments, are expected to have opened by the end of this Parliament in 2015. This announcement received substantial press coverage, including the following sound-bites which appeared in the *Daily Mail*.[1].

'There are good reasons to start with maths. It's the most disciplined field of human knowledge and it's tailor-made for a proper, empirical inquiry into how to raise standards'; 'These schools will be able to select in whichever way they want. It will be up to them to devise their own tests'; 'The idea is that they will be looking towards university. We want professional mathematicians from universities to design a new 16-to-18 curriculum because frankly A-levels are not cutting the mustard'. 'These schools are intended to develop new curricula and methods with deliberate experimentation by teams of professional mathematicians'; 'In so far as there is a goal, it is to produce pupils who excel in Cambridge's entrance papers and similar tests'.

I read these comments with a mixture of pleasure and incredulity. I am pleased to see that Ministers seem to have recognised the strategic importance of providing a quality mathematics education for young people, both for the nation and for the children themselves (all the evidence shows that good mathematics qualifications correlate well with highly paid jobs). There is also something refreshing in the desire to avoid a one-size-fits-all solution. However, it seems absurd to suggest that allowing professional mathematicians to experiment on a tiny cohort of bright kids in years 12 and 13 is an appropriate response. Mathematics underpins so much of modern science, engineering and technology, and quantitative methods are pervasive across the whole academic spectrum. As a result, I would argue that raising the general level of mathematical proficiency of prospective university students should be the priority.

However, it is true that there is a significant number of highly gifted school children for whom the current curriculum is inadequate and this does need to be addressed. A-levels ceased to be a particularly good vehicle for discriminating at the top end some time ago. The potential involvement of university mathematics departments is also welcome as there is an enormous pool of talent within academia that could be used to inspire the next generation. But I would much prefer to see a solution in which universities were resourced to provide education for mathematically gifted 16-to-18 year olds, working with existing schools on a regional basis. In this context, it is interesting to re-visit Adrian Smith's 2004 Inquiry into Post-14 Mathematics Education, *Making Mathematics Count*, which made a number of recommendations aimed at enhancing the links between schools and universities, including: 'The Inquiry recommends that a programme be established to pay selected volunteer undergraduate and postgraduate students in disciplines with high mathematical content to support teachers of mathematics in schools and colleges'.

There is already evidence that regional initiatives work. The Further Mathematics Support Programme (FMSP[2]) is a wonderful example of how this model can be used to great effect. Since its predecessor, the Further Mathematics Network, was set up in 2004, the number of students per year taking Further Mathematics A-level has doubled (and AS Further Mathematics numbers have trebled). The FMSP aims to give every student who could benefit from studying Further Mathematics the opportunity to do so, whether or not their school has the capacity to deliver it, and it emphasises that Further Mathematics is not just for the highest fliers. Advanced mathematical training is beneficial for a far wider group of students, whose primary interest may lie elsewhere. Those wishing to go on to study physics or engineering are obvious examples, but economics and the life sciences are subjects where a thorough understanding of mathematical concepts can be of great value.

The fact that many students begin their university programmes mathematically under-prepared is well documented and the concept of universities providing additional mathematics support outside of the normal curriculum is now quite common. Loughborough and Coventry Universities have been at the forefront of driving this agenda and I was thrilled recently when the work of sigma[3] received the Times Higher Education 2011 award for Outstanding Support for Students. One of sigma's great successes, driven by the vision of its Directors, Tony Croft CMath FIMA and Duncan Lawson CMath FIMA, has been its ability to disseminate good practice across the UK. Bath, Leeds and Sheffield Universities have all been direct beneficiaries of the expertise developed at sigma and the number of students whose learning experience has been enhanced through the national network of mathematics support structures is enormous.

Returning to the idea of elite maths colleges, a particular concern that I have is the prospect that children who go to these proposed new schools will be pigeon-holed as future mathematicians. While some of them no doubt will see this as a desirable outcome, the argument for making the most of the mathematical talents of these youngsters goes far beyond mathematics. We want to encourage young people with a flair for mathematics to go on to university to study whatever really interests them, be it mathematics, chemistry, architecture, or psychology. We mustn't create an environment in which mathematics for mathematics' sake becomes the only valued objective for this elite group. Giving many more bright children the opportunity to glimpse some of the deeper and more profound aspects of mathematics at a young age is certainly something that we should aspire to, but this mustn't be linked to any implication that the only real measure of success is how many of these students go on to study mathematics at a higher level.

This problem already exists to some extent in university mathematics departments. The really bright undergraduates are persuaded

1 http://www.dailymail.co.uk/news/article-2066377/Osborne-600m-drive-set-elite-maths-schools-run-businesses-charities.html

2 http://www.fmnetwork.org.uk/

3 http://www.sigma-cetl.ac.uk/

to progress on to further study (no bad thing) while those for whom this is not the next step, for whatever reason, are left with the impression that their mathematical career is over, though they no doubt have some bright future in another profession. In this way we continue to reinforce the message that studying mathematics at a high level is all about developing mathematicians. Those that make the cut at each stage can continue on the path, while those that don't are no longer of concern to the mathematics community. The repercussions of this attitude are all too apparent to those of us who sit on IMA Council. While the number of new mathematics graduates each year (between 5,000 and 6,000) far outnumbers those for physics and chemistry (less than 3,000 each), the number who go on to join a professional society is woefully low. Membership of the Institute of Physics and the Royal Society of Chemistry stands at roughly 40,000 each, while the IMA has about 4,300 members and the LMS just over half that.

One of the most obvious consequences of these statistics is that the professional and learned societies in Physics and Chemistry have at their disposal considerably more resources with which to support their disciplines and influence decision makers and opinion formers. Over the past few years, the IMA has been at the forefront of an effort to increase the influence and effectiveness of the mathematics lobby, but the limited resources at its disposal make this extremely difficult. That is why IMA Council recently agreed that we should task the organisation to triple its membership over the next three years. We already know where these potential members are – they graduate from mathematics degrees every year. The challenge is to get them to see value in joining a professional and learned society even if they themselves have chosen a career outside mathematics. As part of this, we must ensure that the benefits of becoming a part of the professional community of mathematicians are obvious and make it clear that all people who have an interest in mathematics, its advancement and its applications are equally welcome.❑

CHRIS LINTON FIMA