



NEWSletter

WINTER 2011

Welcome to the Winter 2011 edition of the National **HE STEM** Programme Newsletter

To celebrate the beginning of a new calendar year, the theme for this quarter is Innovation: and we kick off with descriptions of the ten exciting projects which have been made possible by our 'curriculum innovation and enhancement' fund.

The completion of these projects will add considerable value to the **HE STEM** landscape: providing models of problem-based learning and sustainability for chemists; creating better integration of teaching and research, and of industrial and academic perspectives for engineers; enhancing the student experience, employer engagement, and feedback and assessment methods for mathematicians; and developing the employability of student physicists.

In addition to all our other news this quarter, I'm also delighted to be able to present a Q&A session with Marcus du Sautoy, the current Simonyi Professor for the Public Understanding of Science - special thanks are due to colleagues in Birmingham and Loughborough for thinking up such fascinating questions...

I hope you enjoy this latest issue of the National **HE STEM** Programme newsletter.

Rebecca R Rosewarne
National **HE STEM** Programme
Information Officer



If you would like to receive a hard copy of this newsletter, then please make sure that you have registered your interest at our registration of interest page on www.hestem.ac.uk

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The Programme adopts a holistic approach by considering the progression of students from school, through university and into the workplace.



Curriculum innovation and enhancement projects **in Chemistry**

Research-based component for first-year chemistry laboratory course

(Durham)

An overhaul of Durham University's undergraduate laboratory classes is creating a laboratory course with the development of students' higher-level skills at its heart. The RSC's Teacher Fellow, Jacquie Robson, has been working towards embedding problem-based learning into the undergraduate chemistry course and this work is now to be greatly expanded into a complete redevelopment of the 1st year undergraduate lab course: producing an integrated organic, inorganic and physical chemistry lab course that is underpinned by the principles of problem-, discovery- and research-based learning. Titled RELITE (research-led innovative teaching experiments), the course will also have a strong emphasis on developing learner independence with pre- and post- laboratory work incorporated throughout.

Integrating sustainability into the undergraduate curriculum with courses and case studies in sustainable chemical technologies

(Bath)

At Bath University, it is the topic of sustainability which forms the basis of their work. This area is of vital importance to the chemical industry and will be essential knowledge for future graduates. The team at Bath are meeting this need by using the knowledge and experience of their Doctoral Training Centre in Sustainable Technologies and Institute for Sustainable Energy and the Environment to embed sustainability principles into their core undergraduate courses. Their aim is to expose students to the various forms, principles and practices of sustainability — everything from renewable resources and clean energy to product life cycle and corporate and social responsibility — as early as possible in their university education. The project will produce modules for undergraduate teaching as well as a distance learning module for placement students and a series of case studies, developed with industrial partners.





Curriculum innovation and enhancement projects **in Engineering**

Practices and approaches for the integration of teaching and research

(Imperial College London)

This project is identifying and disseminating practices which effectively integrate both the research and teaching needs of HEIs. Surveys, interviews and case studies are being used to address the following questions:

What are the typical practices, work approaches and support resources of those individuals who are able to maintain both outstanding teaching and research profiles? How are / were obstacles overcome?

What are some of the Departmental, Faculty, School or Institutional models which facilitate an effective teaching and research balance, and what is the evidence for this?

What is the role of employer engagement in supporting such practices?

The project outputs will inform the induction and training of new lecturers on matters of teaching and research role integration, elaborate teaching pedagogy through examples of good practice and identify some exemplary initiatives of employer engagement. The project will target a wide cohort of academic staff in research-focused institutions within the UK. Several senior education experts from outside the UK will also be consulted in order to gain an international perspective.

Deep integration in first year engineering programmes

(Middlesex)

In traditional Engineering programmes we expect to see several elements, such as mathematics, domain-specific theory, technology and skills, typically presented in "modules", with material ordered in conventional ways which students often find difficult to apply to real problems. This project "inverts" this curriculum by using a series of real problems from industrial partners in response to which students will identify the need for components such as mathematics, theories, skills and tools. They will then be supported in using these to analyse problems, design, implement, and test solutions and reflect on the variety of approaches. The whole first year curriculum will be delivered within this single, unified framework. This project will find ways to manage the resulting multi-dimensional curriculum, which will require planning, monitoring and assessment across multiple areas, for which control of content ordering will be given to students. Strategies and tools are being

devised for planning this process and predicting challenges arising for the teaching team (such as ensuring learning materials are available on demand.) We are also developing a tool for reflecting on our practice in a concrete, unified form, enabling quality monitoring and improvement.

The hybrid part-time MEng degree scheme: an innovative approach to provision in nuclear and chemical engineering

(Lancaster)

This project establishes an innovative approach to MEng HE provision in Nuclear and Chemical Engineering, in a mode of delivery which combines a traditional full-time student experience with the experiential benefits of part-time provision, collating the priorities of both industry and professional bodies and bringing this expert view to benefit the design of this new mode of study. There will be extensive consultation with industry to identify key requirements for both the syllabus and the delivery of hybrid MEng education, together with consultation across both professional engineering and higher education institutions and students to identify best practice, key accreditation issues and the optimum student experience. The third and fourth years of full-time MEng provision at Lancaster will be rationalized to enable students in industry with the prerequisite qualifications to register for part-time study over four years and graduate with an MEng (Hons) degree. This project comprises two full terms of pilot delivery for a group of students taken from existing cohorts and from industry, and will result in a further two papers in addition to the final report.





Curriculum innovation and enhancement projects **in Mathematics**

Enhancing the second year experience for undergraduate mathematicians

(Loughborough)

Efforts to encourage uptake of Mathematics and Further Mathematics A levels have succeeded. Entries in 2009/10 recovered to >80,000 from about 50,000 in 2002. Many of these students have been inspired to continue mathematical study through initiatives like More Maths Grads and the Further Mathematics Network. However, research evidence highlights persistent problems in year two of many mathematics programmes with disillusionment, disengagement and high failure rates common in some institutions. Loughborough's Mathematics Education is well-placed to respond positively through its alliance of mathematics and mathematics education specialists, and will grasp this opportunity to catalyse and evaluate innovation in the way Year 2 students engage with the most problematic of their modules. The ultimate goal is to ensure that those students who arrived at university eager and inspired to learn mathematics leave university reporting a positive and successful experience of university mathematics, and thus contribute to a virtuous circle of enthusiasm for studying STEM subjects at university.

The objectives are to stimulate enthusiasm, improve engagement, satisfaction and pass rates, particularly in historically problematic modules. A broad-ranging team of mathematicians, educators, undergraduates, postgraduate tutors, a research student, learning technologists, and staff from the Teaching Centre are seeking to achieve these objectives through pedagogical changes aimed at developing a more active, collaborative and engaging curriculum. Key elements include opportunities for student input into the change process and for involvement through peer mentoring. Lessons learned will encourage other institutions to review and enhance their own provision.

Contact: Professor Tony Croft a.c.croft@lboro.ac.uk

Improving feedback in HE mathematical courses

(Sheffield Hallam)

Anyone who looks at the National Student Survey results – and that's most of us, like it or not – will know that students rate our feedback relatively poorly. A substantial number of them say it's slow, and even more that we don't give detailed comments, and that it doesn't help them to clarify those things they don't understand.

Talk to staff, as we did during the More Maths Grads project, and you will find we too have concerns: it takes too long (especially when we do it ourselves!) and we worry about quality (where others do it for us!) In either case we wonder whether students even use it - or just look at the mark?

In this project, we're looking for a large team of colleagues who teach maths, from any STEM discipline, to work with us to improve the feedback process, and to build up a body of practical evidence to help future staff who want to improve their feedback. You may want to experiment with something different (in any part of the process, e.g. from how you mark to how your students engage); if so we can help by connecting people with similar ideas, or with prior experience, and will organise workshops to exchange and develop ideas. The project team will want to evaluate the feedback – by talking to you and your students about it.

That said, there's a lot of good practice around the sector already. We would also like people to allow us to evaluate your current practice, from student and staff perspectives.

If you are interested in taking part or finding out more, please email m.robinson@shu.ac.uk or visit <http://maths.shu.ac.uk/feedbackproject/>





Curriculum innovation and enhancement projects in **Mathematics/Physics**

Integrating formative and summative e-assessment into mathematics teaching and learning for first and second year students

(Leicester)

As the use of electronic learning and assessment increases, thus improving the speed and quality of assessment to students, departments face the challenge of knowing what is possible; what may be appropriately tested; and what support is required to introduce and maintain systems and realise potential benefits to staff and students. This project brings together a large group of university practitioners with professional providers of e-assessment technology, to co-ordinate the sharing of experiences in the UK.

The key aims are to:

- Demonstrate benefits to institutions, staff and students
- Address barriers to the introduction of sustainable and effective assessment
- Give supportive and evidence based guidance.

The expected outcomes are:

- Information for all STEM disciplines on present benefits and developments in e-assessment for maths & stats in HE
- Sharing of best practice through wide-scale dissemination to all STEM disciplines
- Understanding barriers to sustainable use of e-assessment in STEM disciplines and to potential future developments in HE
- Criteria and implementation strategies in terms of pedagogy and resource implications, tested by our case-studies, helping departments and schools introduce sustainable e-assessment into their curriculum
- Web-based e-assessment advisory resource, initially based within the HoDoMS forum, for maths & stats in STEM disciplines.

Professional and Industrial Degrees (PaID): shaping curricula through improved employer engagement

(Exeter)

This project promotes closer collaboration between employers and HEIs in the development of curricula, to support graduates in the acquisition of the skills and experiences which employers demand and identify credible opportunities for the existing workforce to engage in academic study. Specifically, this project is responding by developing a framework for a sustainable work-based degree programme in Mathematics and/or Engineering. These PaID programmes will provide an essential opportunity to access HE for prospective students who are traditionally under-represented or “at-risk” given likely changes in funding arrangements for the HE sector. These groups include mature students already in full-time employment, and communities who are likely to become disenfranchised with the introduction of higher fees and corresponding debt. The outcomes of this project will be evaluated through consultation with HEIs regarding the transferability of the PaID programme framework and the programme will be piloted with at least one regional employer and a small cohort of students from October 2011.

Development and implementation of curriculum materials to develop skills for employment in collaboration with industry

(Portsmouth)

At Portsmouth, as with Durham, the theme of context-based problem solving is seen as a valuable means of delivering the employment skills that graduates need. The project involves producing physics practicals that depart from traditional experiments to longer project group activities that not only develop students’ technical skills and subject knowledge, but enhance their understanding of physics in application and the skills required to make them effective employees. Real-world examples of applied physics are being obtained through collaboration with a variety of industrial and public sector partners and these partners will also be involved in delivering the courses. Field work will be incorporated wherever it is appropriate, and a field study unit will also be produced as part of the project. The project relies heavily upon e-learning technology and the use of virtual learning environments both to facilitate collaboration and as an e-mentoring tool.



Repackaged **Physics** degree at Salford

Repackaged **Physics** degree at the University of Salford

At the University of Salford, the traditional physics degree courses has been transformed and updated in order to combine a high quality teaching programme with practices that enable students to gain a greater understanding of physics in the workplace.

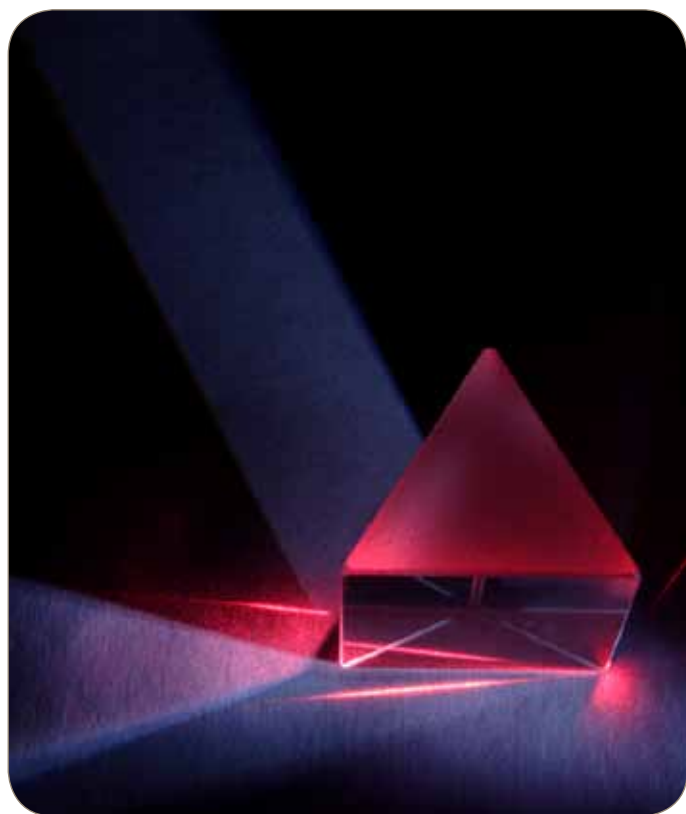
The University of Salford has taken much of its learning from the IOP's marketing and semiotics work conducted in 2008 and used this to inform both the structure of their degree course and their marketing strategy, emphasising the range of careers to which a physics degree can lead. The course has established links to employers by setting up an industry board, who offer advice and are actively involved in some modules.

The first year of the new degree began in September 2010. Despite only a soft roll-out of the new course, application numbers went up 80% from the previous year and final enrolment numbers were up by 77%.

Central to the new first year is the 'Careers and Frontiers' module which features lectures on employability skills, talks from industrialists and problem-based learning group lab work. Later years of the degree will incorporate practical work that solves real industrial problems. Salford is also investigating how to maximise the number of students who undertake work experience in industry, whether for a whole year or shorter placements.

Initially, the students found some of the new ways in which they were expected to work a challenge, in comparison with how they were taught at school. However, over the course of the first semester they began to adapt and appreciate the new learning methods. In the second semester, staff now report that the students are showing a growing enthusiasm for their group work and particularly appreciate the careers talks from industry.

Application numbers for the 2011-2012 year are again encouraging: they show a 69% increase on the 2010-2011 figure, compared to the general rise in applications to Salford across all disciplines of 32%.





Maths in context

Who Needs **Maths**?

The answer is everyone, but the maths taught in the classroom and the maths used in real world jobs may seem worlds apart. A new initiative for Sussex schools aims to highlight the link between the classroom and real jobs. Volunteers from local companies including UK Power Networks, Ricardo, Thales UK and the Home Office Scientific Development Branch met with teachers on the 26th January 2011 to explore ways that the teaching of maths can be set in a real world context.

The volunteers are STEM Ambassadors: people with backgrounds in Science, Technology, Engineering or Maths. Together with teachers they explored ideas for linking teaching to the ways in which they use maths in their day jobs. Resources such as the "Maths in a Box" kit from the More Maths Grads and **HE STEM** Programmes can bring difficult mathematical concepts to life. During the evening, teachers and Ambassadors worked together to generate ideas for how the "Maths in a Box" resource could be used in class.

Together they explored ways in which the mathematical understanding which underpins the STEM Ambassadors' jobs could be translated into teaching maths in classrooms.

Over 60 teachers and STEM Ambassadors came to the event at Warden Park School, Cuckfield which was organised by STEM Sussex, part of the University of Brighton, who co-ordinate the National STEM Ambassadors programme in Sussex.

At the end of the session, each teacher from the 17 Sussex secondary schools represented took away a "Maths in a Box" kit to use. The STEM Ambassadors will also explain to students in person how they use maths when they visit schools later this year.



Teach First working to increase number of qualified teachers in **STEM** subjects

Teach First is currently working to recruit a record number of STEM participants into its 2011 cohort. The independent education charity is aiming to train and place 780 exceptional graduates in schools in challenging circumstances across England from September, 41% of whom will train to be teachers in STEM subjects (Maths, Science, ICT and DT). If targets are met this will be a 40% increase on last year's figure. The charity, which came 7th in the 2010 Times Top 100 Graduate Employers league, currently has 402 STEM teachers from its 2010 and 2009 intakes in schools in London, the East Midlands, the West Midlands, the North West and Yorkshire and the Humber.

Teach First is an independent charity which works to improve the life chances of children from the most deprived backgrounds. In the short term it does this by recruiting high calibre, motivated graduates who would not normally consider a career in teaching and working to place them in challenging schools while supporting them to become innovative, high impact teachers.

"...we are committed to increasing the number of qualified teachers in STEM subjects."

The challenge of recruiting STEM teachers to any school is great, but the problem is even more acute for schools in challenging circumstances where demand significantly outstrips supply. Teach First seeks to address this challenge by working in partnership with a number of prestigious organisations, to ensure that recruitment targets are reached, whilst attracting the highest calibre of graduates to apply.

An Advisory Board of experts from the Gatsby Foundation, the Institute of Physics, the Institution of Engineering and Technology, NESTA, the Ogden Trust, the Royal Society, the Royal Society of Chemistry, and the Wellcome Trust, have agreed to share their expertise on the difficulty of raising the profile of STEM careers to top STEM graduates and to work with Teach First to find solutions. The market research company Trenderence has been engaged to carry out research on behalf of the Board.

James Darley, Head of Graduate Recruitment at the charity, said "Teach First believes the shortage of specialist STEM teachers is unacceptable and we are committed to increasing the number of qualified teachers in STEM subjects. Without an inspiring STEM teacher, pupils studying these subjects may not fulfill their potential and could miss out on crucial job and life opportunities in a society that is becoming increasingly focused on STEM innovation."

The **Teach First** Teacher's view from the classroom

'There are so many highlights from Teach First, but it's often the small things that you remember: like a parent who told me that every day when his son got home, he'd tell him what he'd got up to in science. Another proud moment was when one of my Year 11s told me they were taking A-level Chemistry because they had enjoyed my lessons so much.'

Caroline Cane
Taught: Science
Now: Policy Officer, Department for Education

*"I love teaching maths because it's a core subject and I know how much of an impact it has in terms of job applications, or in getting into university. I organised a maths trip for my gifted and talented Year 11 group which was so much fun as I got to see the students in a different light – and as it was a revision trip it really impacted their results. For the first time ever there were no C grades; there was a record number of A*s too! I'm now an Assistant Principal at Harefield Academy – I hope that within time I can progress even further and make as much of an impact as I can on education."*

Sugra Alibhai-Watson
Taught: Maths
Now: Assistant Principal, Harefield Academy

Addressing motivation and barriers to uptake of **STEM** courses and employment among under-represented groups



This research project (carried out by Reena Pau and Marcus Grace in the MaSE Research Centre, School of Education at the University of Southampton) aims to gain a better understanding of motivation and barriers to uptake for each of the different under-represented groups, and how university actions and procedures might be improved to mitigate these influences.

The study is investigating this phenomenon by developing an understanding of how students studying STEM-related GCSE, A level and undergraduate courses perceive their courses and future STEM opportunities, based on their formal and informal learning experiences. This will be compared with the views of undergraduates in areas such as medicine and pharmacy, which are sciences where the disparity is not as significant. This will help us understand the factors that attract these different student groups to STEM-related courses. A further aim is to find out from GCSE and A-level students what marketing approach would attract them to taking STEM-related courses.

We have been asking participants to design a poster/mind-map to 'advertise science careers'. We will be asking all participants to complete a short questionnaire about their background, feelings and thoughts on science. Each group will have a digital recorder on their table, to get an idea of

how they came up with their conclusions and the overall design. We are conducting focus groups to get a deeper understanding with regards to their thinking on positive messages.

Participants spent the majority of their time talking about why they did not think careers in science were valuable or satisfying. Generally these were the reasons they discussed for not wanting or liking science careers. The way in which STEM careers are perceived (e.g. geeky, or just people in overalls !) were not given as a reason not to study engineering or other STEM subjects, but the decision to give up or carry on is clearly taken early. The positive reasons young people identified were:

- Money
- Prestige
- Saving the world e.g. medical engineering
- Becoming an accountant, teacher or scientist.

Reena Pau, University of Southampton



Sigma support for postgraduate tutors

Sigma support for postgraduate tutors

An important area of work of the National **HE STEM** Programme concerns support for undergraduates in the STEM disciplines. In mathematics, such support is increasingly provided at physical centres where postgraduate students are employed to offer one-to-one and small group help to undergraduates who drop in for assistance – thus offering a different kind of support from that which is made available via traditional tutorials. The sigma network has developed one-day workshops for postgraduate mathematics tutors which have taken place at Loughborough University (19th November, 2010) and Cardiff University (9th February 2011) for postgraduate students at not only these two institutions but also York, Coventry, Swansea, and Exeter.

The workshops provide both a historical background and a rationale for mathematics support and explain the variety of ways in which mathematics support is made available at different institutions. The ways in which working in a support centre differs from module tutoring are also discussed. A variety of problems and scenarios are explored and there is plenty of opportunity for postgraduate tutors to discuss the 'do's and 'don't's of working in a support centre. A session on individual learning differences raises awareness of maths anxiety, specific learning differences such as dyslexia, and the relationship of support tutoring to counselling, alerting postgraduates to potential problems and suggesting possible solutions. The workshop also includes a session on the many resources available to help and encourage students who are struggling with the mathematical components of their courses and the way these may be used. (Statistics support often presents a particular challenge when tutors find themselves supporting final year project students or other postgraduate students who are grappling with data collection and analysis requiring a type of statistical thinking with which they may be unfamiliar.) Networking with postgraduates doing similar work within other universities is obviously encouraged in order to strengthen the ongoing support system of the tutors.

The workshop presenters to date have been Tony Croft, the Director of sigma – centre for excellence in mathematics & statistics support; Michael Grove, Director of the National **HE STEM** Programme; Alun Owen, from the Statistics Consultancy Service; Peter Samuels, Academic Skills Tutor in Mathematics at Birmingham City University and Rob Wilson, Director of Learning & Teaching at the School of Mathematics, Cardiff University.

For further information about these and other sigma events, please contact Moira Petrie
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Industrial Group Projects

Industrial Group Projects

The IOP is working in partnership with nine physics departments (Bath, Birmingham, Bristol, Cardiff, Exeter, Hertfordshire, Liverpool, Leicester and UCL) to develop and establish undergraduate group projects with their local industries. The University of Durham are also involved in an advisory capacity, as they have been successfully running group projects for 20 years.

The dual aims of this project are to promote stronger links between universities and employers and to match graduates' skills with employers' needs. Students gain an insight into how they could be employed once they have graduated, they learn about working in a team, adhering to a budget and timeline, and how to report to an industrial contact. The company gains a real problem solved and potential recruitment opportunities.

On a longer term level, the industrial clients gain an appreciation of the skills of physicists and what sort of problems they can help solve, and departments can also build up their network of industrial contacts.

The nine departments will be receiving funding from the National **HE STEM** Programme to enable them to develop a local version of Durham's scheme and buy out academic time, in addition to equipment. They will also receive support from a dedicated project manager, based at Durham. The departments will spend the next six months setting up their schemes and the undergraduate projects will commence in the 2011–2012 academic year.

Each department's scheme will vary to suit their own needs but departments will meet to exchange ideas and share good practice. Working together, the project partners will produce guidance and advice for any other universities that may wish to adopt similar schemes.

For more information please visit www.iop.org/hestem





Q & A with Marcus du Sautoy

Questions (and answers!) with

Marcus du Sautoy

Marcus du Sautoy is the current Charles Simonyi Professor for the Public Understanding of Science and Professor of Mathematics at the University of Oxford and a Fellow of New College.

In 2001 he won the prestigious Berwick Prize of the London Mathematical Society awarded every two years to reward the best mathematical research made by a mathematician under 40. In 2004 *Esquire* Magazine chose him as one of the 100 most influential people under 40 in Britain and in 2008 he was included in the prestigious directory *Who's Who*. In 2009 he was awarded the Royal Society's Faraday Prize, the UK's premier award for excellence in communicating science. He received an OBE for services to science in the 2010 New Year's Honours List. He also received the Joint Policy for Mathematics Board Communications Award for 2010.

Marcus du Sautoy plays the trumpet and football. Like Beckham he also plays in a prime number shirt, no. 17, for Recreativo FC based in the Hackney Marshes. Born in 1965, he lives in London with his wife, three children and cat Freddie Ljungberg.

Are mathematical truths truer than other kinds of truth?

One of the things that attracted me to mathematics was its power to access eternal truths. The power of proof in mathematics is what sets it uniquely apart from the other sciences. For example the theorems in Euclid's *Elements* are as true today as they were 2000 years ago. You can't say the same about Ancient Greek chemistry or biology. In the other sciences there is more of an evolutionary approach: survival of the fittest theory. Proof in mathematics means that you can know with 100% certainty for example that there are infinitely many prime numbers. You aren't suddenly going to discover that actually the primes have run out. Mathematics is constantly changing and we are continually discovering new truths but each new generation stands on the shoulders of giants as Newton once famously declared. It is like building a huge pyramid of knowledge where proof guarantees that the lower layers are secure foundations on which to build the next layer of truth.





*What do you think is the role of history in motivating the **HE STEM** curriculum?*

History can play a very useful role in explaining the evolution of mathematical and scientific ideas. Many people think that mathematics just arrived in some huge textbook and are unaware of how and why new ideas and theories were developed. Explaining the historical motivation for why mathematicians created trigonometry for example in order to navigate the night sky provides students with their own motivation for studying the ideas. Also it is quite empowering for a student to recognize that there was a time when even something like negative numbers seemed such a strange abstract idea that their use was banned in medieval Europe. The way we learn mathematics and science actually has such a strong historical narrative underpinning it that it seems crazy that we don't use these stories to help bring the science alive. To recognize that science and mathematics is created by people and is an incredibly human activity can play an important part in engaging students. I've found history a very powerful tool in telling the stories of mathematics in my books like *The Music of the Primes*. Indeed my own understanding of my subject has been greatly enhanced by finding out the stories behind the mathematical ideas.

*Do you have any ideas about how the **STEM** outreach community can engage more with parents and the general public as well as pupils?*

It is extremely important that we engage with the general public to communicate the importance of science and mathematics. Outreach is not just about exciting the next generation of scientists to emerge from schools and universities. Science impacts on the whole of society and unless the public understand the process of science and its implications they are disenfranchised. You can't have a meaningful dialogue about GM crops, vaccination, climate change and other important bits of science that will impact on the future of society without an understanding of the basic science. As Professor for the Public Understanding of Science at Oxford I am constantly trying to find new ways to engage the public about science: TV, Radio and print media are powerful mediums. But the growth of social media like Twitter is proving a powerful tool in engaging in dialogue about science. The greatest challenge for me is finding ways to get people actively involved in doing science rather than passively consuming it. Projects like Galaxy Zoo in Oxford and Lab UK at the BBC are wonderful examples of citizen science which are a powerful way of engaging the public.

Richard Feynman said that mathematics is a tool for reasoning which enables physicists to develop new laws. Is the same true for all science and engineering subjects, so that mathematics is essential for technological progress?

Mathematics is the language of science. It is very difficult to articulate scientific ideas or make predictions about the universe without the language of mathematics. Even biology, traditionally at the other end of the scientific spectrum, is becoming increasingly mathematical. We have a big mathematical biology group in Oxford who are realising the power of mathematics to make sense of the biological world. For example mathematics is being used to study protein folding which is key to understanding several neurodegenerative diseases which are a result of the misfolding of certain protein strings. Mathematics evolved as a subject because humans wanted to understand and navigate the world around them. But mathematics is so much more than just an essential tool for technological progress. Most mathematicians study their subject because of the excitement of discovering new truths about the mathematical world. As G.H. Hardy once wrote in *A Mathematician's Apology*: Mathematics is a creative art not a useful science. It is aesthetics which often motivates our choice of direction in the mathematical world. But the exciting thing is that because mathematics grew out of our wish to navigate the natural world, even the most esoteric corners of the mathematical world can end up having important technological implications. For example, who would have believed Fermat's discoveries about prime numbers 350 years ago would become the key to sending secrets across the internet?

Why is it that when a mathematician tells people what they do for a living, the most frequent response is 'I could never do maths at school'?

The tragedy is that people go through their education never seeing what mathematics is really about. We teach them the grammar and vocabulary of mathematics but miss out on telling them the big stories. Why aren't we showing kids how to see a cube in 4 dimensions or crack codes with prime numbers or do magic tricks with symmetry? In English they get to read Shakespeare! Why are kids cheated of the mathematical Shakespearean tales? Too often kids are bored by mathematics. The curriculum is too conservative, worrying unduly about the utilitarian role of mathematics. But we don't teach *Macbeth* because it's useful. If more students got what mathematics is really about they would probably see the point of learning the grammar and vocabulary of the subject.



Other news

HE-FE funding call

The National **HE STEM** Programme and the LSIS STEM Programme are seeking to collect a series of case studies for national publication to demonstrate the depth and breadth of activities taking place between Higher Education Institutions and Further Education Colleges working in partnership.

Case studies of not more than 1500 words should be sent to info@hestem.ac.uk by 5.00 p.m. on Friday 1st April 2011.

Further details are available from www.hestem.ac.uk

Mathematics HE summit

The HE Curriculum Innovation Project held its first Mathematics HE Summit in January, at which delegates included: Heads of Mathematics or their representatives from 25 universities offering mathematics degrees (about half of those in England and Wales); Education representatives from the Institute of Mathematics and its Applications, the Royal Statistical Society, the Operational Research Society and the Council for the Mathematical Sciences; and representatives from the National **HE STEM** Programme, sigma and the Maths, Stats and OR Network. Findings from this day of debate, provocative presentations and discussion have been written up for dissemination and use by the MSOR Network when planning other innovative activities.



Career clips

The IOP and National **HE STEM** Programme have produced a series of short careers video clips to illustrate the breadth of options available to those who study physics at A-Level and beyond. Each clip is 5–8 minutes long, designed to appeal to 14–16 year olds, and is linked to the GCSE curriculum.

The four clips are:

- **Ultrasound in Physiotherapy: visiting Wolverhampton Wanderers Football Club**
- **Energy Efficiency in Architecture: talking to architects from AHMM**
- **Solar Energy in Research and Industry: accompanying a PhD student from Imperial College to Hawaii**
- **Forces and Motion in Games Programming: developing video games with NaturalMotion.**

The clips are available at: www.iop.org/hestem/careerclips

New President for the Royal Society

The 61st President of the Royal Society, Sir Paul Nurse, has outlined his vision for a Royal Society which is “effective rather than just symbolic” and which will act as “the primary advocate for science in the UK” in an interview which can be read in full at

<http://royalsociety.org/people/paul-nurse/interview-jan-2011/?from=homefeature>

Teach First expands into North East

Teach First is to expand into the North East of England. Building on its success in five existing regions, Teach First will support North East school improvement programmes by recruiting 40 graduates who will become inspirational teachers in the region and leaders committed to influencing change in education in the long term. Two of the region’s leading Initial Teacher Training (ITT) providers - Northumbria University and the University of Sunderland - will partner Teach First to train the teachers.

For further information visit: www.teachfirst.org.uk



Women in Science & Engineering Awards (WISE) 2010

Congratulations to the University of Northampton on scooping the prestigious national WISE Award for Outreach 2010; and in particular to Tricia Goodchild, Champion for Girls into Engineering at the University. Working with Senior Lecturers in Engineering, Computing and Environmental Science, Tricia is a force to be reckoned with when it comes to encouraging girls to consider careers in engineering. Tricia was recently presented with the award by Her Royal Highness, The Princess Royal, the Royal Patron of WISE. You can read more about WISE at

http://www.wisecampaign.org.uk/parents_and_teachers/wise_awards.cfm

Where the Maths you learn is used

Maths careers have published a downloadable version of 'Where the maths you learn is used', a booklet which makes explicit the links between the mathematics curriculum and its applications in science, technology, business and industry, and which can now be downloaded from

http://www.mathscareers.org.uk/viewItem.cfm?cit_id=382856



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