



centre for excellence
sigma Σ
in mathematics & statistics support

and the winner is...
mathematics support





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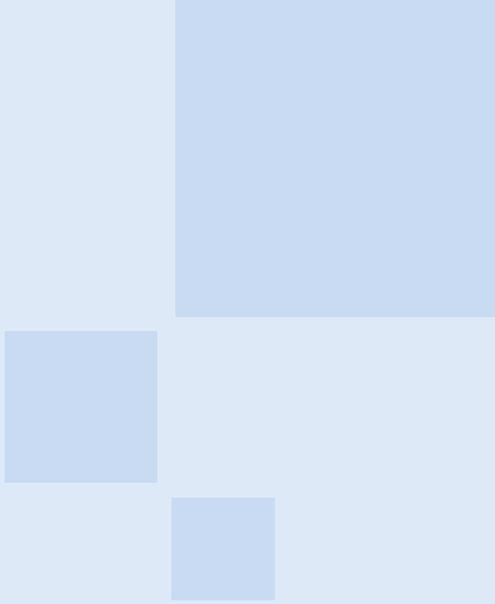
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The 2011 Times Higher Award for Outstanding Support for Students

At the Times Higher Awards ceremony on 24th November 2011, it was announced that Loughborough and Coventry Universities had won the award for Outstanding Support for Students, in recognition of the work of **sigma**, Centre for Excellence in University-wide mathematics and statistics support.

The nomination of **sigma** had been under the banner heading of "Setting the standard in mathematics support for students". At the heart of **sigma**'s work is the very popular drop-in model which sees over 12,000 student visits per year to the drop-in centres in the two Universities. Students from an enormous range of disciplines – from Architecture to Zoology (and all points in between: Business, Economics, Engineering, Nursing, Psychology and Social Sciences to name but a few) – take advantage of the help on offer in these and similar centres throughout the UK.

In addition to the drop-in centres, **sigma** provides support for students undertaking large-scale projects (final year undergraduate, masters and research students) through bookable appointments at the Statistics Advisory Service, assistance for students with additional needs such as dyslexia and an extensive range of on-line resources.

In making the award to **sigma**, the judges' citation, given by Liam Burns, President of the NUS stated:



Image courtesy Charles Fox, www.charles-fox.com

*"**sigma** is a fantastic example of institutions recognising genuine concerns in standards and acting in a positive way to address them. Students' reports about the support they received were exceptionally positive. Loughborough and Coventry should be incredibly proud of delivering support for students in a positive, innovative and transferable way."*

Whilst **sigma** at Coventry and Loughborough Universities received the award, the real winner was mathematics and statistics support across the country. In this booklet, we outline how **sigma**'s work has contributed to the growing recognition of the importance of mathematics and statistics support and to the development of a national and international community of practitioners.



What is mathematics support and why is it needed?

Mathematics and statistics support refers to activities and resources which are provided to support and enhance students' learning of mathematics and statistics (as they are encountered by students of any discipline within higher education) which are provided separately and in addition to normal lectures, tutorials, examples classes, personal tutorial sessions, etc.

Students of many disciplines in higher education are required to engage, to greater or lesser extents, with mathematics and statistics. Even students of those few disciplines with no quantitative elements often find that part of the selection process for graduate-level jobs is a numerical reasoning test.

The 2012 RSA report *Solving the maths problem: international perspectives on mathematics education* concluded that "English universities are side-lining quantitative and mathematical content because students and staff lack the requisite confidence and ability. This has the potential to damage standards in English universities".

This followed ACME's 2011 report *Mathematical Needs: Mathematics in the workplace and in higher education* which

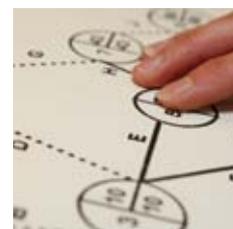
attempted to quantify the scale of the problem:

"We estimate that, of those entering higher education in any year, some 330,000 would benefit from recent experience of studying some mathematics (including statistics) at a level beyond GCSE, but fewer than 125,000 have done so".

In 2008, a report from the Public Accounts Committee urged universities to improve retention by providing "additional academic support for students, for example those struggling with the mathematical elements of their course". This statement partly describes the services that **sigma** provides and the innovations that we have developed over the past seven years – except that they are not just for those who are struggling, but are also for those who are doing well but who want to do even better.

"Over my three years at Coventry University I spent a lot of time in the Maths Support Centre and I do believe that without it I would not have attained the qualification I did."

Student who achieved 1st class honours





A brief history of **sigma**

In 1991, with funding from British Petroleum, Coventry University established the BP Mathematics Centre to enable early identification of student problems and to provide on-going support. In 1996, following a visit to Coventry, colleagues from Loughborough set up the Mathematics Learning Support Centre based on the Coventry model.

In 2005, HEFCE launched the Centres for Excellence in Teaching and Learning (CETL) initiative. Loughborough and Coventry's collaborative work in mathematics support was recognised as a Centre for Excellence and **sigma**, Centre for Excellence in University-wide mathematics and statistics support was formally created.

In addition to its work within the host universities, **sigma** was one of the most outward facing CETLs and provided funding to help establish mathematics support centres in other institutions and worked closely with the MSOR Network of the Higher Education Academy, to institute the annual CETL-MSOR conference (Continuing Excellence in Teaching and Learning in Mathematics, Statistics and Operational Research).

In 2009, HEFCE funded the University of Birmingham to co-ordinate the National HESTEM Programme. Recognising the enabling role of mathematics across all STEM disciplines and acknowledging our expertise, the HE STEM Programme invited **sigma** to lead its mathematics support strand of activities.



*"The vision for a Mathematics and Statistics Support Centre at the University of Lincoln has been modelled, unashamedly, on the good practice we saw developed through **sigma**."*

Professor Mary Stuart, Vice-Chancellor, University of Lincoln.

Mathematics Support Across England and Wales

CETL Centres

As part of its CETL submission, **sigma** committed to provide funding and support to enable the University of Leeds to set up a mathematics support centre. This it did in 2005.

In 2007, after a competitive funding call (requiring matched funding), **sigma** gave pump-priming funding to the Universities of Bath and Sheffield to establish mathematics support provision.

Initial funding was for a period of two years and all three centres are now fully embedded in the student support infrastructure of their universities with recurrent central funding.

"I just sat down for an hour and we went over loads of stuff, which was amazing."

University of York student.

HE STEM 1st round centres

Recognising the success of **sigma**'s pump-priming approach, the National HE STEM Programme committed funding to initiate five new centres. The successful bidders from a large field were the Universities of Central Lancashire, Kent, Lincoln, York and London Metropolitan University who set up their centres in 2010.

These centres have grown at different rates: the Centre at the University of York has been particularly successful – the report of the 2012 QAA Institutional Audit states that the review team found "the successful establishment of the Maths Skills Centre to support students across a wide range of disciplines" to be a feature of good practice.

"I was given the opportunity to speak out my concerns and not just filled with information."

University of Kent student.

HE STEM Wales centres

In 2010, the Wales HE STEM Spoke identified mathematics support as a key feature of successful STEM provision and established a mathematics and statistics support initiative across HEIs in Wales. Following advice from **sigma**, the Spoke set up a pilot scheme at Swansea University, using postgraduate students to provide drop-in support. Training for the tutors was provided by **sigma** (the tutoring resource described on page 11 was developed out of this session).

Following the success of the pilot scheme, funding was made available to other HEIs in Wales and centres were established in the University of Glamorgan, the University of Wales, Newport and Aberystwyth, Bangor, Glyndwr, Swansea Metropolitan and Swansea (College of Engineering, and College of Science) Universities. Prior to the commencement of these initiatives, **sigma** provided tutor training workshop for all participants.

The Spoke has facilitated two "whole Wales" workshops for the new centres to share their emerging practice and discuss barriers they are facing. At both these events, **sigma** has offered advice from experienced practitioners.

*"Without **sigma** we would have been unable to achieve the significant progress in Wales to date on making maths support available to more STEM students in higher education."*

Alison Braddock, Director of HE STEM Wales.



HE STEM 2nd round centres

Mathematics support was identified as one of the major successes of the National HE STEM Programme and, following a budget re-profiling, additional funding (to be matched by the HEIs) was made available to establish nine new centres in 2012. The successful candidates were the Universities of Birmingham, Brighton, Liverpool, Warwick, and Wolverhampton and Anglia Ruskin, Cardiff Metropolitan, Keele, and Liverpool John Moores Universities.

sigma also provided mentors for each of these new initiatives - experienced members of the wider mathematics support community who were available to review the various plans and actions, advise on best practice and were also on call should any issues arise.

Other centres

Many HEIs have set up some form of mathematics support without direct funding from **sigma** or the National HE STEM Programme; in some institutions this is long-established, whilst in many others it is relatively new. The recent **sigma** report *Mathematics Learning Support in Higher Education - the extent of current provision in 2012* shows that 85% of the 103 HEIs responding to a survey have some form of mathematics support - although there is a huge range in the nature of the provision (from a few hours a week of peer support through to the extensive provision offered at institutions like Loughborough and Coventry).



*"It is hard to overstate the importance of the expansion of the **sigma** Mathematics Support Network ...Maths support has now attained a critical mass and overcome the significant hurdle where universities worry whether offering maths support is an indication of modest aspirations."*

David Youdan, Executive Director, Institute of Mathematics and Its Applications

The **sigma** regional hub network

Many mathematics support centres are new, small scale operations. Particularly in institutions where the support is provided from a central unit, rather than a mathematics department, the individuals offering mathematics or statistics support can often feel isolated in their own institution. The **sigma** regional hub network provides staff and institutions with local access to workshops, training events and information, giving opportunities to meet fellow practitioners and work together to share resources and experiences.

sigma CETL's regional hub pilot scheme started with the establishment of the South West and South Wales (SW) hub based in the University of Bath in 2009. Based on the success of the SW hub, the North East & Yorkshire hub was established towards the end of CETL funding in 2010. **sigma** continued this policy within the National HE STEM Programme, and extended the **sigma** regional hub network to six, covering all of England and Wales.

The six hubs are:

- **sigma** Eastern England hub based in University Campus Suffolk and co-ordinated by David Bowers.
- **sigma** Midlands hub based in Coventry and Loughborough Universities and co-ordinated by Duncan Lawson and Tony Croft.
- **sigma** South East hub based in Brunel University and co-ordinated by Martin Greenhow.

- **sigma** South West & South Wales hub based in the University of Bath and co-ordinated by Jane White.
- **sigma** North East & Yorkshire hub based in the Universities of Leeds and Sheffield and co-ordinated by Liz Meenan and Chetna Patel.
- **sigma** North West and North Wales hub based in the University of Liverpool and co-ordinated by Sarra Powell.

The network encourages people from all institutions to get involved in their nearest regional hub. Each hub holds at least two events a year. These develop and support its members and contribute to the wider **sigma** network. Events run by the hubs have covered a wide range of topics including: diagnostic testing, statistics support, support for nursing students and online resources. The network website <http://sigma-network.ac.uk> provides a focal point for the exchange of ideas and information.

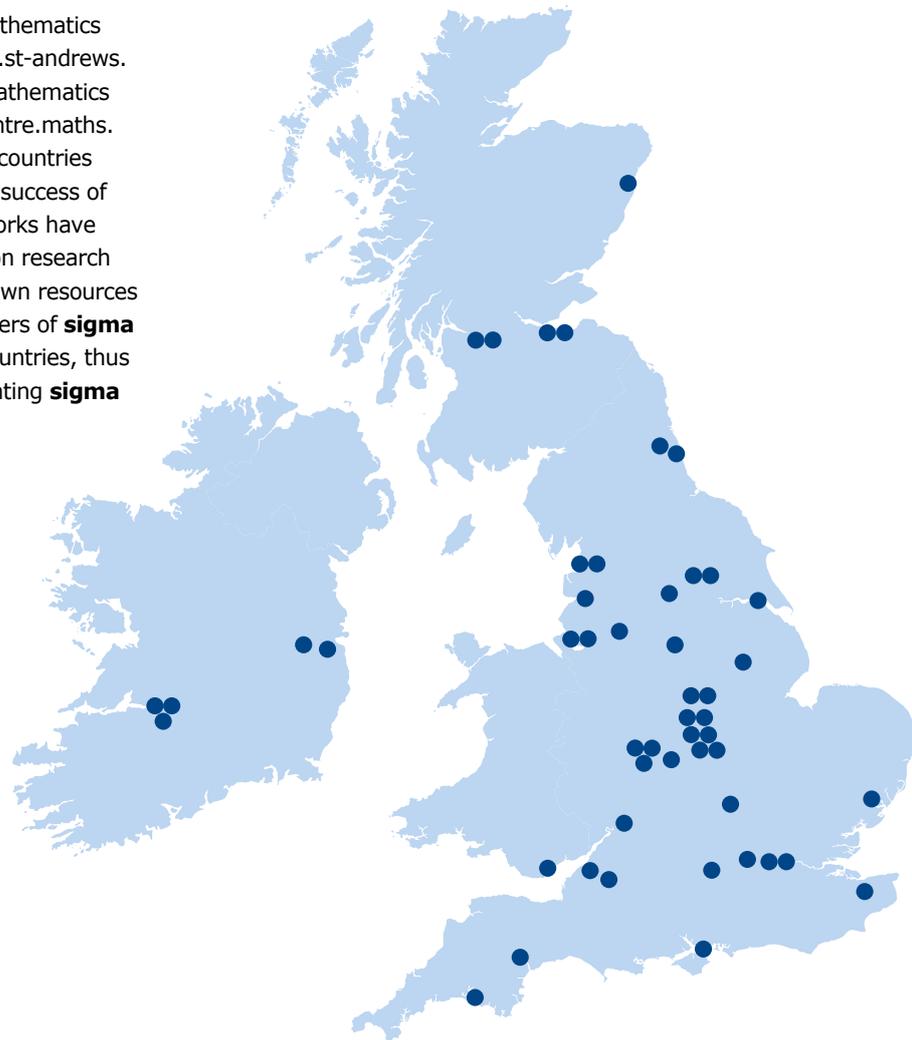
*"We stand on the shoulders of giants. From our point of view, the giants are Coventry and Loughborough Universities and **sigma**. We have unashamedly copied our ideas from them."*

Professor John O'Donoghue, Director Irish National Centre for Excellence in Mathematics and Science Teaching and Learning.

Beyond England and Wales

sigma has also had significant influence outside of England and Wales, and it is seen by many as an international leader and expert on mathematics support. **sigma** has been approached directly by universities and individuals in Ireland, Oman, Scotland, South Africa, Sweden, Switzerland and Australia for advice on the establishment and maintenance of mathematics support.

sigma has also advised both the Scottish Mathematics and Statistics Support Network, (<http://www.st-andrews.ac.uk/mathsnetwork/home/>) and the Irish Mathematics Learning Support Network (<http://supportcentre.maths.nuim.ie/mathsnetwork/>). Colleagues in both countries decided to set up networks as a result of the success of the **sigma** hubs, and members of both networks have visited **sigma** on secondment, collaborated on research and resource projects and contributed their own resources to the mathcentre community project. Members of **sigma** regularly attend events in these and other countries, thus acting as international ambassadors representing **sigma** and the HE sector.





Sharing good practice and resources

sigma has played a central role in developing and supporting a community of practice in mathematics support both nationally and internationally. In addition to the success of both the new centres and the **sigma** Network initiatives, **sigma** also co-ordinates a range of activities which are crucial to the establishment and maintenance of good practice.

The CETL-MSOR Conference

The first CETL-MSOR (Continuing Excellence in Teaching and Learning in Mathematics, Statistics and Operational Research) conference took place in 2006 at Loughborough University organised by **sigma** in collaboration with the MSOR Network of the Higher Education Academy. Since then it has taken place annually, being hosted by a variety of institutions - Birmingham (twice), Lancaster, Coventry, Sheffield and the Open Universities. The aim of the conference is to promote, explore and disseminate emerging good practice and research findings in mathematics and statistics support, teaching, learning and assessment.

The CETL-MSOR conference is now firmly established as the UK's premier event for those concerned with the scholarship of learning and teaching of mathematics in higher education. Over 100 delegates have attended each year from a wide variety of disciplines.

*"I think this was a brilliant conference.
The best I have been to."*

Anonymous feedback on 2012 CETL-MSOR Conference.

The conference and its edited proceedings have been identified by practitioners as playing a crucial role in the development of mathematics support. They allow individuals, hub members and colleagues from the UK and further afield to share their experiences, discuss issues or interventions that they have trialed. The proceedings are available at <http://www.mathstore.ac.uk/?q=node/2049>. These are an invaluable source of advice, innovations and ideas for people who are considering a review of existing supports or the establishment of new supports.

"It is a sign of a good conference when there are clashes which meant I missed some talks I wanted to see."

Anonymous feedback on 2012 CETL-MSOR conference.

mathcentre

mathcentre (www.mathcentre.ac.uk) is an internationally renowned website which provides free access to a large repository of mathematics support resources for both staff and students. The site was established by Tony Croft, Duncan Lawson and Mike Savage in 2003, prior to the establishment of **sigma**, as a way of providing mathematics support resources directly to students, particularly those in institutions where there was no mathematics support, and also to staff wishing to offer mathematics support (removing the need for them to develop their own resources).

Through the involvement of the **sigma** directors, it has had a significant impact on the mathematics support community. There are a wide range of topics and resources available to support students from GCSE-level upwards including self study guides, test yourself diagnostic tests/exercises, video tutorials, iPod and 3G mobile phone downloads. The website currently enjoys an average of 20,000 hits per month.

An important development within the site has been the **mathcentre** community project. This section of the site allows members of the mathematics support community to upload resources that they have developed for sharing – the resources have to be peer reviewed by another member of the community before they are made available for wider dissemination. This innovative project enhances the collaborative nature of the mathematics support community.

mathcentre also contains links to guides and reports on best practice in the provision of mathematics support and it catalogues research papers on the evaluation of mathematics support centres. The recent establishment of a sister website **stats**tutor, www.statstutor.ac.uk, has been welcomed as a significant development.

*"The work of **sigma** is a perfect example of what we set out to achieve at the outset of the National HE STEM Programme ... A key feature has been the activities of the **sigma** network which has allowed individual practitioners to come together as part of a national community to share learning, resources and expertise."*

Michael Grove, Director, National HE STEM Programme

sigma prizes

In 2009, **sigma** launched the annual **sigma** network prizes for outstanding contributions by individuals (in UK HEIs or from overseas) in the field of mathematics and statistics support. The two annual prizes are the Outstanding Contributor and Rising Star awards.

The Outstanding Contributor award is for a sustained contribution to mathematics and/or statistical support over a period of at least 5 years, and the Rising Star is for notable contributions to mathematics and/or statistical support at an early career stage. The prizes allow the wider community to celebrate the achievements and contributions of their peers in mathematics and statistics support. They are also a vehicle through which the importance of this work is highlighted within institutional hierarchies.

The prize winners have been:

2009

Outstanding Contributor

Chetna Patel - University of Sheffield
Jan Robertson – De Montfort University

Rising Star

Not awarded

2010

Outstanding Contributor

Christie Marr - University of St Andrews

Rising Star

Ciarán Mac an Bhaird – National University of Ireland
Maynooth

2011

Outstanding Contributor

Liz Meenan - University of Leeds

Rising Star

Inna Namestnikova- Brunel University

2012

Outstanding Contributor

Rob Wilson - Cardiff University

Rising Star

Not awarded

*"What has been most valuable has been the experience and expertise which **sigma** has shared enthusiastically with us at each stage of the process."*

Alison Braddock, Director, HE STEM Wales

Good practice reports, literature reviews and community surveys

Evaluating, reflecting and adapting the services offered is at the heart of the mathematics support community, and essential to establishing good practice in the provision of mathematics support. **sigma** strongly advocates this approach and is at the forefront of most of these activities, having produced or commissioned a number of guides and reports including:

- Tutoring in a mathematics support centre: a guide for postgraduate students.
- Gathering student feedback on mathematics and statistics support provision: a guide for those running mathematics support centres.
- Setting up a maths support centre (An introduction to maths support).
- Evaluation of mathematics support centres
 - A review of the literature.
- Mathematics learning support in higher education
 - the extent of current provision in 2012.
- How to set up a mathematics and statistics support provision (A guide for anyone interested in setting up or enhancing maths and/or statistics provision)

All of the above reports are available from www.sigma-network.ac.uk, the **sigma** network website.

Enhancement of mathematics support

In 2011, within the National HE STEM Programme, **sigma** launched a competitive funding call for a Practice Transfer Adopter (PTA) scheme entitled 'Enhancing a Mathematics Support Provision'. Working with the MSOR Network of the Higher Education Academy, the scheme was extended to include HEIs in Scotland and Northern Ireland. The purpose of this scheme was to provide support to HEIs with existing mathematics support to enhance their provision using the experience gained through the **sigma** regional hubs and via projects that **sigma** had funded.

The ten successful applicants were the Universities of Bath, Exeter, Leeds, Lincoln, St Andrews and Ulster; Birmingham City, Cardiff and Robert Gordon Universities; and Queen's University Belfast. The specific schemes were varied in nature and included improvements to an existing drop-in support, the addition of a statistics advisory service, the implementation of a student ambassador scheme and the establishment of a repository for support materials.

*"My colleagues in the **sigma**-sw hub are an invaluable source of experience, creative ideas and support ... Our maths and stats support project has now received permanent University funding and I am sure that this would not have happened without us having access to the **sigma** network."*

Rachel Canter, University of Exeter.

sigma mentors

With both the adopters scheme and the 2nd HE STEM new centres call, **sigma** introduced a cohort of mentors. The mentors are experienced mathematics support practitioners from throughout the UK and Ireland who act as advisors during the planning and implementation of the new projects. This has proved to be an effective way of sharing good practice, enabling the adopters and new centres to make more rapid progress than if they had been left to their own devices. The mentors typify a prevalent characteristic of those involved in the **sigma** network – they are willing to collaborate and share with newcomers, there is no sense of competition between mathematics support providers.

"Of most use to us was our mentor who was happy to share their mistakes, so we could avoid them and gave practical advice that will give us the best chance of sustaining our maths support programme."

Ruth Fairclough, University of Wolverhampton.



The future

This report gives a snapshot of some of **sigma**'s activities over the past seven years. Clearly **sigma** has been a success story, not only in terms of its impact at Coventry and Loughborough Universities, but also because of its influence at both a national and international level. **sigma** is recognised as a leader in the field of mathematics support, and has created an impressive portfolio in terms of the establishment of good practice, its support for new centres and new initiatives, and the establishment of the network of hubs.

sigma's achievements were recognised by the receipt of the prestigious THE Award in November 2011. However, the real winner is mathematics support in general. The award underlines the value of the work done by many colleagues across the country in providing support to students to enable them to fulfil their potential in their chosen discipline of study.

Mathematics and statistics support is becoming firmly embedded in the student support infrastructure at a growing number of universities. Several English HEIs make explicit reference to their mathematics support provision in their Access Agreements with the Office of Fair Access. In addition to Coventry and Loughborough, HEIs making such statements include Brighton, De Montfort, Newcastle, Oxford Brookes, Portsmouth, Salford and York.

"Continue the delivery and further development of services that support students' academic skills post-entry: Maths Aid and the Writing Development Centre."

Newcastle University Access Agreement

Reports published in 2012 such as RSA's *Solving the mathematics problem* and the SCORE and Nuffield Foundation reports on the mathematics in 'A' level examinations in a range of disciplines allied with the 2011 ACME *Mathematical Needs* report provide strong evidence that the 'mathematics problem' is likely to remain a feature of the higher education landscape for some time to come. Furthermore, many disciplines which have not traditionally been associated with quantitative skills are placing more emphasis on them (as highlighted by the British Academy's Languages and Quantitative Skills programme – see http://www.britac.ac.uk/policy/Languages_and_Quantitative_Skills.cfm accessed 16 July 2012).

It is clear that, for the foreseeable future, the need for mathematics support will remain. Although funding from the National HE STEM Programme ended in July 2012, the mathematics support community is committed to maintaining itself as an effective community of practice. The **sigma** regional hub co-ordinators have committed themselves to continue the work of the hubs, it has been confirmed that the CETL-MSOR conference will take place in 2013 at Coventry University and a steering group of active mathematics support practitioners has been established to continue to promote the development of the **sigma** Network. It is to be hoped that this voluntary commitment can be matched by funding from appropriate bodies to enable the work of the **sigma** Network to continue to thrive.



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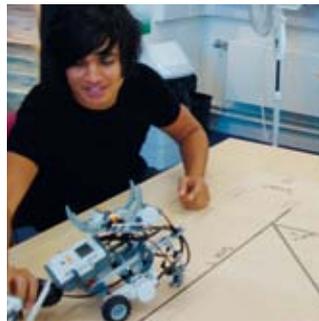
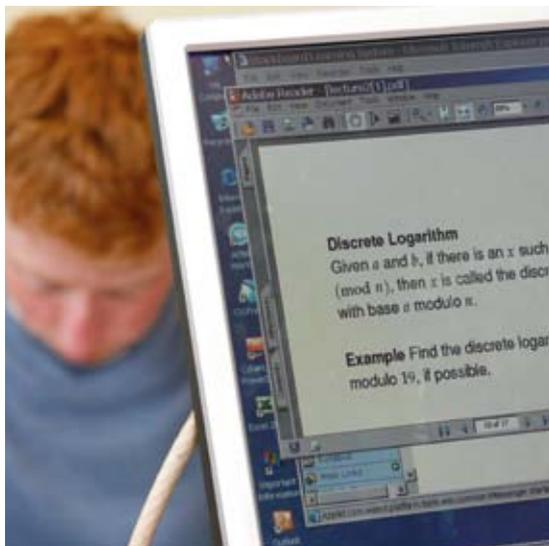
Just as this booklet was about to be sent to the printers, on 24th July 2012 the House of Lords Select Committee on Science and Technology published their report *Higher Education in Science, Technology, Engineering and Mathematics (STEM) subjects*. A large part of this report deals with problems at the interface between schools and higher education *in mathematics*. The report concludes that the mathematical preparation of many students is not adequate for their university courses and recommends that the study of mathematics should be compulsory for all students post-16 and that mathematics to A2 level should be a requirement for students intending to study STEM subjects in HE. At least until such recommendations have been implemented, mathematics support in HE is very necessary.

"There is an urgent need for this [the commitment of individuals to sustain the momentum established during the HE STEM Programme] to be complemented by the provision of funding – not just to sustain Support Centres in individual institutions, but to facilitate collaboration between them and the research that would provide the evidence on which future improvements in practice can be based."

Professor Harry Tolley, University of Nottingham,
National HE STEM Programme Internal Evaluator.

"Mathscope is a support unit for students experiencing difficulties with mathematics in whatever subject they are studying."

University of Salford Access Agreement



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